

**HUSBANDRY PRACTICES AND MITIGATION OF HUMAN-CARNIVORE
CONFLICTS: A CASE OF THE MAASAI STEPPE, TANZANIA**

By

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DECLARATION

The research presented in this dissertation was carried out in the School of Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg from January 2009 to June 2010, under the supervision of Prof. Trevor Hill.

This research represents original work by the author and has not otherwise been submitted in any form for any Degree/Diploma to any other University. Where use has been made of the work of others, as well as the author's work used for external publications, it is duly acknowledged in the text.

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ABSTRACT

Biodiversity losses are often influenced by humans due to increased demand over natural resources and retaliatory killing of wildlife as a result of human–wildlife conflicts. Large carnivores are in decline globally due to the current human–carnivore conflicts. This study was conducted in the Maasai steppe of northern Tanzania to understand the role of traditional husbandry techniques in reducing livestock predation, herding challenges that place livestock at risk for predation, willingness of pastoralists to participate in schemes for livestock security improvement, and the role of Tanzania National Parks (TANAPA) in mitigating human–carnivore conflicts. Data were collected using interviews with individuals in households and with herders in grazing fields and were reinforced with field observations. The primary husbandry strategies for livestock protection in homesteads were the bomas where livestock were enclosed at night, while in the grazing fields the strategies included: splitting livestock herds, herder among livestock, herder carrying weapons, and noise. There was no significant correlation between the wealth of an individual and the type of livestock protection strategy used at homesteads. All traditional strategies used by pastoral communities were equally ineffective in preventing livestock predation both at homesteads and in the grazing fields. However, over a four year period, there were no successful predations in any boma reinforced with chain-links, suggesting that reinforcing bomas with sturdier materials such as chain-link can be effective against livestock predation. Grazing in groups was found to provide more effective livestock protection in the grazing fields than any other strategy. While losing livestock by herders in the grazing fields contributed most to increased livestock predation, other herding challenges exposing livestock to predation included the seasonal nomadic lifestyle and long distances travelled by pastoral communities. The majority of respondents (91%) were willing to improve their livestock security by the use of chain-link fences at homesteads, while 87% were willing to participate in an insurance scheme for livestock security. Neither experience of livestock attack nor level of awareness of insurance scheme influenced willingness to participate in the scheme. There is growing awareness among pastoral communities of the benefits provided by carnivores and wildlife at large. Therefore, major conservation agencies such as TANAPA, Wildlife Division (WD) and other stakeholders should focus more than they have been on addressing the

actual conflicts i.e. human–carnivore conflicts and helping to improve husbandry practices against predation to achieve conservation objectives by reducing retaliatory killing of carnivores.

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ACRONYMS

CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBNRM	Community-Based Natural Resource Management
CC	Community Conservation
CCI	Community Conservation Intervention
CCS	Community Conservation Services
FAO	Food Association Organization
GCA	Game Controlled Area
GR	Game Reserve
MDGs	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
NCA	Ngorongoro Conservation Area
NP	National Parks
NR	Natural Resources
NRM	Natural Resource Management
PAs	Protected Areas
TANAPA	Tanzania National Parks
TLP	Tarangire Lion Project
USAID	United States Agency for International Development
WD	Wildlife Division

CHAPTER ONE

INTRODUCTION

1.1 Biodiversity loss and Millennium Development Goals (MDGs)

The major challenge facing the world is the extensive environmental degradation, amidst burgeoning human population, leading to loss of biological diversity (Cock, 2007). The impact on biodiversity loss is amplified by the fact that the majority of people in the developing world depend almost entirely on the extraction of natural resources to sustain their livelihoods (Food and Agriculture Organization (FAO), 2002; Dyar and Wagner, 2003; Cock, 2007). More than 60% of the world's ecosystems are degraded due to human-related activities (Millennium Ecosystem Assessment (MEA), 2005), while habitat destruction due to livestock grazing, logging, clearing, and expansion of agricultural lands is the major driving factor towards ecosystem changes and loss of biodiversity. In addition, technological advancement exacerbates environmental degradation, for example, in food production, despite increased agricultural yields per unit area (FAO, 2002) and eutrophication of freshwater ecosystems because of over use of inorganic fertilizers which lead to degradation of ecosystem processes (Parmesan *et al.*, 1999; Walther *et al.*, 2002).

The other challenge that the world is facing is global climatic change, which is leading to unprecedented changes in ecosystems (Pearson and Dawson, 2003). Extreme climatic changes are expected to render some wildlife species more vulnerable to extinction, while others may experience reduced mobility and distribution, changes in migratory patterns, high frequency and severity of disease outbreaks, restricted availability of suitable habitats, and an increase in invasive species (Pearson and Dawson, 2003; Thomas *et al.*, 2004). Approximately 30% of wild species is predicted to become extinct as a consequence of extreme climatic changes (Thomas *et al.*, 2004) with resultant detrimental impacts upon biological diversity.

Besides global climatic change and technological advances, cultural beliefs and values can contribute to detrimental impacts on ecosystems and biodiversity. For example, cultural values may differ from conservation values in the use of certain biological species that are needed for

spiritual beliefs. Hence, culture can influence people's perception on how they value natural resources, and this may lead to unsustainable resource use (Fiallo and Jacobson, 1995).

Although the challenges leading to environmental degradation and loss of biological diversity are myriad and complex, the major concern for many conservationists is to reduce the loss of biodiversity and promote people's livelihoods. The MEA stipulates the need to rescue the remaining biological diversity to achieve conservation goals. If environmental degradation continues, it will be difficult to achieve the goals of improved health, environmental protection, and poverty eradication through natural resource use (Powledge, 2006). Achieving conservation goals and improved local livelihoods requires drastic changes and new approaches to integrated management among governments, private sectors, and local communities through Community-Based Natural Resource Management (CBNRM) programmes (Boggs, 2000). To achieve the objectives of conservation of natural resources and improving local livelihoods, MEA developed two approaches: i) to integrate the principles of sustainable development into policies and programmes; and ii) to ensure environmental losses are reversed through integrated Natural Resource Management (NRM). The new approach towards integrated NRM (i.e. CBNRM) adopts the principle of sustainability and allows local communities to manage and benefit from natural resources. However, development activities can be sustainable only if they meet the needs of the present and do not take future needs for granted. Conflicts with local communities over resource use, the costs (e.g. livestock predation) local people bear by living with wildlife, crop damage by and competition for resources with wildlife, and wildlife population declines will still continue if local communities are not involved in conservation strategies (Newmark and Hough, 2000; Turner, 2001; Powledge, 2006).

1.2 Human–carnivore conflicts in perspective

Populations of large carnivores (lions, leopards, cheetahs, and hyenas) are declining throughout Africa as a result of habitat fragmentation and retaliatory killing by pastoralists due to livestock predation. Human–carnivore conflict is a critical conservation issue, which creates opposition against carnivore conservation efforts due to economic and livelihood losses suffered by local communities living with carnivores. Livestock predation can have serious economic consequences for pastoral communities, and compensation schemes that may offset the costs are

often lacking (Ogada *et al.*, 2003; Frank *et al.*, 2005; Graham *et al.*, 2005), fuelling further opposition to carnivore conservation. Carnivores, when they attack livestock and when they threaten human lives, come into conflict with local people, (Ogada *et al.*, 2003; Patterson *et al.*, 2004; Packer *et al.*, 2005; Kissui, 2008). In response to damage caused by carnivores i.e. livestock predation, communities retaliate by killing carnivores indiscriminately (Mills and Hofer, 1998; Rasmussen, 1999; Woodroffe and Frank, 2005). The cost of livestock predation is greater where people's livelihoods depend entirely on livestock keeping, as with herding societies (Ogada *et al.*, 2003). Retaliatory killings of carnivores have increasingly become an important cause of large carnivore mortality in many ecosystems (Kissui, 2008).

Human encroachment in protected areas (PAs) intensifies the conflicts between carnivores and livestock keepers. Although PAs are principally secured from human activities, the majority of them are not large enough to sustain viable populations of wide ranging species such as lions and leopards (Newmark, 1996; Woodroffe and Ginsberg, 1998; Romanach *et al.*, 2007; Schiess-Meier *et al.*, 2007). Thus, communal lands outside PAs play an important role in enhancing carnivore conservation. However, success in mitigating human–carnivore conflicts and promoting coexistence between people and carnivores is critical for carnivore conservation success outside PAs.

Although large carnivores in Africa are protected by wildlife laws, communities living with them have few incentives to protect these animals and respect the legislation because of the costs incurred due to carnivores and the low economic benefits realized from wildlife conservation in general (Frank *et al.*, 2005). Improved livestock husbandry practices can potentially be used as a tool for large carnivore conservation by reducing livestock predation and retaliatory killing of carnivores. Livestock husbandry is known to have existed for over 5 000 years (Ogada *et al.*, 2003), and during this time pastoralists have developed herding strategies that enable them to cope with the ever-changing environmental conditions. Throughout Africa, many traditional pastoral societies are abandoning traditional livestock husbandry practices in the wake of new development and technological advances (Woodroffe *et al.*, 2001). However, it remains

important to understand whether traditional husbandry practices can be used as a tool to promote large carnivore conservation.

This study was aimed at understanding the role of traditional husbandry practices in addressing livestock predation and its contribution to conservation of large carnivores in the Maasai Steppe, Tanzania. Retaliatory killing of large carnivores is a serious problem in the Maasai steppe (Kissui, 2008), and some conflict mitigation interventions have been proposed, such as the use of chain-link fences. However, no assessment has been undertaken to understand the willingness of, attitudes of, and obstacles facing pastoralists towards adopting specific intervention strategies for conflict mitigation. This study examined the role of husbandry practices in preventing predation on livestock and explored the factors limiting participation of pastoralists in the implementation of strategies for reducing human–carnivore conflicts. Results from this study will provide information necessary to develop effective human–carnivore conflict mitigation strategies and promote conservation of large carnivores in the Maasai steppe.

1.3 Study aim and specific objectives

1.3.1 Aim

To document existing traditional husbandry practices in relation to attempting to reduce human–carnivore conflicts, and examine husbandry challenges that place livestock at risk of predation by large predators.

1.3.2 Specific Objectives

- To examine the role of husbandry practices currently in place (including livestock herding, boma type/style, and guard dogs) in reducing livestock depredation
- To identify the husbandry challenges communities face in the Maasai Steppe
- To examine the willingness of and challenges for pastoralists to invest in improved livestock husbandry practices
- To examine conservation agency’s efforts to reduce predation on livestock in communal lands

CHAPTER TWO

LITERATURE REVIEW

2.1 Conservation status and threats to large carnivores

Many large carnivore populations have suffered dramatic declines over the past century with some species becoming globally extinct (e.g. *Dusicyon australis*, Falk Island wolf), while many only survive in *in-situ* conservation (Woodroffe, 2001; Treves and Karanth, 2003). Most carnivore species experience continuous reduction of their geographical ranges e.g. *Ursus arctos* (brown bears), *Puma concolor* (pumas), and *Panthera onca* (jaguars) in North and South America, *Canis lupus* (wolves) in Europe, *Panthera tigris* (tigers) and *Panthera pardus* (leopards) in Asia, and *Panthera leo* (lions) and *Lycaon pictus* (wild dogs) in Africa (Woodroffe, 2001; Treves and Karanth, 2003). Currently, carnivores range in only 5% of the earth's surface area that is conserved under various forms including National Parks, Game Controlled Areas, Game Reserves, and private reserves (Gittlemen *et al.*, 2001). However, even under some form of conservation, 24% of all carnivore species are described as being threatened (Nowell and Jackson, 1996). The principal causes for carnivore population decline include: continued changes in land use practices (Nowell and Jackson, 1996; Bauer and Van der Merwe, 2004) which lead to habitat loss and fragmentation (Frank *et al.*, 2005), endorsed human persecution (Frank, 1998), declines in natural prey (Gittleman *et al.*, 2001; Johnson *et al.*, 2001), and diseases (Funk *et al.*, 2001).

Large carnivores have come into conflict with humans wherever there has been interaction among humans, livestock, and large carnivores. Other reasons leading to human–carnivore conflicts include: competition for resources due to overlap of protein needs and competition for space (Treves and Karanth, 2003; Loveridge *et al.*, 2002; Woodroffe and Frank, 2001). Available land is becoming a scarce resource in most of the areas surrounding protected areas, and this impacts upon large carnivores in their range distribution as more land is transformed into other land uses such as cultivation and livestock grazing, that are not compatible with carnivore conservation (Loveridge *et al.*, 2002).

In some parts of the world, carnivore conservation efforts are contributing to increasing human–carnivore problems. For example, the changing land use practices due to the regrowth of forests in the United States provide room for potential habitats for carnivores (Mladenoff *et al.*, 1997). Successful recovery of carnivore numbers has raised concerns regarding human–carnivore conflicts (Bangs 1998; Breitenmoser, 1998). Conservationists must now resolve the human–carnivore conflicts across such landscapes to rescue the remaining large carnivore populations.

In Africa, large carnivore attacks on people and livestock are at the heart of the human–carnivore conflict (Treves and Karanth, 2003; Loveridge *et al.*, 2002; Frank, 1998; Nowell and Jackson, 1996; Packer *et al.*, 2005). As a result, large carnivores are threatened (*Canis simensis*, Ethiopian wolf), critically endangered (*Lycaon pictus*, African wild dog), endangered (*Panthera leo*, African lion), or vulnerable (*Acinonyx jubatus*, Cheetah) (Ogada *et al.*, 2003; Nowell and Jackson, 1996).

Large carnivores require extensive home ranges and large prey populations (Graham *et al.*, 2005). Thus, only vast relatively intact ecosystems can support viable populations of carnivores, and it is extremely difficult to maintain large areas for these large carnivores due to the rapidly growing human populations and land use requirements. As a consequence, large carnivores are the first to suffer when human populations expand and cultivate untouched habitats (Graham *et al.*, 2005). The human population increases at an alarming rate and is likely to drive changes in pastoral societies and increasing contact rates with carnivores (Sieff, 1997). An example is the relative rarity of large carnivores in the densely populated areas of Europe and North America (Mladenoff *et al.*, 1997). Bears, wolves, and lynxes (*Felis lynx*) rapidly declined from the British Isles as the human population spread, although they persisted longer in the less densely populated mountainous and northern areas (Cozza *et al.*, 1996).

Livestock predation by carnivores is by no means restricted to the developing world. Wolf and bear predation is a common problem in parts of the Italian Abruzzo, where extensive grazing is practised (Cozza *et al.*, 1996). Brown bear (*Ursus arctos*) and wolverine (*Gulo gulo*) predation on free ranging sheep in Norway is also common (Landa and Tommeras, 1997; Sagor *et al.*,

1997). The carnivore–livestock predation conflict, particularly in the developed world, is triggered by a change in husbandry during the nineteenth century especially in areas where these carnivores are recolonising or have been reintroduced. Domestic animals are now rarely herded or guarded by dogs whilst grazing and thus are more vulnerable to predation (Hemson, 2004). Furthermore, herdsman have lost the tradition of coexistence with large predators, and modern protective legislation for carnivores is not matched by a positive attitude of co-operation (Breitenmoser, 1998). Feral dogs frequently contribute to problems of livestock predation, but the blame is often apportioned to their wild relatives (Cozza *et al.*, 1996).

2.2 Husbandry practices by pastoral communities

Pastoral communities depend wholly on livestock products for their livelihoods. Africa is a continent with enormous contradiction and unmatched cultural values towards Natural Resources (NR). Two-thirds of the continent is either arid or semi-arid, and agriculture is the major problem being an incompatible activity with conservation interventions (Ellis and Galvin, 1994). Wildlife conservation and livestock production are the major land use forms in these areas, although for the past twenty years agro–pastoralism has been on the increase in most of the pastoral lands (Barrow and Murphree, 1998; Campbell and Chege, 2000; Western and Nightingale, 2002).

Three thousand years ago, pastoral communities in East Africa were able to endure and thrive and positively coexist with wildlife in spite of the ever-changing environmental conditions (drought and diseases) due to low human population densities (Swift *et al.*, 1996). Today, the valued lifestyle is affected by intensified land use often leading to overgrazing which in turn leads to reduced forage quantity and quality that, in most cases, negatively impact on livestock production by making livestock more vulnerable to diseases. Livestock grazing influences the abundance of natural prey by altering the flora composition, hence leading to predators' change of behaviour by switching to easy and available livestock prey (Sunquist and Sunquist, 2001; Nowell and Jackson, 1996; Sillero-Zubiri and Laurenson, 2001).

The rapid human population growth and change of lifestyle from pure pastoralism to agriculture has led to increased human–wildlife interactions and conflicts. Grazing lands have been reduced

in many areas surrounding protected areas (PAs), and the available land is degraded. These conditions force pastoralists to move closer to wildlife areas, hence increasing the risks of conflicts.

Pastoral communities have developed a range of techniques for safeguarding livestock from predation, and studies (Ogada *et al.*, 2003; Kollowski and Holecamp, 2006; Ogeto, 2007; Hazar, 2006) have investigated the role of husbandry in providing livestock security. Pastoralists are known to keep large numbers of livestock that serve as social capital and a sign of wealth (Hazar, 2006). Large numbers of livestock, however, require large pieces of land which are increasingly unavailable due to rapid human population growth and increased land use requirements leading to increased human–carnivore conflicts.

Historically, pastoralists have been seen as a major threat to environmental conservation due to the impact of their activity i.e. livestock grazing (Collett, 1987; Howell, 1987). Traditional livestock grazing is known to have existed for over 5 000 years in many parts of the world (Swift *et al.*, 1996), and during this time pastoralists have developed herding practices that allow them to cope with the ever-changing climatic conditions. The nomadic lifestyle and low human population ensured the long-term exploitation of fragile rangelands and allowed pastoralists to exploit more than one environment. For instance, in Maasai traditional societies, the male Maasai are divided into different age-groups: *layon* (children below 15 years), *moran* (warriors, 16 to 35 years), and traditional leaders and elders. There is also a well-defined division of labour within each age-group (Homewood and Rodgers, 1991). For example, *layon* are the primary herders of livestock in the field during the day, while the *moran* are exempt from herding activities, but they, as warriors, are responsible for retaliatory killing of large carnivores after livestock attacks, and are only assigned particular tasks such as herding during critical times such as during extreme drought.

2.3 Attitude of pastoral communities towards conservation

Studies on attitude have been increasingly accepted as being a stepping stone to understanding community awareness and perception towards conservation intercessions (Holmes, 2003). Conservation beyond the boundaries of protected areas (i.e. National Parks, Game Reserves, and Game Controlled Areas) is intended to benefit both wildlife and people by expanding wildlife habitats and extending wildlife-derived economic benefits to local communities (Western and Wright, 1994). Financial gains can change people's attitudes toward conservation of NR. However, conflicts between wildlife and communities surrounding PAs in most cases erode local support for wildlife conservation (Goldman, 2003). It is anticipated that wildlife-based benefits will counteract the costs borne by local communities living with wildlife and will encourage tolerance towards wildlife. However, where the linkages between benefits and wildlife are not clearly understood, wildlife-based benefits may be ineffective at sustaining conservation. Fabricius *et al.* (2001) argue that the direct financial benefits obtained by local communities from conservation initiatives are often too low and inequitably distributed among societies to change local communities' negativity towards conservation.

Other factors such as community involvement in conservation, cultural backgrounds, and educational levels may influence the behaviour of local communities and hence may affect the outcomes of conservation initiatives (Hazar, 2006). Adams and McShane (1996) argue that the future of conservation lies in obtaining the collaboration, understanding and participation of the local people. Local communities should play a role in protecting and fostering biological resources as they provide enormous benefits as biological resources are renewable if well preserved. Rachel Carson (1963) in Cock (2007, ii), however, states that "man's attitude towards nature is today critically important simply because we have now acquired a fateful power to alter and destroy nature. But man is part of nature and his war against nature is inevitably a war against himself". By contrast, it is possible for people to value the aspects of biological resources without interfering with or consuming them (Connelly and Smith, 1999).

In Africa, large carnivores (lions, leopards, cheetahs and hyenas) are among the most financially valuable species in terms of attracting tourists and trophy hunters (Treves and Karanth, 2003; Okello, 2005). However, they are the most problematic to local communities surrounding PAs

(Frank *et al.*, 2005). Negative perceptions of pastoralists towards carnivores are a result of the economic cost due to livestock losses, and threat to life. In Africa, the local costs of tolerating large carnivores exceed the benefits obtained from conservation (Fabricius *et al.*, 2001). Historically, much of the land outside PAs has been home to pastoral communities and their livestock (Fascione *et al.*, 2004). It has been emphasized that pastoral communities have always lived in harmony with wildlife and are naturally conservation-minded (Parkipuny, 1989), although skeptics argue that the presence of pastoralists is directly linked to wildlife disappearance (Mordi, 1991; Prins, 1992). As development activities surrounding a PA increase, communal lands are sometimes the only suitable dispersing areas for wildlife (Parkipuny, 1989). In many cases, local communities are denied access to PAs but are expected to tolerate damage by wildlife migrating out of PAs (Langholz *et al.*, 2000).

Carnivores in most cases are forced into conflict with humans, and the various reasons for human–carnivore conflicts have been provided. For example, in some cases, it is thought that carnivores learn that livestock are easier prey or are forced to change their prey due to the depletion of their natural prey (Mizutani, 1993). Studies have also indicated that when livestock numbers exceed wild prey in communal lands, especially during the migratory season, conflict incidences tend to increase (Mishra, 1997; Kissui, 2008). In other regions, predation incidences occur simply because there is nothing to prevent this. The availability of natural prey allows predators to take wild species in preference to domestic animals. However, if natural prey is scarce, predators will progressively prey on livestock as a substitute food source (Schuess-Meier *et al.*, 2007).

2.4 Community conservation interventions as a tool for long-term carnivore conservation

In Africa environmental destruction is visible in many countries with National Parks, Game Reserves, and Game Controlled Areas remaining as undisturbed habitat fragments (Cock, 2007). Community conservation programmes have long been established and well developed for the purpose of sharing wildlife benefits with communities surrounding PAs and integrating conservation with sustainable development. Some examples of Community-Based Natural Resource Management (CBNRM) approaches include those in Zimbabwe, Mali, and Zambia. The major aims of such interventions are to improve the relationship between PAs and local

communities surrounding PAs and to ensure that the conservation interest is well understood at all levels. Historically, community conservation programmes were developed as a strategy to achieve protection of natural resources (Hulme and Murphree, 1999). In addition, Hulme and Murphree (2001) state that the biological diversity to be conserved should be seen as exploitable resources that can be managed to achieve both conservation and development goals. A community conservation strategy entails the delegation of responsibility and control over resources to a community level from a government level.

Conservation interventions, such as CBNRM, are concerned with the sustainability of resources over preservation (Berkes, 2004). Some conservation interventions have succeeded through emphasizing the participation of local people (Western and Wright 1994; Getz *et al.*, 1999), for example, CBNRM programmes in Botswana, Zambia, Mozambique, and Zimbabwe. There is compensation for wildlife damage (livestock predation) to increase communities' tolerance (Kiss, 1990), for example, the Mbirikani Ranch in Kenya (Frank *et al.*, 2005) and contribution to development activities in communal lands (Abbot *et al.*, 2001; Salafsky *et al.*, 2001). The positive outcomes of community conservation still remain uncertain. Questions arise on whether the attitude and behaviour of local communities towards conservation is changing (Swenson and Andren, 2005; Dyar and Wagner, 2003). There are big challenges facing community conservation initiatives and these include: designation of conservation interventions that integrate resource use by communities and access to markets as the major strategy towards achieving conservation (Hulme and Murphree, 1999). Other challenges include conflicting values among local communities over resource use and inequitable sharing of wildlife benefits among societies.

Community conservation interventions (CCI) are criticized for the lack of local institutions' role in their strategies (Agrawal and Gibson 1999; Wells *et al.*, 1992; Barrett and Arcese 1995; Oates, 1999). For example, CCIs do not pay enough attention to the differences within communities and how these differences can influence conservation strategies (Agrawal and Gibson, 1999). Not recognizing the role of local institutions in CCI may complicate the implementation of any

conservation strategy (Ostrom *et al.*, 1999). Conservation strategies will be difficult to accomplish if not compatible with local institutional values (Becker, 1999). Hence, for CCI strategies to be accomplished there needs to be delegation of power and authority to local institutions (Neumann, 1998). Conservation interventions that attempt to involve local communities and yet deny their participation in decision making processes, implementing rules, and exercise of power over allocation of funds will not achieve Community Conservation (CC) through sustainable use (Agrawal and Gibson, 1999). However, it is still very difficult for conservation agencies to develop CC programmes that directly meet the needs of local communities and biological diversity due to the increased human population densities and high resource demands. Overall performance and success of CC programmes have fallen below what is expected (Kellert *et al.*, 2000; Barrett *et al.*, 2001), as local communities still remain the major stakeholders in many discussions related to conservation strategies (Goldman, 2003).

2.5 Other conservation efforts towards long-term carnivore conservation

Conservation practices contribute to reducing the losses of biodiversity in and outside PAs. Human–wildlife conflicts and the continued decline in wildlife resources are a big challenge in conservation (Forester and Machlis, 1996). Because humans are the major driving factor towards large carnivore losses through retaliatory killing, trophy hunting, and habitat fragmentation, there is an increasing concern regarding the status and distribution of carnivores worldwide, as the human population continues to grow around protected area boundaries. Greater success is anticipated in modifying the mode and frequency with which the activities of humans and livestock overlap with those of carnivores. Success should permit carnivore populations to persist despite human population growth and alteration of habitat (Fascione *et al.*, 2004).

Carnivore conservation depends on the protection of the biological landscape, and in most cases wildlife managers seek to maintain important aspects of life including the biological diversity, composition, structure, and function of those systems, and their ability to endure over a period of time (Fascione *et al.*, 2004). Changing attitudes and views on nature have transformed the goals of carnivore conservation from those based on fear and economic interests to those based on a better understanding of ecosystem function and adaptive management (Berkes, 2004). Many carnivore populations escaped extinction during the twentieth century as a result of legal

protections, habitat restoration, and changes in public attitudes (Treves and Karanth, 2003). However, encounters between carnivores, livestock, and humans are increasing, raising concerns regarding the costs of carnivore conservation. Conservation entails making decisions on suitable actions from an array of choices. For conservation to be effective, wildlife managers need to know what actions do and do not work.

Conserving natural diversity is known to be important for various reasons including: nature's fundamental values, its economic values, and its emotional, spiritual, and psychological values. These values are not equally isolated, but different people have different values towards nature, which must be taken into consideration for conservation to be achieved (Norton, 1987). There is an array of human values towards nature, from the view that everything in nature has its own right to exist to the view that nature is there for human use. A range of values may exist both among and within human cultures, and different people within the same culture may have different values towards nature. Both the awareness and understanding of such values need to be understood to achieve conservation interventions. Currently, conservationists have recognized the necessity of working outside PAs for viable wildlife populations to be sustained (Holmes, 2003).

Declaration and preservation of PAs have contributed significantly to the conservation of large carnivores. Protected areas provide space for carnivores to roam and increase in the absence of human interference. However, many PAs are not large enough to encompass wide ranging carnivorous species and migratory ungulates, hence communal lands are still vital in carnivore conservation efforts (Fascione *et al.*, 2004). Protected areas can also biologically suffer from the edge effect that can have significant impacts upon wider ranging wild species which come into conflict with humans beyond park borders. Edge effect often causes high mortality rates, creating population declines (Woodroffe and Ginsberg, 1998) with direct impact spreading to individual species in PAs. However, PAs are often imposed against the local communities' will, and this in turn produces adverse consequences for PAs. For instance, in Madagascar, the National Parks have been created without communities' involvement and are now suffering from heavy resource destruction from local people (Durbin and Ralambo, 1994). The rapid human population densities and competition for resources and space are threatening the existence of National Parks.

However, the National Park system is currently leaving 93% of the world's surface unprotected, particularly in the developing countries (Langholz *et al.*, 2000). Regardless of these limitations, maximizing wildlife benefits that directly address human–carnivore conflicts in communal lands has the potential to encourage local peoples' support of conservation activities outside PAs (Prins and Grootenhuis, 2000).

Conservation beyond PAs will help secure potential wildlife habitats that are not represented within National Park systems. The dilemma in large carnivore conservation due to conflicts with humans suggests that community involvement in conservation initiatives is crucial. Conservation education to create awareness in communal lands towards the economic and social values of wildlife to communities is a vital aspect to successful large carnivore conservation. Along with educating people, programmes targeting attitudinal changes and addressing sources of conflicts are extremely important to large carnivore conservation (Ericsson and Heberlein, 2003). It is essential that conservation interventions consider reducing the costs local communities incur from wildlife. Due to the diverse limitations of core PAs, there is an increased interest in semi-protected landscapes (communal lands) and human–wildlife interactions that occur within them, and these are rapidly gaining credibility in conservation strategies. However, successful conservation action requires knowledge of both conservation goals and the obstructions standing in the way of achieving them.

2.5.1 Community-Based Natural Resource Management (CBNRM) as a way forward

There are growing concerns regarding the management of environmental services. Rapid changes in land use increasingly threaten the sustainability of landscapes and reduce biological resources (Hassan *et al.*, 2005). The communities have a core interest of understanding environmental problems that they experience and designing interventions to improve communities' livelihoods. Local communities need incentives to conserve natural resources. It is believed that the larger the material benefits accrued from natural resources, the better natural resources will be conserved.

CBNRM is a community-based approach towards the management and use of natural resources in a sustainable manner (United States Agency for International Development (USAID), 2000). The fundamental assumption in a CBNRM programme is that the benefits local communities obtain from NR will benefit both the NR and society (Ashley, 1998). CBNRM programmes have a strong social and conservation equity plan (Campbell and Shackleton, 2000), and one of the features of CBNRM is the value it places on traditional knowledge. To reduce the ongoing loss of biological diversity local communities should willingly share the responsibility to conserve biodiversity.

In many cases, where biological resources lie at the centre of disputes with local communities, new ideas and solutions have been developed on how best to resolve the conflicts through CBNRM (Newmark and Hough, 2000). CBNRM is an approach that aims at maintaining and improving the integrity of ecosystems, improving local communities' livelihoods, building the capacity of local communities to manage their own biological resources in a sustainable way, and providing financial and technical support for communities that join the programme (Hulme and Murphree, 2001). CBNRM focuses not only on the management of natural resources but also on community development and creating local institutions for managing resources. CBNRM is meant to address both natural resource management (NRM) and human issues.

CBNRM programmes attempt to address conflicts over resources with local communities. Conflicts over biological resources occur in many parts of the world as a result of disputed rights to resource use by local communities. Conflict over natural resource use has always been a common aspect in the management of natural resources as local communities are denied access (Fabricius *et al.*, 2001). As the intensity and level of conflict vary, so should the chances for resolving such conflicts. The management of environmental processes requires the coordination of all stakeholders that directly depend on the biological resources i.e. governments, regional, and local institutions. A collaborative management system is crucial to ensure sustainability of biological resources by meeting the present human needs without jeopardizing future needs. CBNRM aims to govern the NR base as one of its foundations for local communities'

livelihoods (Turner, 2001). There are three major values of CBNRM programmes to communities' livelihoods: the direct resource use that can be marketed or consumed, the indirect values from the environmental processes (regulation of river regimes, nutrient cycling in cultivated lands), and the cultural or religious values that local communities may have towards natural resources (Turner, 2001).

Currently, the idea of CBNRM is being practised and accepted in many parts of the world. Many African countries such as Mali, Botswana, Zimbabwe, Zambia, Namibia, Mozambique, and Burkina Faso have adopted this approach as part of their national policies towards NRM (Fellizar, 1993). The approach recognizes that local people surrounding PAs should have direct control over the benefits and utilization of natural resources to allow an increased value of natural resources to benefit the local communities. The programmes aim at achieving both rural development and conservation strategies.

Since its introduction as a strategy for NRM, CBNRM has faced challenges from development practitioners. The major concern is whether or not local communities could be trusted to manage the natural resources due to their self-interest and exploitation of the resources leading to environmental destruction that is not reversible. However, domination of resource management by governments has continued, and biological resources continue to be degraded, and inappropriate use of these resources has increased (Fellizar, 1993). The CBNRM programmes attempt to overcome the limitations of other approaches. CBNRM does not isolate local communities but rather respects them as major stakeholders in resource management, although this does not necessarily provide assurance of a positive outcome of any CBNRM approach.

With CBNRM being a new approach, faults and dissatisfaction are expected, however, people practising CBNRM learn from their mistakes and through this process CBNRM evolves, hence the risk is worth taking (Newmark and Hough, 2000). Among the many reasons some governments choose CBNRM is that it is the type of strategy that allows development

practitioners to achieve several development goals (e.g. social justice, poverty alleviation, and NR conservation), although the financial benefits accrued from CBNRM strategies are often low. Many perceive the driving factor for CBNRM to be promoting conservation of biological diversity rather than community livelihoods (Boyd *et al.*, 2001).

The CBNRM programme in Botswana is among the most successful approaches towards NRM. It is a joint venture between the private sector, local communities, and the government (Boggs, 2000). The management of natural resources delegated power to local communities from the government. The programme aims to encourage diversification of income-generating activities from resource use by local communities to improve the quality of life. CBNRM in Botswana differs from other regions (such as Zambia and Zimbabwe). In Botswana, all the revenue accrued from natural resources goes back to the local communities (Taylor, 2000).

The aim of CBNRM in Botswana was to provide legal rights for local communities to manage natural resources aiming at improving communities' attitudes towards conservation and improving wildlife management practices (Government of Botswana, 1997). On the other hand, financial benefits have been recognized within communities and this is projected to improve NRM through changed attitudes towards wildlife (Boggs, 2000), although more information is still needed on the changed attitudes and improved NRM from the translated economic returns. However, local communities in Botswana felt isolated from the management and monitoring of any business venture, and this resulted in a relationship breakdown among the three parties (private sector, local communities, and government). There have been concerns that the local communities should be empowered to make decisions, to enforce and implement rules, and to actively operate business enterprises for the programme to be successful (Campbell and Shackleton, 2000). CBNRM in Botswana has not been able to accomplish the empowerment and capacity building goal (Boggs, 2000).

Local communities, however, are comprised of members with different interests and values towards natural resources, and cultures are dynamic and may fluctuate, and this may result in increased conflicts and mistrust within societies (Campbell and Shackleton, 2000). Therefore,

CBNRM programmes in Botswana should include adaptive mechanisms to accommodate such changes.

The CBNRM programme in Zimbabwe followed the land crisis that started in the year 2000 leading to the concerns of land management and ownership. The government of Zimbabwe was reluctant to facilitate land ownership to local communities and was not able to address major concerns of equity, and this negatively impacted on the success and implementation of CAMPFIRE. Decisions on resource use and land ownership remained centralized by the government. The idea behind this was to distribute benefits accrued from wildlife to local communities without authorizing them to own land (Sibanda, 2001).

CAMPFIRE formally born in early 1980's later regarded traditional practices and indigenous knowledge as the critical components in achieving NRM (Zimbabwe Trust, 1990). CAMPFIRE has integrated indigenous knowledge and traditional practices in the management guidelines (e.g. the Tonga knowledge on hunting seasons, prohibiting hunting of female animals, and animal migration). Non-recognition of such indigenous knowledge may lead to conflicts by undermining people's interests and values. Indigenous knowledge, however, has its own pitfalls: the new generation can easily be influenced by modern (western) notions of equality and may not understand the values of traditional practices. Many of the younger generation are more interested in private land ownership rather than managing common property (CAMPFIRE, 2001).

CAMPFIRE is a strategy towards NRM that promotes development activities and protecting environmental processes (Murphree, 1991). It was introduced in response to the failure of wildlife conservation initiatives that were based on policy and law enforcement. CAMPFIRE has now attracted international attention towards NRM in Zimbabwe. CAMPFIRE focuses on the impact of traditional knowledge on NRM, the impact on local communities' livelihood, and the uneven distribution of revenue accrued from CAMPFIRE strategies. CAMPFIRE is a new way that allows local communities to flourish and develop without degrading natural resources. It also seeks to allow local communities to access and utilize NR without diminishing the natural environment (Sibanda, 2001).

The direct benefits accrued from CAMPFIRE to local people are identified to be a major incentive for wildlife management in Zimbabwe. There is a link between the direct benefits obtained and the level of participation by local people in conservation initiatives (Murphree, 1991; Rihoy, 1992). Although wildlife benefits may contribute to the improved livelihoods and the willingness of local people to participate in CAMPFIRE, this may not necessarily be the key inspiring factor towards conservation. CAMPFIRE has failed to address some issues regarding resource ownership and integrating more indigenous knowledge in the programme. As a result local communities failed to support CAMPFIRE. Another major constraint of the programme is the uneven distribution of wildlife benefits to local communities (CAMPFIRE, 2001). However, CAMPFIRE is an innovative strategy towards NRM that allows access and utilization of natural resources sustainably.

The CBNRM programme in Mozambique attempted to provide local communities with the right to resource use and the power to manage their own natural resources. Through this programme it is believed that local communities will be able to improve their quality of life and achieve socio-economic ambitions. This programme has managed to reduce conflicts among the private sector, the government, and local communities, has increased wildlife benefits to communities, and has formed local institutions to manage natural resources (CAMPFIRE, 2001). Regardless of the achievements, CBNRM programmes in Mozambique have experienced external influences that have given rise to false expectations about the wildlife benefits that could be obtained. These actions have led to tension among stakeholders and confusion over resource access rights that previously existed (Boggs, 2000). Conflict over natural resource control emerged among stakeholders. The government attempted to resolve the conflicts by applying CBNRM principles that evolved from CAMPFIRE. CBNRM programmes were introduced to local communities as a way of improving their livelihoods through direct benefits accrued from wildlife and a sustainable use of natural resources. The programme also promised control over NRM by local residents.

The driving factor towards the acceptance of the CBNRM programme in Mozambique was the ability of local communities to obtain direct benefits to win their support for conservation. The benefits local communities obtain have to compensate the costs they bear (Barrow and

Murphree, 1998). Uneven distribution of benefits may create tension. For instance, in Tchumo Tchato, local residents negatively perceived the CBNRM programme because the financial reward was distorted by conservation agencies (Rihoy, 1992).

However, division among community members should be expected in any society, and people will have different interests and values about natural resources. The success of CBNRM relies on the allocation of roles and ownership among community members and the level of resource use that does not destroy the environment. The benefits accrued from resource use should be distributed equitably within the community to reduce conflicts and mistrust among stakeholders. Community participation in CBNRM programmes should not be based on financial values accrued but rather on cultural values towards natural resources to achieve conservation goals (Barrow and Murphree, 1998). There are many challenges involved in CBNRM programmes, but such programmes are crucial in improving rural livelihoods and providing a sense of resource ownership by local residents to achieve conservation goals. Local communities play an important role in wildlife conservation, however, one can argue that CBNRM, as it is practised in southern Africa, cannot be the answer towards achieving conservation goals, although it plays a major role in communities' livelihoods.

The literature has portrayed the broader aspects of the human–carnivore conflicts in many parts of the world, the traditional husbandry practices local communities used in the past to cope with the conflicts, conservation efforts practised in some parts of the world, and the new approach of CBNRM as a way forward towards achieving conservation of the natural environment.

Livestock predation by large carnivores and retaliatory killing of large carnivores is a critical conservation issue, and mitigation measures to reduce the human–carnivore conflicts are crucial. Populations of large carnivores are rapidly declining in Africa as a result of retaliatory killing of carnivores by pastoralists due to livestock predation. In the Maasai steppe, over 100 lions were killed over a three year period (2004-2006) due to livestock predation (Kissui, 2008). However, livestock husbandry by local communities may or may not prevent livestock predation. The literature provided a summary of the study in this particular field of research. The aim included critically reviewing previous research, and this involved identifying the strengths and

weaknesses of various arguments and what aspects required greater detail. The literature created baseline information for this research. The aim is not to duplicate what has been done but to add to the existing literature. Therefore, this research aims at understanding the role of the current husbandry practices in addressing the human–carnivore conflicts, the herding challenges pastoralists in the Maasai steppe face that place livestock at more risk of attack, local communities’ willingness to improve their livestock security, and conservation agency efforts in addressing the human–carnivore conflicts in the area.

Conflicts between large carnivores and humans are a major concern needing immediate attention to rescue the remaining carnivore populations. To achieve this, a combination of efforts is needed from all stakeholders (i.e. governments, private sector, and local communities). It should be made clear that all stakeholders (with no exception) have roles to play towards achieving conservation initiatives. Local communities’ efforts in addressing the human–carnivore conflicts are a stepping stone to achieving wildlife conservation. However, there is a need to improve local communities’ husbandry techniques and strategize the practices in conservation initiatives. Conservation agencies have outreach programmes that aim to change local people’s attitudes towards conservation through benefit sharing to win their support in conserving wildlife. The outreach programmes are not effective in addressing the actual problems (livestock predation and crop damages) that directly affect local communities’ livelihoods but instead only support development activities in communal lands hence increasing local people’s anger towards conservation. The costs communities bear from wildlife are not worth the benefits they obtain from wildlife. Local communities need incentives to conserve wildlife.

Conservation approaches need to adapt to changing situations. In the past, human–wildlife conflicts were low due to low human population densities, and people coexisted with wildlife with minimal conflicts. The increased human population leads to more land use requirements resulting in increased human–wildlife (carnivores) conflicts as a result of competition for resources (space and protein requirements). These conflicts call for conservation organizations to redesign their approaches to reduce the conflicts by involving all stakeholders (local communities and private sectors) at all levels (decision making, implementation and monitoring and evaluation of programmes).

CHAPTER THREE

METHODS

3.1 Introduction

An outline is given of the research methods, the statistical analysis performed is summarized, and some limitations of the study are presented. The research was conducted between May and December 2009. Both qualitative and quantitative research techniques were used. Qualitative data are essential to provide the actual experiences of respondents and support the quantitative data by providing reasons for the quantitative data (Neumann, 2000). Qualitative information allows a thorough questioning of communities' attitudes towards insurance schemes for livestock predation, levels of tolerance, how communities perceive wildlife threats, and how they cope with the perceived threats.

3.2 The study area

The research was carried out in the Maasai Steppe ecosystem (Fig. 3.1) on the eastern and northern sides of Tarangire National Park. Six villages namely: Olasiti, Oltukai, Loiborsoit, Emboreet, Loibosiret, and Makuyuni were surveyed (Fig. 3.2). The six villages were selected from different locations to explore any differences or similarities of husbandry techniques and challenges on herding practices related to the villages' close proximity to the park boundaries.

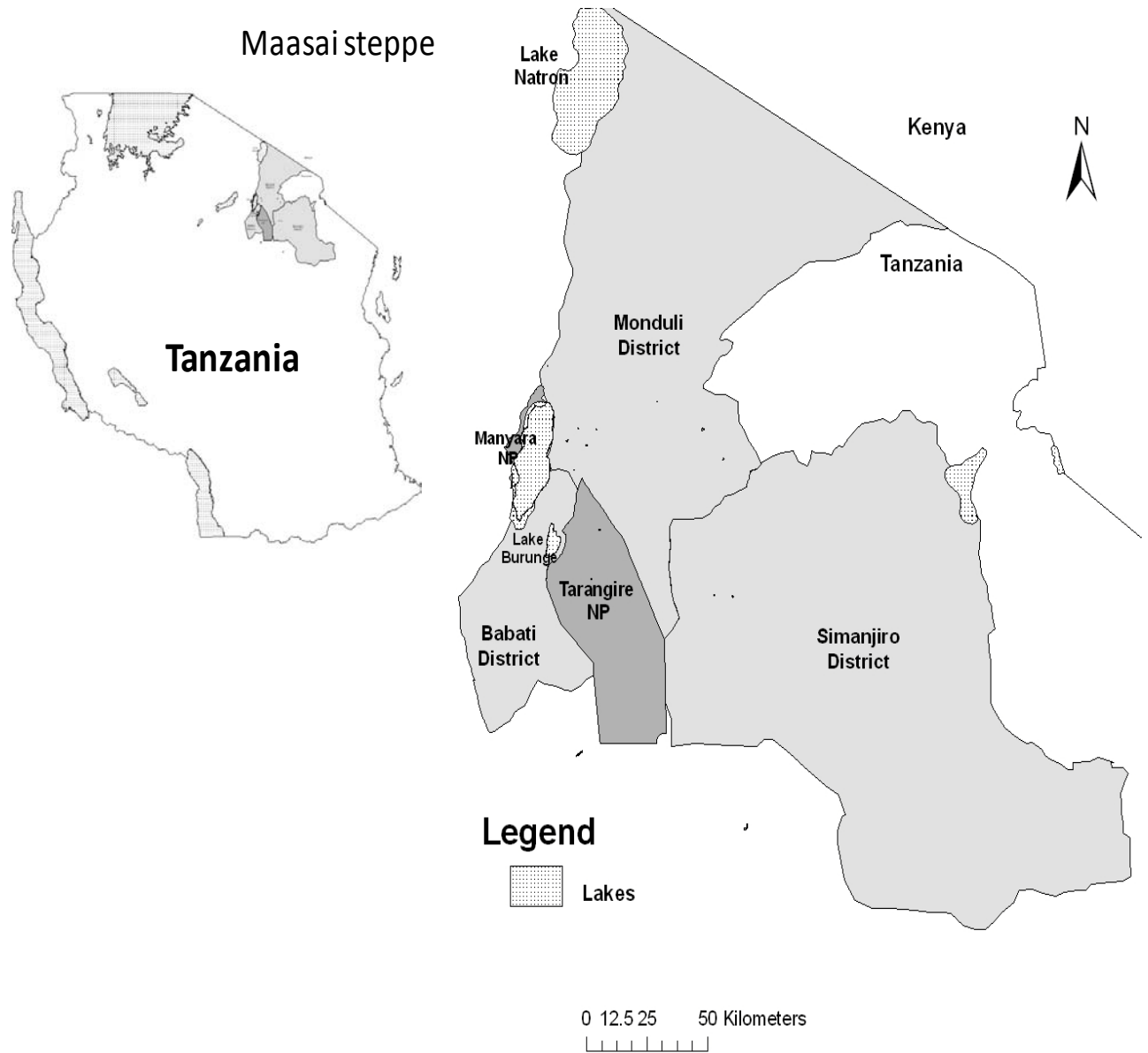


Figure 3.1: Map of Tanzania showing the Maasai steppe ecosystem and the location of Monduli, Babati and Simanjiro districts in which study villages were located.

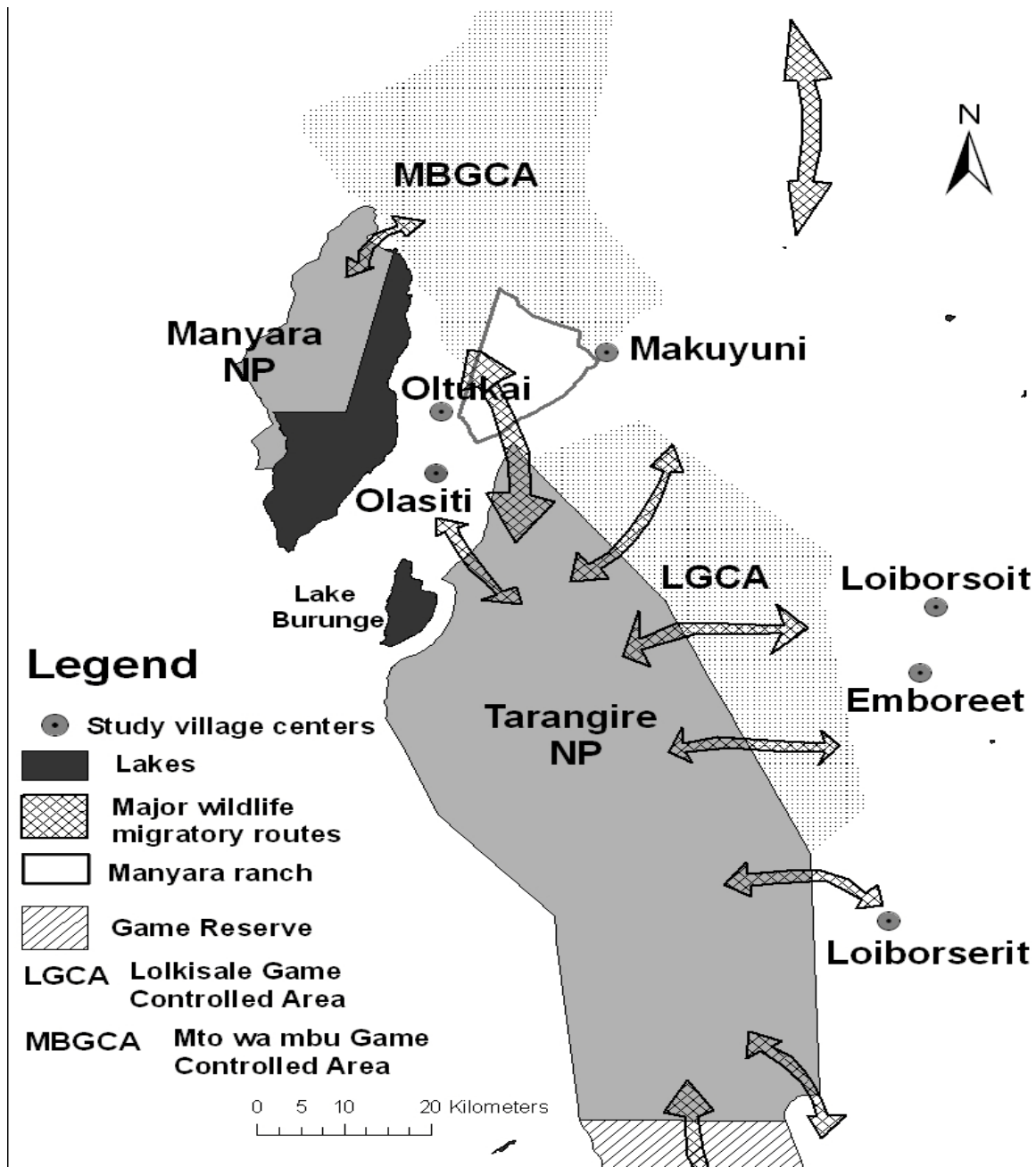


Figure 3.2: Map of the Maasai steppe showing surveyed villages (adapted from Kissui, 2008).

The Maasai Steppe is situated in northern Tanzania ($3^{\circ} 40'$ and $5^{\circ} 35'$ South and $35^{\circ} 45'$ and $37^{\circ} 00'$ East) (Fig. 3.1) at an elevation of approximately 1 200 to 1 600 metres above sea level. The Maasai Steppe encompasses approximately 35 000 km², including the Mto wa mbu Game Controlled Area to the north, Lolkisale and Simanjiro Plains Game Controlled Areas to the east, Mkungunero Game Controlled Area to the south, and Kwakuchinja Open Area to the west. This

ecosystem contains the second largest migratory herbivores in East Africa after the Serengeti-Maasai Mara ecosystem (Borner, 1985; Prins, 1987). The Tarangire and Manyara National Parks are included in the Maasai steppe ecosystem and cover approximately 10% of the ecosystem, whereas 80% of the land is private land held by individuals or villages (Borner, 1985). Tarangire and Manyara National Parks are the core protected areas within the Maasai Steppe ecosystem. Tarangire National Park was established in 1970, and it comprises a 2 800 km² portion of the Maasai steppe ecosystem, whereas Manyara National Park covers 330 km² of the Maasai steppe ecosystem. Communal lands outside core protected areas provide wildlife dispersal areas from Tarangire and Manyara National Parks. Communal lands play a major role for small-scale pastoralism and for conservation of biological resources.

The common vegetation type in Maasai Steppe is wooded savanna dominated by *Acacia*, *Terminalia*, *Combretum*, and *Commiphora* tree species. Other major vegetation types include riverine grasslands and *Euphorbia* species (TANAPA, 1994). The Maasai steppe ecosystem, like any other Savannah landscapes in East Africa, is characterized by a semi-arid climate with spatially and temporally varying rainfall. The annual rainfall pattern consists of short rains between November and December followed by a short dry spell in January and a long rainy season from February to May and a dry season from June to October. Average annual rainfall is approximately 650 mm (TANAPA, 2002). Temperatures are highest from December to February and lowest in June and July. Average temperature range is from 16 °C to 27 °C. These climatic conditions affect both domestic and wild animals resulting in variability in the availability and distribution of grazing pasture and water, and this leads to inconsistent but regular annual migration by both wild animals and pastoral communities that inhabit these areas.

3.2.1 Local communities and lion killings in the Maasai steppe

The dominant ethnic group in the Maasai steppe ecosystem are the *Maasai*, while others include: the *Waarusha*, *Wambulu*, *Wamang'ati*, *Wasomali*, *Wachagga*, and *Wambugwe*. The study revealed that agro-pastoralism is the dominant form of land use in the ecosystem, and communal lands in Maasai steppe serve as refuge areas for migratory ungulates and large carnivores (Kissui, 2008). Human–carnivore interaction in the ecosystem is shaped by the grazing patterns as inhabitants in the area practise a system of nomadic livestock grazing due to fluctuating

grazing pasture and water seasonally. This nomadic lifestyle increases the chances of human–carnivore conflicts due to the increased interaction among humans, livestock, and carnivores in the course of moving. Livestock are moved to temporary grazing fields closer to the park boundaries during the dry season when grazing pasture is scarce in communal lands. Livestock spend up to six months away from permanent homesteads.

Maasai being the dominant ethnic group in the area, reports have recorded high numbers of lion killings over years by Maasai warriors (*moran*) (Table 3.1) as a result of livestock predation incidents. However, the number of lions killed in the area for the entire period indicated in Table 3.1 is uncertain, as the numbers represent only the lion numbers that were verified as having been killed, suggesting that more lions might have been killed without being detected due to lack of transparency by local communities.

Table 3.1: Numbers of lions killed in 21 villages in the Maasai steppe ecosystem, January 2004 to June 2010 (Kissui, unpublished data)

	Village	2004	2005	2006	2007	2008	2009	Up to June 2010	Total
1	Emboreet	1	2		1				4
2	Engaruka Chini	5	4						9
3	Engaruka juu	1	2						3
4	Esilalei	4	3	1	2	1	3	2	16
5	Kimotorok						5		5
6	Loiborsiret	2	1			2	4		9
7	Loiborsoit	16	8	3	2	2	2	3	36
8	Lolkisale			1	1		1		3
9	Losirwa			1	1		1	1	4
10	Makuyuni						4		4
11	Mbaashi	1						1	2
12	Minjingu	1	2		2	1			6
13	Mswakini chini		1	7					8
14	Mswakini juu	1					1		2
15	Naitolya						3		3
16	Olasiti					2	4		6
17	Kakoi					2		1	3
18	Oltukai	3	1			4	4		12
19	Selela	25	9	11	19	1	2	2	69
20	Lemoti							4	4
21	Mbuyuni							2	2
	Grand Total	60	33	24	28	15	34	16	210

Maasai warriors conduct lion hunts after any livestock attack, and this threatens the lion population densities in the ecosystem, though the lion population sizes for the entire ecosystem are not well known, suggesting that further studies are needed on the actual population sizes of lions and other large carnivores. In addition to lion hunts in the area, pastoral communities poison carnivores in retaliation against livestock attacks. Poisoning is achieved by applying poison to the stock carcass, and this has detrimental impacts on the general wildlife, including birds of prey, that will scavenge on the carcass. Finding solutions to resolve the human–carnivore conflicts in the Maasai steppe is crucial to conservation strategies and will provide an insight into other areas with similar conservation issues.

3.3 Sampling Techniques

To assess the socio-ecological aspects that shape communities' attitudes and the impacts on conservation, survey villages were selected on the basis of high rates of large carnivore–livestock conflicts as reported in previous studies (Kissui, 2008) and of the need to represent regions with high incidences of retaliatory killings of large carnivores, especially lions, by pastoral communities. Other criteria for selecting these villages included: close proximity to the park and possible differences in husbandry practices and herding challenges that put livestock at more risk of attack. Study villages were selected from Monduli, Babati, and Simanjiro Districts. The selected villages were Oltukai and Makuyuni from Monduli District, Olasiti from Babati District, and Loiborsoit, Emboreet, and Loiborsiret from Simanjiro District.

For the households in study villages, a selective sampling approach was used to obtain appropriate units of analysis by selecting interviewees who were well informed according to the judgement of village leaders. A selective sampling approach is a useful one because it allows researchers to use their own judgments with regard to the type of respondents to choose (Bailey, 1978). A list of households included in the survey was obtained from the household lists that were available from village offices, and this included an equal proportion from each sub-village. To obtain respondents who could freely express themselves, interviewees selected to answer questions were aged 15 years and older. A pilot survey was conducted in early May 2009 in Oltukai village to pretest and improve the questionnaire. Eight households and four herders were

selected for interviews during the pilot survey. The pilot survey improved the quality of the questionnaire as there were additional questions added to improve the clarity and understanding of the questionnaire by respondents.

3.3.1 Questionnaire survey

A questionnaire is a common tool in collecting both qualitative and quantitative data to evaluate communities' feelings and perceptions. The research administered both formal and informal surveys through a semi-structured questionnaire. The homestead (*boma*), which often incorporates several households (i.e. the owner, several wives, and children), was considered the appropriate unit of survey to supplement the general observations on preventive measures within a homestead.

Three sets of surveys were conducted to collect data on husbandry practices, herding challenges, and willingness of pastoralists to improve their mode of livestock protection. The first set was household surveys. Households were selected depending on their knowledge and background on livestock predation according to previous studies or reports that were available in village offices. Appointments with selected households were fixed in each village prior to the surveys. For household surveys, the household was the unit of the research and a total of 146 households were surveyed. Questionnaire surveys included both open-ended and closed-ended questions. The household surveys covered the following subject matter:

- a) Demographic information
- b) Livestock predation experience
- c) Preventive measures for livestock during the day and at night
- d) Herding practices and challenges
- e) Attitude towards insurance schemes for livestock predation and willingness to improve livestock security

This method helped to understand how different husbandry techniques are used in different villages and how each plays a role in reducing the conflicts and to compare the differences and

similarities on herding challenges that place livestock at relatively more risk of being attacked. Attitudes of pastoralists towards insurance schemes for livestock predation were also considered, and the questions were asked of whether the scheme will help reduce the retaliatory killings of large carnivores, especially lions, in Maasai Steppe.

Household surveys were used to understand how pastoral communities perceive wealth. The wealth indicator being the number of livestock a person has, it was asked if wealth influences their attitude towards improving livestock security (i.e. participating in insurance schemes for livestock predation and improving their livestock security by the use of chain-link fences instead of traditional thorn bush fences). Livestock numbers being the major wealth determinant in pastoral communities, the number of livestock was ascertained for each stock type (i.e. cattle, goats, and sheep) in three ways: through the livestock owner, by the researcher's own count, and a third person who is a resident in the village and knows the interviewee very well in order to verify the accuracy of the information provided by the respondents. Other aspects such as distance of each household from the park boundaries, ethnic group, predation incidences, and age of the interviewee were used to evaluate the attitude of pastoral communities to improving their livestock security and participation in insurance schemes for livestock predation. A total of 146 households were surveyed.

The second set of the survey was with herders above 15 years old. Surveys with herders were administered on encounter with them in the grazing fields in each study village. Interviews with herders focused on gathering information on herding practices and various herding challenges that place livestock at more risk of being attacked by predators. A total of thirty six questionnaire surveys were conducted with herders in all the study villages.

The third set of the survey was conducted with Government officials from the Tanzania National Parks (TANAPA). A total of ten interview questionnaires were administered to TANAPA officials based in the Tarangire National Park with the aim of understanding strategies being implemented by the institution towards addressing the human–carnivore conflicts and how such strategies engage local communities.

3.3.1.1 Factors affecting livestock security

Improvement in livestock security was assessed by observing the type of livestock enclosure (thorn bush/chain-link fence) used, the presence and number of dogs at the household, the number, age and sex of people in the household, and the number of predation incidents per household over the previous two years. A set of data collected from on-going studies conducted by the Tarangire Lion Project (TLP) was used to compare the effectiveness of bomas reinforced with chain-link fences versus traditional bomas made of thorn bush walls or trees. This information was collected through monthly visits to bomas that were reinforced with chain-link, referred to as experimental bomas, and to traditional bomas with thorn bush enclosures used as controls. This information was collected over a period of four years from May 2006 to March 2010 with the raid attempts and success or failure recorded on each visit for both experimental and control bomas for the entire period.

3.3.2 Field observation

Additional data were collected in the field and during surveys. The field observations were conducted to supplement information obtained from household and herders' surveys. Information collected through field observations included: the number of herdsman per livestock herd, herdsman's age classes, and the presence and number of domestic dogs. Observations during household surveys were used to obtain additional information on the type/style of enclosure used for each stock type (i.e. goats and sheep, cattle and donkeys, and baby goats (kids) and sheep (lambs)).

3.4 Statistical analysis

All survey data were analysed using SPSS 11.5 (Statistical Package for Social Science). All responses were cleaned, coded, and entered into Excel spreadsheets and then imported into SPSS format.

A Pearson chi-square analysis was used to determine the relationship between preventive measures for each livestock type at homesteads and attack experiences. Similarly, the association

between wealth status and the type of preventive measure used by households for each stock type at homesteads was assessed using chi-squares. Where the numbers of respondents for individual categories of preventive measures were small, categories were either combined into broad categories or the less common categories were removed from the analysis. For example, thorn bush enclosure and thorn bush enclosure with dogs/planting trees for enclosure and planting trees for enclosure with dogs were combined into a single category. A Pearson chi-square analysis was used to determine the relationship between herding age-groups (i.e. young boys, old boys, elders, and women) and livestock type. Variables such as livestock attack experiences and awareness of insurance schemes explained attitude trends of pastoralists' participation in insurance schemes for livestock predation. A one-way Analysis of Variance (ANOVA) was used to compare challenges related to herding practices across the surveyed villages.

A descriptive analysis was used for qualitative data such as the livestock security measures that pastoralists use against livestock predation for each stock type at homesteads, in the grazing fields, and temporary bomas. Similarly, with the herding challenges that herders face and the willingness of pastoralists to improve their livestock security through the use of chain-link fences and participation in insurance schemes for livestock predation. TANAPA's efforts to address the human–carnivore conflicts were also analysed in a descriptive manner.

3.5 Limitations of the study

Limitations in any social study are unavoidable. The major methodological limitation of the study was the language barrier. Because the majority of the pastoral communities in the Maasai steppe speak Maasai only, I had to rely on my translator assistant, who was Maasai, to translate the questions and responses. I trained my assistant on how to translate the questions, but it was difficult to evaluate whether the questions were accurately translated into Maasai and the answers into Swahili. However, I strongly believe that this had a negligible negative impact on my study because the majority of interviewees also spoke Kiswahili a language I can communicate in.

Secondly, the traditional lifestyle of pastoralists (i.e. nomadic lifestyle due to seasonal variation in grazing pasture and availability of water for livestock) prolonged the study as some of the pre-selected respondents were absent on their appointment days. This could bring about a variation in an individual's attitude due to circumstances that were faced while away. This was countered by household revisits.

Other limitations experienced included: transparency and willingness of respondents to participate in the study and this may have influenced the quality of information collected. To overcome this, a large sample size was selected from each study village and multiple data collection techniques were used i.e. surveys at household levels, surveys with herders in the field, and field observations, to validate the information.

CHAPTER FOUR

RESULTS

4.1 Introduction

This research investigated the different husbandry practices used by pastoral communities in the Maasai steppe, including boma type/style, use of domestic dogs, herding practices, and challenges herders face. The survey was carried out to understand the role of such practices in reducing livestock predation in bomas where livestock are enclosed at night and in the grazing fields during the day. This chapter is divided into subsections presenting results on household characteristics, preventive measures used to secure livestock against predation in bomas and in the field, livestock herding practices, and livestock losses due to predation. Other aspects of husbandry practices presented include: challenges related to livestock herding, attitudes of pastoralist communities toward insurance schemes for livestock predation, willingness of pastoralists to participate in interventions for improvement of livestock security, and factors determining willingness of pastoralists to participate in intervention programmes.

4.2 Profile of study population and household characteristics

One hundred and forty-six respondents were surveyed: of which 124 were males (85%) and 22 females (15%) from six villages. The lower percentage of female respondents was possibly due to Maasai culture where women would not speak in the presence of men and shied away from being interviewed. The women who participated in the study were interviewed in the absence of men. The percentage of the sample was distributed over the following age classes: 40% (35 – 45 years), 32% (> 45 years), 25% (26 – 35 years), and 3% (15 – 25 years). The *Maasai* tribe was the dominant ethnic group in the sample with 78% of respondents, the rest consisted of *Waarusha* (11%), *Wambulu* (5%), *Wasomali* (3%), *Wachagga* (2%), and *Wamang'ati* (1%).

Pastoralism and small-scale subsistence farming are the predominant livelihood strategies in the study area (Table 4.1). Ninety-six percent of the respondents were agro-pastoralists, 3% pastoralists and 1% were engaged in agro-pastoralism and business (gemstone dealers/retail shops).

Table 4.1: Occupation of respondents in the studied villages

Village	Occupation				
	Pastoralist	Farmer	Business	Agro-pastoralist	Agro-pastoralist and business
Emboreet (n=34)	3%	0%	0%	94%	3%
Loiborsoit (n=28)	0%	0%	0%	100%	0%
Loiborsiret (n=28)	0%	0%	0%	96%	4%
Oltukai (n=24)	0%	0%	0%	96%	4%
Makuyuni (n=16)	13%	0%	0%	87%	0%
Olasiti (n=16)	0%	0%	0%	100%	0%

The age–sex composition of households was recorded to understand its impact on the probability of predation occurrence and the ability of household members to defend livestock within a household context in order to assess whether fewer or larger numbers of people can influence predation. The age classes 0 to 10 years and 11 to 20 years comprised the largest proportion of household members (Table 4.2). The numbers of males and females in different age classes per village are summarized in Table 4.2, showing the age–sex structure for the sampled population to be biased towards children and females with fewer adult males.

Table 4.2: Recorded percentages on the age–sex composition for households in sampled villages

Village	Sex	Age class (% of total)					Total
		0-10	11-20	21-31	31-40	> 41	
Emboreet	Male	47.64	17.28	16.23	9.16	9.69	382
	Female	43.65	20.30	22.59	8.12	5.33	394
Loiborsiret	Male	38.46	28.67	15.15	9.09	8.62	429
	Female	35.62	29.94	15.46	9.98	9.00	511
Loiborsoit	Male	48.40	19.79	14.97	7.75	9.09	374
	Female	44.06	19.55	18.56	10.15	7.67	404
Makuyuni	Male	41.51	13.84	12.58	8.81	23.27	159
	Female	42.65	15.44	23.53	8.82	9.56	136
Olasiti	Male	46.88	29.17	9.38	4.17	10.42	96
	Female	37.61	23.85	20.18	10.09	8.26	109
Oltukai	Male	42.60	17.94	19.73	10.31	9.42	223
	Female	37.45	16.46	22.22	10.29	13.58	243

The average household size in the surveyed villages was approximately 24 people. Despite the large number of people in households, 82% (n=120) of respondents indicated that their livestock (cattle, donkeys, goats, or sheep) had been attacked by a predator in the previous two years (Table 4.3), suggesting that a large number of households did not improve livestock security.

Table 4.3: Frequency of responses on attack experience (n=146)

Question		No. of respondents	%
Have you experienced any livestock attack over the past two years?	No	26	18
	Yes	120	82

Wealth was assessed by examining the number of livestock owned by the households. The average livestock holding in the study area was 24.3 ± 5.2 (range: 0-750 heads) per household. The majority (71%) of the sampled population owned livestock of between 0 and 250 heads, 18% between 251 and 500. However, 11% of households owned livestock between 501 and 750 and >750. Mean livestock holdings per village are summarized in Table 4.4.

Table 4.4: Average livestock holdings (mean \pm SE) for households in the surveyed villages

	Emboreet (n=34)	Loiborsoit (n=28)	Loiborsiret (n=28)	Oltukai (n=24)	Makuyuni (n=16)	Olasiti (n=16)
Cattle	119.6 \pm 18.3	98.9 \pm 25.67	139.9 \pm 37.9	68.6 \pm 14.9	141.9 \pm 40.7	32.1 \pm 8.3
Goats and sheep	108 \pm 16.9	133.4 \pm 20.1	198.4 \pm 41.6	73.8 \pm 13.1	161.3 \pm 39.2	48.4 \pm 11.4
Donkeys	2.6 \pm 0.2	7.6 \pm 1.3	5.3 \pm 1.1	3.1 \pm 0.5	5.2 \pm 0.9	1.6 \pm 0.8

4.3 Preventive measures against livestock predation by carnivores

4.3.1 Livestock protection at home

There were eight different measures employed by pastoralists to protect livestock in homesteads, while six different measures were used for protection in the grazing fields (Table 4.5). In most cases, two or more measures were used simultaneously to improve the security of livestock. For example, the most commonly combined measures were: the use of domestic dogs and bomas made of thorn bushes; and the use of domestic dogs and bomas made of planted trees.

Table 4.5: Types of measures used by pastoralists to protect livestock against predation at home and in the grazing fields

Preventive measures at homesteads	Preventive measures in the field
<ul style="list-style-type: none"> • Boma made of thorn bushes • Boma made of poles • Boma made of poles and thorn bushes • A person staying inside a boma at night • Boma made of planted trees for enclosure • Boma made of poles and chain-link fence • Boma enclosure made of bricks • Domestic dogs 	<ul style="list-style-type: none"> • Splitting livestock into smaller herds • Herders among livestock • Herders carrying weapons (spear/stick) • Herders in groups • Noise • Domestic dogs

Most respondents from herders' surveys (98%) used multiple strategies of protective measures for each livestock type at home. The primary technique for protecting livestock at home is the use of a boma. To compare the frequency of livestock attacks for different protective measures, the frequency of respondents reporting attack experiences and those with no attacks were compared for the most commonly used protective measures for cattle and donkeys (Fig. 4.1). Figure 4.1 demonstrates the attack success/occurrence with the commonly used preventive strategies for cattle and donkeys at homesteads.

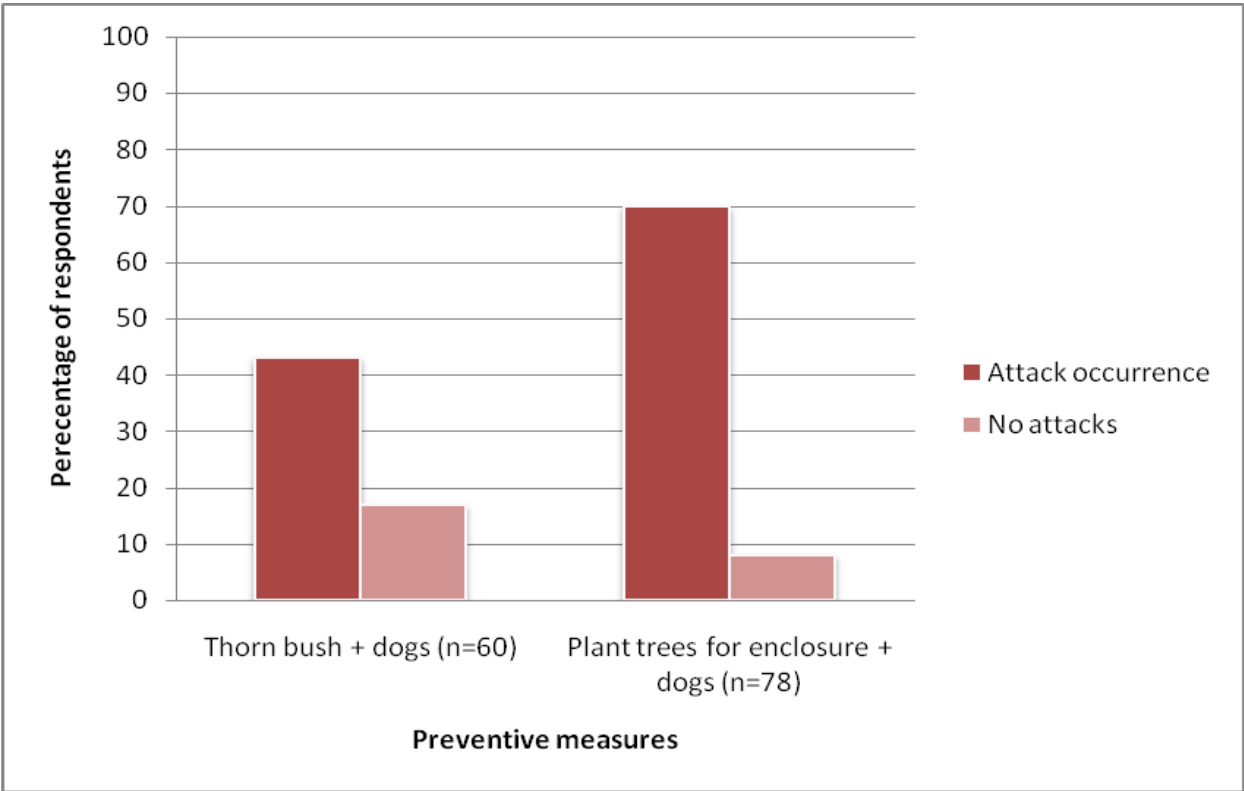


Figure 4.1: Frequency of respondents reporting attacks by predators on cattle and donkeys for the most commonly used preventive measures in homesteads.

There were several types of bomas used for protecting livestock defined by the type of materials used to construct boma walls (Plate 4.1), including the use of thorn bush enclosures, combination of poles and thorn bush enclosure, planting trees for enclosures, boma made of poles and mud, use of bricks, poles, and chain-link fences (Table 4.5). Respondents reported using domestic dogs and staying inside bomas at night to maximize livestock security. The number and type of livestock, determine the type of materials used for boma construction due to the varying behaviour of each stock type. For example, it is common to find bomas with brick walls used for small livestock while in many cases cattle are kept in bomas with thorn bush enclosures. However, several factors may influence livestock protection in a boma including: the number of people in a household, type of enclosure, and the presence and number of domestic dogs.



1a.



1b.



1c.



1d.

Plate 4.1: Various types of boma enclosures used by pastoralists at homesteads in the Maasai steppe 1a. Poles, 1b. poles and thorn bushes, 1c. planted trees, and 1d. hut with wall plastered with mud and cow dung.

Although several types of materials are traditionally used for constructing boma walls (Images 4.1. a, b, c, d), none appears to provide adequate security against livestock predation because pastoralists still experience attacks on their livestock (Table 4.3). The weaknesses of the major strategies currently used at homesteads to prevent livestock attacks on cattle and donkeys are illustrated in Figure 4.1, in which all preventive measures experienced successful predator attacks. For cattle and donkeys, significantly more respondents reported livestock attacks while

using different types of boma walls than respondents without attacks ($\chi^2 = 7.471$, $df = 1$, $p = 0.006$ (see Fig. 4.1). There were similar observations for goats and sheep (Fig. 4.3). Respondents suggested that domestic dogs are only effective in alerting the boma owners in case of predator approach, and that did not translate into actual prevention of livestock attacks.

In many pastoral communities such as those in the Maasai steppe, livestock numbers are the major wealth determinant. The number of livestock owned was categorized into four classes as indicators of wealth as: 0 to 250 poor, 251 to 500 moderately wealthy, 501 to 750 rich, and above 750 very rich pastoralists. Looking at the effect of wealth on the type of livestock protection measures used by pastoralists, interestingly, there was no significant relationship between wealth status and the type of protective measure used to protect cattle and donkeys ($\chi^2 = 3.623$, $df = 3$, $p = 0.325$), suggesting that people's wealth status did not influence the type of measure they used for livestock security.

Pastoral communities in the Maasai steppe use similar approaches as for cattle and donkeys to protect goats and sheep at night (Fig. 4.2). Few of the respondents who used bricks, poles, or chain-link fences with the help of domestic dogs had not experienced any attacks, unlike other traditional measures used such as planting trees, thorn bush enclosures or a combination of poles and thorn bush that had experienced attacks. In contrast in the case of cattle and donkeys, there was no significant correlation between livestock attacks experienced and the type of preventive measure used to protect goats and sheep ($\chi^2 = 6.398$, $df = 3$, $p = 0.095$) at homesteads. There was no relationship between wealth status and the type of preventive measure used to protect goats and sheep ($\chi^2 = 4.222$, $df = 3$, $p = 0.247$).

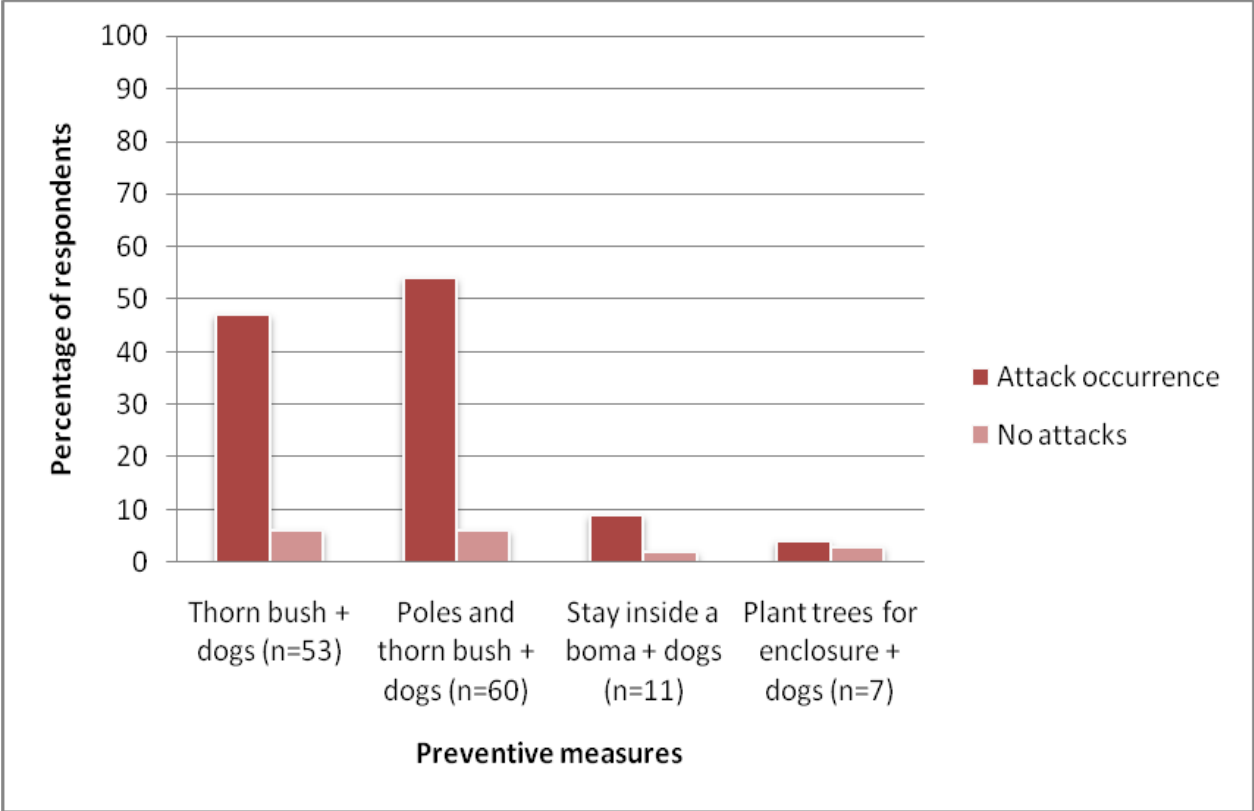


Figure 4.2: Frequency of respondents reporting attacks by predators on goats and sheep for different preventive measures used in homesteads.

The type of preventive measures used to protect calves, kids and lambs were different from those used for cattle and donkeys and for mature goats and sheep. The majority of respondents mentioned keeping calves, kids and lambs in small shelters constructed of poles, with walls plastered using mud and cow dung and thatch grass and having the assistance of domestic dogs. Many of the pastoral communities believe that these small houses can provide adequate security for these particular livestock types. However, significantly more respondents using this measure reported experiencing attacks on calves, kids and lambs (Fig. 4.3), indicating that this preventive strategy is ineffective against predation.

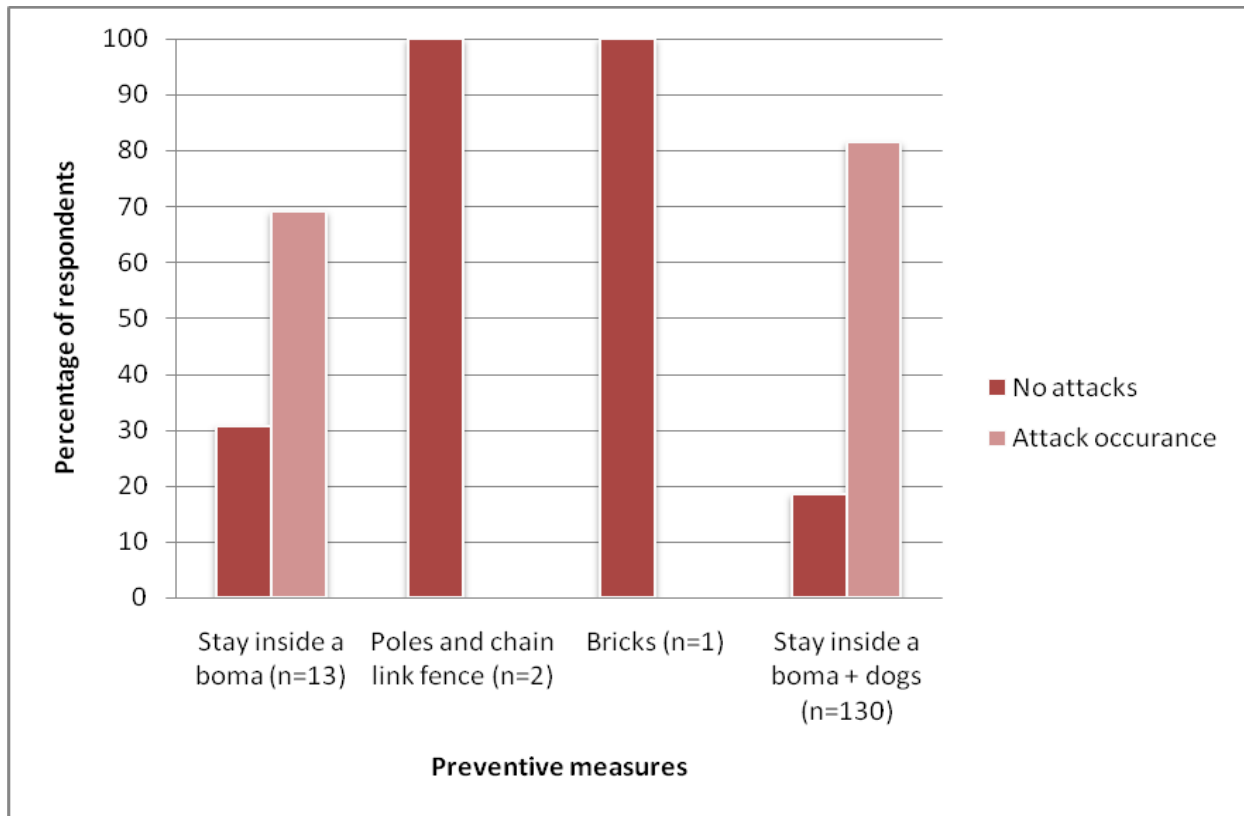


Figure 4.3: Frequency of respondents reporting attacks by predators on calves, kids and lambs for each preventive measure used in homesteads.

4.3.1.1 Chain-link fences as a preventive measure against predation of livestock

Monthly dialogue sheets were used to conduct an assessment on the effectiveness of chain-link fences as a strategy for preventing attacks on livestock by predators in bomas. Forty three (43) bomas were reinforced with chain-link fences with the aim of preventing predation on livestock.



Plate 4.2: Example of a chain-link reinforced boma in the Maasai steppe.

The number of visits to bomas reinforced with chain-link fences i.e. experimental bomas (Plate 4.2) and traditional bomas (made of thorn bush enclosures/planted trees for enclosure) i.e. control bomas are presented in Table 4.6. Over a period of four years (May 2006 to March 2010), experimental and control bomas were visited monthly to collect information on whether bomas reinforced with chain-link fences are more effective in preventing livestock predation than traditional bomas. The preliminary results from monthly visits to experimental and control bomas indicate that both boma types experienced similar numbers of predation attempts, but the probability of predation was higher in control bomas than in chain-link reinforced bomas due to the type of material used for traditional bomas that cannot prevent predators from breaking through (Table 4.6 and Fig. 4.4).

Table 4.6: Visits to experimental and control bomas from May 2006 to March 2010 showing number of visits and predation attempts and successes

	Number of bomas reinforced with chain-link fences (experimental bomas)	Number of bomas constructed with thorn bush walls (control bomas)	Total
Bomas visited	43	41	84
Number of visits	412	394	806
Predation attempts	20	19	39
Predation success	0	6	6
Probability of predation success	0	0.31	

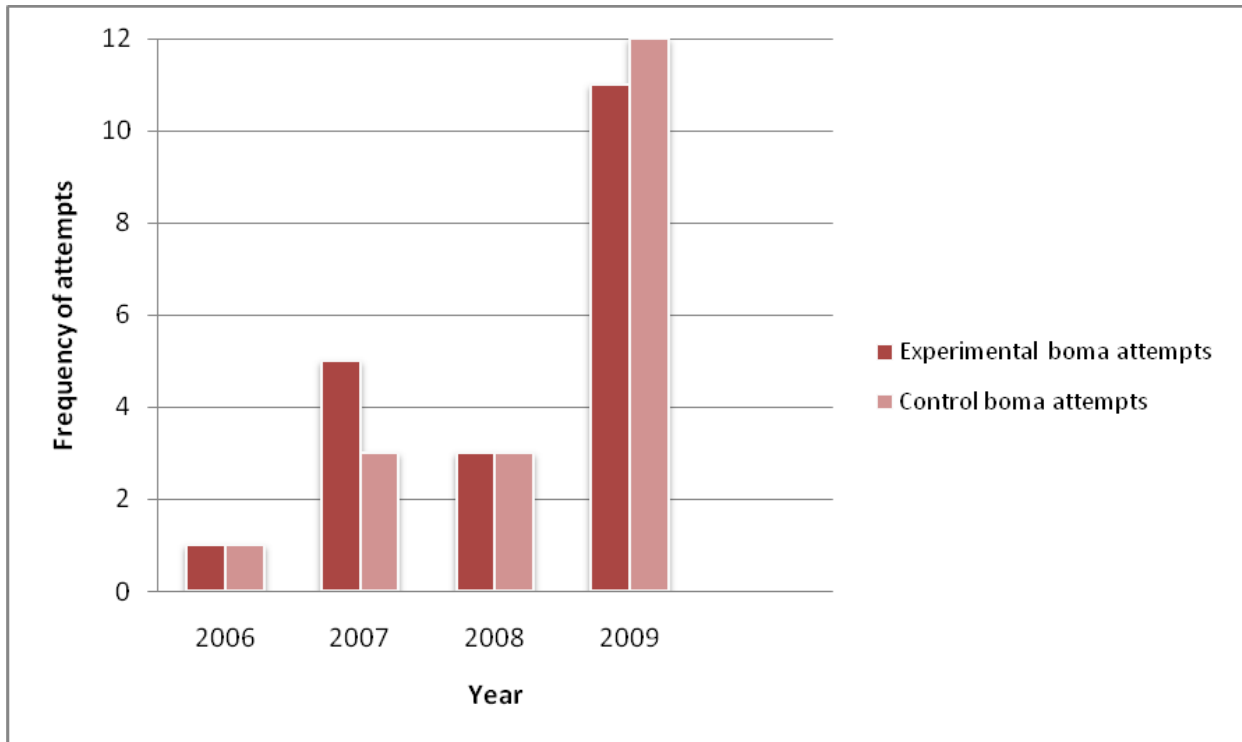


Figure 4.4: Numbers collected from May 2006 to March 2010 showing frequency of predation attempts by predators for bomas reinforced with chain-link and for traditional bomas made of thorn bushes in the Maasai steppe ecosystem

4.3.2 Livestock protection in the grazing fields

During the day, livestock are driven outside the bomas and closely attended to by herdsman of different age groups. Livestock herding strategies in the grazing fields differ depending on livestock type. Techniques used to protect livestock in the field include: herders standing in the middle of a livestock herd, splitting livestock herds according to stock type, grazing in groups in open areas, livestock grazing within the village, and herders carrying weapons (spear/sticks). Comparing the effectiveness of techniques used to prevent livestock attacks in the field, grazing livestock in groups appeared to be the most effective security measure for cattle and donkeys (Fig. 4.5) and for goats and sheep (Fig. 4.6).

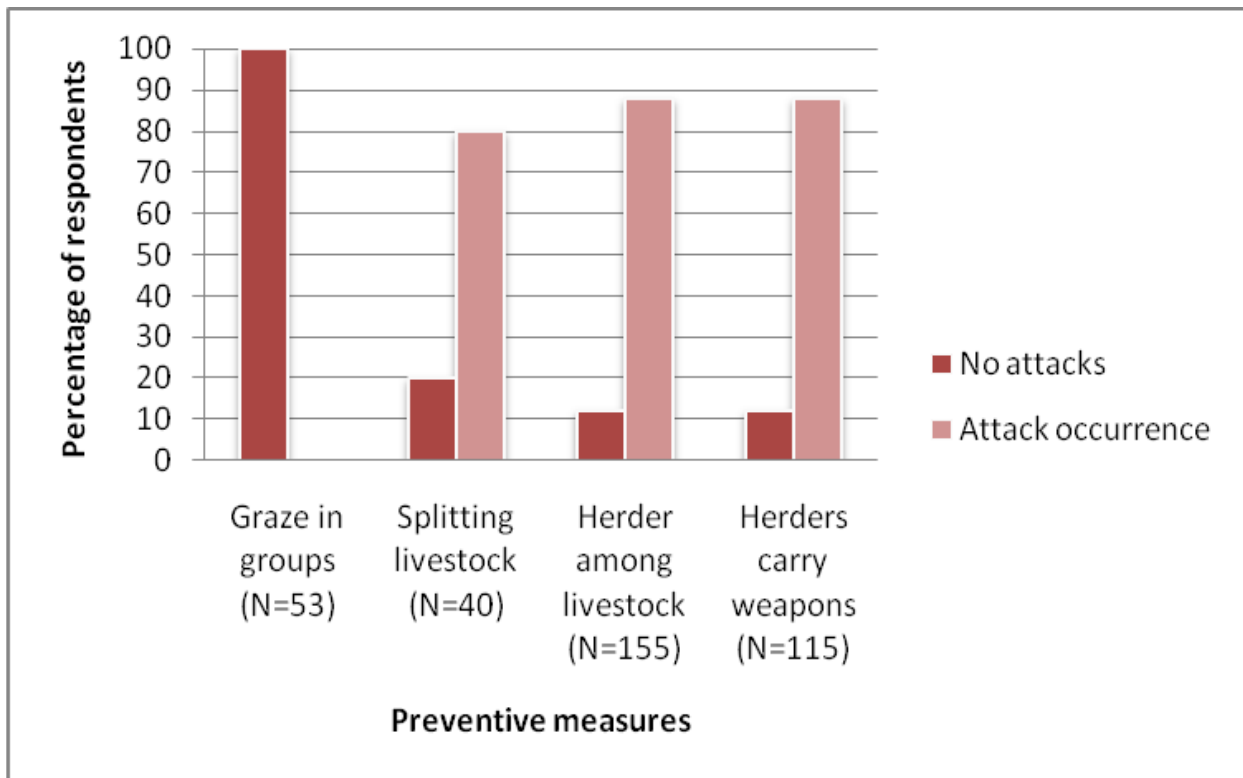


Figure 4.5: Frequency of responses reporting attacks by predators on cattle and donkeys for each preventive measure used in the field

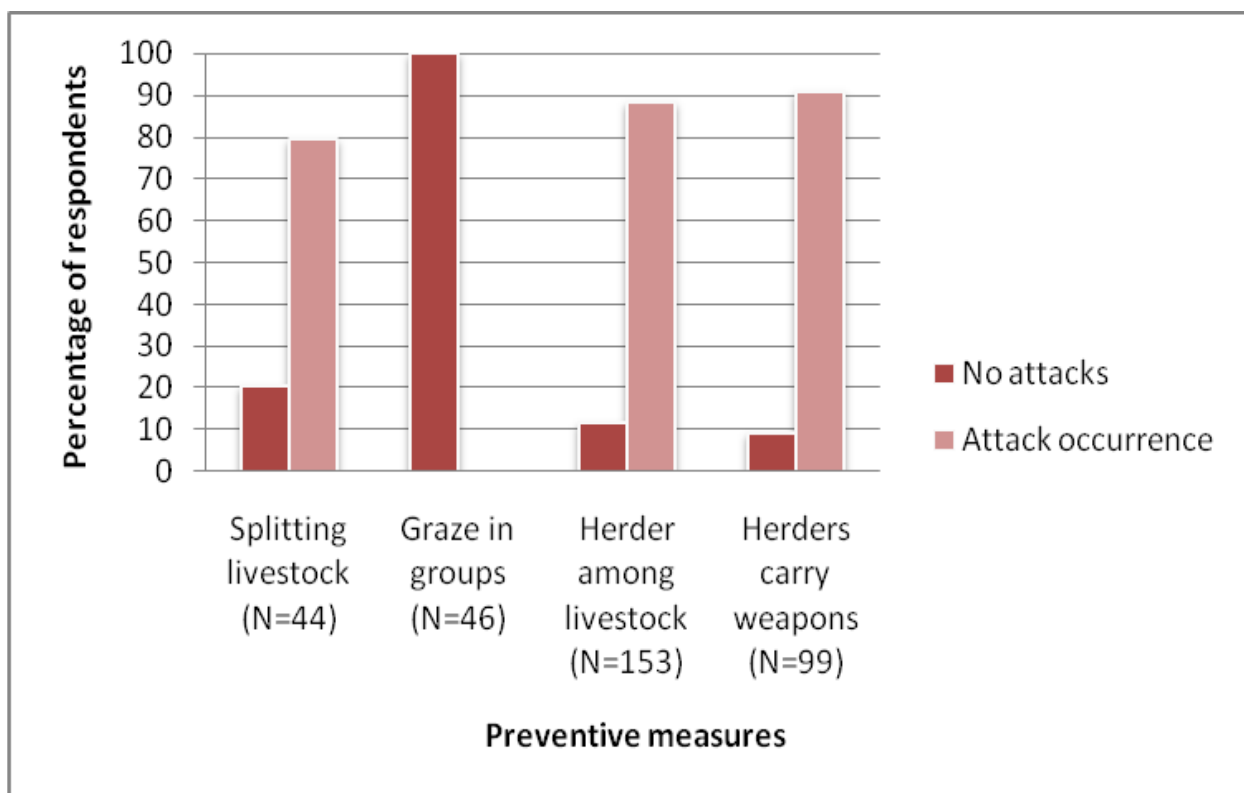


Figure 4.6: Frequency of responses reporting attacks by predators on goats and sheep for each preventive measure used in the field

In contrast, calves, kids and lambs are not taken out for grazing but instead graze within the village and, in most cases, near the boma where they are closely attended by small boys left at homesteads, thus providing improved security as predators may be deterred by noise at homesteads.

Livestock protection in grazing fields is predominantly based on the alertness and behaviour of the herder as perceived by respondents. Predators may be deterred by the presence of a large number of people, noise, and the weapons that the herders carry, hence herding in groups, as perceived by most of the respondents, may increase the security of both herders and livestock.

4.4 Livestock herding practices and livestock losses

In pastoral communities, females and males of all age groups are responsible for livestock herding, although the majority of herders are males depending on the number of people present in a household. This was revealed by all respondents that participated in the study. The number of respondents of different age classes participating in herding livestock is presented in Table 4.7: *morans* (older boys) were the major herders for cattle and donkeys, whereas *layon* (young boys) were the major herders for goats and sheep (44%). Fifty-eight percent of respondents also mentioned *layon* participating in herding calves, kids and lambs, while 39% of respondents mentioned that *morans* participate in herding goats and sheep. Thirty-one percent of respondents pointed out that *layon* participate in herding cattle and donkeys, 18% mentioned both *moran* and *layon* accompany each other herding cattle and donkeys, and 13% said *moran* and *layon* accompany each other to herd goats and sheep. There was a significant association between age group and herding different livestock types ($\chi^2 = 85.579$, $df = 4$, $p = 0.0001$).

Table 4.7: Number of respondents on the relationship between herders' age class and livestock type

Livestock type	Age-sex class				
	Layon (Ages:4-15)	Moran (Ages:16-35)	Makaa/Landisi (Ages:>35)	Women (Ages:5-35)	Layon & Moran (Ages:4-35)
Cattle & donkeys	31%(n=45)	44%(n=64)	3%(n=5)	0%	18%(n=26)
Goats & sheep	44%(n=64)	39%(n=57)	2%(n=3)	1%(n=2)	13%(n=19)
Calves, kids & lambs	58%(n=101)	2%(n=3)	0%	26%(n=38)	1%(n=2)

Livestock losses in the field were found to be a serious problem for all pastoralists in the study area. Reasons contributing to livestock losses include: i) carelessness of herders because of sleeping or playing in the field, ii) livestock herds that mingle in the grazing fields or water points, iii) scattering of livestock when herded in thick bushes (woodlands), and iv) scaring of livestock by predators in the field. Ninety-four point four percent of the respondents from herders' surveys mentioned losing livestock in the field, and all respondents (100%) thought that livestock losses contributed to predation because in most cases livestock that are lost are not always found, and livestock carcasses are sometimes found in the field. The majority of the herders (98%) mentioned seeking assistance from colleagues to conduct a search after livestock loss. The frequency of responses on whether or not people lose livestock in the field and if this contributes to livestock predation, the reason for livestock losses, and the commonly lost livestock type are presented in Table 4.8.

Eighty-eight percent of respondents from household surveys stated that goats and sheep herded mostly by *layon* (small boys), are lost most frequently. A large majority (76%) of respondents from household surveys also mentioned scattering of livestock when herded in thick bush being the major reason for livestock loss, while 42% of respondents said it was due to carelessness of the herder while sleeping or playing. Thirty-five percent of respondents thought livestock were lost when different herds mingle in the grazing fields and at water points. A number of respondents had multiple responses for why they thought their livestock got lost in the field and thought that losing livestock in the grazing fields contributed to increasing livestock predation. Hence, the increased livestock predation due to livestock losses suggests increased retaliatory killings of large carnivores.

Table 4.8: Reported frequency of livestock losses by herders and its contribution to predation

Question	Responses	Number of respondent	%
Do you lose livestock in the field?	No	4	11.1
	Yes	34	94.4
Do livestock losses contribute to livestock predation?	No	0	0
	Yes	36	100
		N=36	
Why lost?	Carelessness of herder (layon sleeping or playing)	32	88.9
	Scattering, when herded in thick bush	36	100
	Mixing of herds in the fields & at water points	36	100
	When scared by predators	28	77.8
		N=36	
Livestock lost often	Cattle	7	19.4
	Goats & sheep	20	55.6
	Goats	36	100
	Sheep	7	19.4
	All	11	30.6
		N=36	

4.5 Effect of the season on herding practices and livestock predation

Pastoral communities move livestock at certain times of the year in response to changes in weather conditions (rains/water) and the availability of pasture in the village lands. Thus, they are forced to move their livestock from permanent to temporary bomas, sometimes more than 40kms away in search of pasture. Livestock can stay in temporary bomas for three to six months during which different techniques are employed to protect livestock from predation.

Eighty-five percent of respondents take their livestock to temporary bomas during certain times of the year, especially during the dry season, whereas 15% do not take livestock to temporary bomas perhaps because of the small number of livestock holdings. Eighty-six percent of respondents who took livestock to temporary bomas mentioned taking domestic dogs with them to maximize livestock protection, while 14% did not take domestic dogs. The number of respondents moving livestock to temporary bomas is shown in Table 4.9.

Table 4.9: Frequency of respondents on selected questions on herding practices and livestock predation in temporary bomas

Question	Responses	No. of respondents	%
Do you normally take livestock to temporary bomas on certain times of the year?	No	22	15
	Yes	124	85
		n=146	
Are dogs also taken to temporary bomas?	No	18	15
	Yes	106	85
		n=124	
Do you think more livestock are lost to predators in temporary bomas than in permanent bomas at home?	No	72	58
	Yes	52	42
		n=124	

Respondents were asked whether they thought having livestock in temporary bomas contributed to livestock losses due to predators. The majority (58%) thought this was not the case, suggesting that it did not matter where the livestock were because predators were widely distributed. However, 42% were of the opinion that more livestock were lost to predators in temporary bomas at night because livestock are moved closer to wildlife areas and there are fewer people in temporary bomas, hence there is relatively more risk of attack on livestock (Table 4.9). The long

walks that have to be made by livestock in search of grazing pasture and water during the dry season also exposes livestock to predators.

A variety of techniques are used to protect livestock from predation in temporary bomas. These include: i) use of thorn bush enclosure, ii) carrying of weapons such as spears by herders, iii) making of frequent noise to repel approaching predators, iv) lighting of fires at night to repel predators, v) herders staying among livestock, and vi) having a large number of people in temporary bomas. However, no single technique was found to be effective in preventing livestock attacks, suggesting that the risk of livestock being attacked by predators was similar regardless of the preventive technique used ($\chi^2 = 1.712$, $df = 5$, $p = 0.887$; Fig. 4.7).

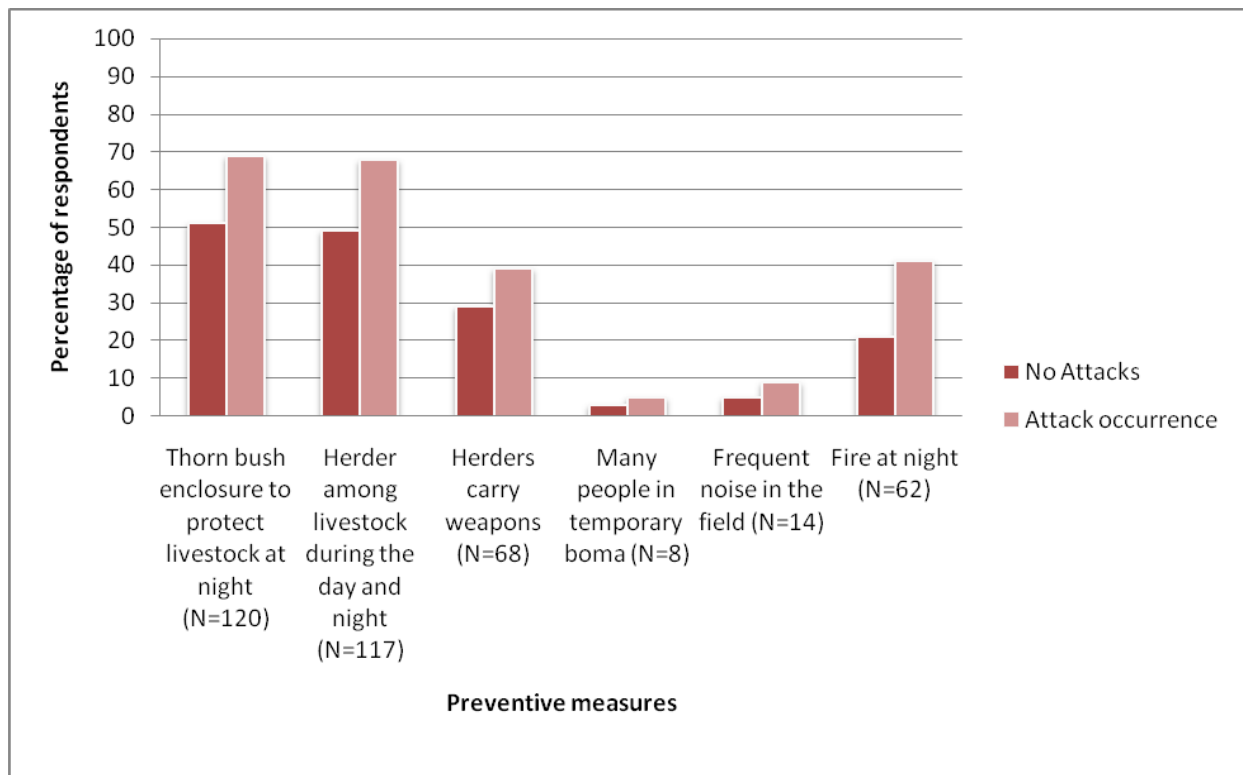


Figure 4.7: Frequency of responses on attacks by predators on livestock for each preventive measure used in temporary bomas.

4.6 Challenges related to livestock herding practices in the Maasai steppe

Pastoral communities in the Maasai steppe face a number of challenges while herding livestock both within the village and in temporary bomas. Eighty-four percent of respondents mentioned fear of attacks from wildlife, especially carnivores, as the major challenge while herding in the grazing fields or looking for water especially when they have to move to temporary bomas which in most cases livestock are moved relatively closer to wildlife areas (Table 4.10). Seventeen percent indicated the challenge of long walks in search of pasture and water, which also exposes livestock and herders to predators and other dangerous wildlife such as elephants, buffaloes, and snakes. Fifteen percent mentioned herders' sickness to be another challenge that leads to less attention paid to livestock and more risk of livestock attack when out in the field (Table 4.10).

In comparing the herding challenges that place livestock at risk of being attacked by predators, analysis indicated significant variations across villages (ANOVA: $F = 5.46$, $df = 5$, $p = 0.0001$, Table 4.11). Villages like Loiborsiret, Loiborsoit, and Emboreet experienced significantly more threats from predators as opposed to Oltukai, Olasiti, and Makuyuni villages, said by respondents to be due to villages' close proximity to park boundaries (Table 4.10).

Table 4.10: Frequency of respondents on major challenges pastoralists face in the Maasai steppe related to livestock herding practices (n=146)

Village	Threats from wildlife	Long walks	Health of herders	Losing livestock	No problems
Emboreet	33	4	0	0	0
Loiborsiret	25	4	5	0	0
Loiborsoit	24	6	2	0	0
Makuyuni	11	4	2	0	2
Olasiti	11	4	0	2	2
Oltukai	19	3	13	0	3
Total no. of respondents	123	25	22	2	7
%	84	17	15	1	5

Table 4.11: Duncan’s Multiple Range Test for comparison of herding challenges between villages; means with the same letter are not significantly different

Duncan Grouping		Mean	N	Village
	A	2.0000	38	Oltukai
	A	1.9474	19	Olasiti
B	A	1.7368	19	Makuyuni
B	C	1.4118	34	Loiborsiret
B	C	1.3125	32	Loiborsoit
	C	1.1081	37	Emboreet

4.7 Attitude of pastoralists towards schemes to improve livestock security

There are variables that can influence pastoralists’ attitudes toward schemes for improving livestock security. The attitude scales were constructed to assess the willingness of pastoralists to participate in insurance schemes to improve livestock security (Table 4.12).

Table 4.12: Frequency of responses to selected questions on willingness to change their mode of livestock protection and on their attitude towards insurance schemes for livestock predation (n=146)

Question	No	Yes
Are there any village initiatives to reduce the human–wildlife conflicts?	100%	0
Do you have a boma reinforced with materials such as chain-link fence to improve your livestock security?	91%	9%
If not, are you willing to participate/contribute in conflict mitigation programme like use of chain-link fence?	0	100%
Do you understand what an insurance is?	80%	20%
If an insurance scheme for livestock predation is initiated, would you be ready to participate?	13%	87%
If an insurance scheme was to be initiated, do you think livestock owners will not hunt down the predators killing livestock especially lions?	34%	66%

Respondents were asked whether or not they understood what insurance was, and 20% understood what it meant, while the majority (80%) did not understand what insurance was. Respondents who did not know the meaning of insurance, were asked whether they would be willing to participate in an insurance scheme after having been given a description, meaning, and operation of an insurance scheme in relation to livestock security. Responses to this question were tested to understand whether awareness about insurance influenced willingness to participate in an insurance scheme. There was no significant relationship between awareness and the willingness to participate in an insurance scheme ($\chi^2 = .337$, $df = 1$, $p = 0.765$), suggesting that lack of awareness about an insurance scheme did not influence household's decision to participate in the scheme. In addition, there was no significant correlation between attack

experience and willingness to participate in an insurance scheme for livestock predation ($\chi^2 = .050$, $df = 1$, $p = 1.000$).

Respondents were further asked whether retaliatory killing of predators would stop if an insurance scheme for livestock predation were initiated, and 34% indicated that killing of predators especially, of lions, would not stop, whereas 66% thought it would stop (Table 4.12). One respondent who thought that killing of predators, especially of lions, would stop stated that:

“.....if our livestock are insured and replaced after any predation incident both at homesteads and in the field, we have no reason to go after the predators again”.

And, on respondent who thought that retaliatory killings of predators, especially lions, would not stop stated that;

“.....lions will still come back for our livestock even when they are insured and replaced; hence we want to kill all predators, because we are tired of losing our livestock to predators, otherwise it will be a waste time and money”.

Preliminary results suggest that chain-link fences can improve livestock security; respondents were asked whether they were willing to reinforce their livestock enclosures with chain-link fences, and all those who did not have (91%) the chain-link fence were willing to improve their livestock security by the use of chain-link fences (Table 4.12). All respondents (100%) felt that chain-link fences are effective in reducing livestock attacks at homesteads.

4.8 Tanzania National Park's efforts towards addressing human–carnivore conflicts

To understand TANAPA's efforts in addressing the human–carnivore conflicts in the area, its officials were asked how they perceived the conflicts in the area. All respondents (100%, n=10) thought that the human–carnivore conflicts in the Maasai steppe ecosystem are very high (Table 4.13) and have detrimental impacts upon large carnivore conservation due to retaliatory killings by local communities. One official stated that:

“.....we lose a lot of lions killed by pastoral communities every year as a result of livestock predation in the area. They either spear or poison them and the situation is becoming more serious. For example in 2006 seven lions were killed at once by local communities in a neighbouring village after a livestock attack though there was no evidence of any livestock kill, and in 2009 five of our lions were poisoned at once by pastoralists, so the impact of the conflicts to our carnivore population is enormous”.

All respondents indicated that TANAPA does not have strategies in place to deal directly with human–carnivore conflicts apart from information gathered and collection of trophies when retaliatory killing of large carnivores occur. However, one official stated that:

“.....we have our anti-poaching units that conduct patrols in the park and are responsible to assist local communities when livestock predation occurs in the surrounding communities by scaring the predators or assisting the local communities when there are human injuries, there are no other strategies beside this”.

When asked whether there were specific laws within the organization that protect large carnivores from retaliatory killings, all respondents mentioned that there were no specific laws to protect large carnivores, except for the general Wildlife Conservation Act of 2009. Section 73(1) of the WCA No.5 of 2009 states that “Nothing in this Act shall make it an offence to kill any animal in defence of human life or livestock.”

Table 4.13: Frequency of responses by TANAPA officials to selected questions on human–carnivore conflict perception, effectiveness of outreach programmes to reduce livestock predation, community involvement in human–wildlife conflict mitigation, and wildlife laws (n=10)

Question	Responses	No. of respondents	%
How do you perceive to be the level of human-carnivore conflicts in Maasai steppe ecosystem?	Very low	0	0
	Moderate	0	0
	Very high	10	100
How effective are the Community conservation programmes (outreach) in resolving the human-carnivore conflicts?	Not effective	9	90
	Somehow effective	1	10
	Very effective	0	0
To what level are communities involved in addressing the human–carnivore conflicts?	Not involved at all	6	60
	Somehow involved	3	30
	Involved to a large extent	1	10
Are there specific law(s) within the organization protecting carnivores from retaliatory killings by pastoralists?	No	10	100
	Yes	0	0

4.8.1 Role of outreach programmes in resolving human–wildlife conflicts

TANAPA has a department that deals specifically with communities adjacent to its National Parks i.e. outreach programmes. Through this department TANAPA supports community development projects. To understand the role of outreach programmes and communities in

conservation, TANAPA officials were asked about the level of community involvement in addressing the human–carnivore conflicts, and 60% mentioned that communities were not directly involved in resolving human–carnivore conflicts through the outreach programmes, 30% mentioned local communities being involved in some way, while 10% mentioned communities being directly involved to a large extent (Table 4.13).

To assess the effectiveness of the outreach programmes in resolving human–carnivore conflicts in the area, TANAPA officials were asked to evaluate the effectiveness of the outreach programmes in resolving the conflicts. The majority of respondents (90%) thought that the programmes were not effective in addressing the human–carnivore conflicts, whereas 10% thought that the outreach programmes addressed the problem of human–carnivore conflicts to some extent (Table 4.13). In response to this, one official stated that:

“.....our outreach programmes are not very effective in targeting the actual problems that local communities face with regard to their livelihoods (livestock predation and crop damages). The programmes focuses more on development activites in communal lands. For instance our case in Tarangire, we do not have sufficient manpower within the outreach department to allow us deal with the various issues surrounding us (i.e. one senior staff for the entire ecosystem), this needs to be dealt with. Secondly, I think we need to restructure our programmes by targeting the actual problems that directly affect communities’ livelihoods to achieve conservation goals and fully involving local communities at all levels as our major stakeholders in our intiatives to improve the relationship with our neighbours”.

4.9 Conclusion

The results of the research illustrate that pastoralists in Maasai steppe still experience livestock predation with the currently used traditional measures to protect livestock and herders facing a number of challenges that place both herders and livestock at relatively more risk of attack by predators. The research suggests that all techniques used by pastoral communities in the study area were ineffective in preventing predation at homesteads, in grazing grounds, and in temporary bomas. However, use of chain-link fences at homesteads appeared to be the only technique that may reduce the chances of predation on livetsock. The study reveals that there was

a large number of children and females as opposed to adult males in all surveyed households, suggesting that the number of people in a boma does not guarantee livestock security.

Herding practices in the Maasai steppe are influenced by seasonal conditions depending on availability of grazing pasture and water. Herders face a number of challenges while in the grazing fields. The seasonal movement of livestock in search of grazing pasture expose both livestock and herders to predators hence increasing the chances of attack. Losing livestock was observed to be another herding challenge contributing to the increased human–carnivore conflicts because most of the livestock that were lost were not found and ended up being exposed to predators, and this may lead to change in behaviour by predators. Grazing in groups was observed to be the only effective technique to reduce attacks on livestock in the grazing fields, suggesting the necessity for further studies on how best to improve livestock security in grazing fields and temporary bomas.

The attitude scales obtained (willingness of pastoralists to participate in schemes for livestock security improvement) indicate that many respondents (87%) were willing to participate in insurance schemes for livestock predation, and 91% of respondents were willing to improve livestock security through the use of chain-link fences.

TANAPA, however, does not have clear strategies in place to deal with human–carnivore conflicts in the area and does not have specific laws to protect large carnivores from retaliatory killings by pastoralists. TANAPA’s outreach programmes moreover, are not effective in addressing the human–carnivore conflicts and do not involve local communities in conservation initiatives resulting in negative attitude by local people towards conservation. This calls for a change in conservation strategies to address the human–carnivore conflicts in areas with similar conservation issues and to achieve conservation goals.

CHAPTER FIVE

DISCUSSION

5.1 Traditional measures for protecting livestock from predation

Human–carnivore conflicts are a threat to conservation of carnivores as a consequence of retaliatory killings by pastoralists (Table 3.1) whose livelihoods and lives are threatened (Hazzah, 2006; Kissui, 2008). The interaction between carnivores and pastoralists is known to increase with increasing human population densities and fragmentation of wildlife habitats due to increased human activities surrounding PAs i.e. agriculture and grazing activities (Frank *et al.*, 2006). This, coupled with the reduction of natural prey, forces carnivores to switch to livestock, making the coexistence of pastoralists with carnivores and the idea of conservation difficult. In most cases, human–carnivore conflicts are detrimental to pastoralists’ social capital and this undermines pastoralists’ tolerance towards predators and conservation. Implicit

This research attempted to understand the role of husbandry as practised by pastoralists in reducing human–carnivore conflicts in the Maasai steppe. Pastoralists keep large numbers of livestock that stand as their social capital (Pratt and Gwynne, 1977) and this demands high labour input to protect them. Several strategies have been developed over time to cope with changing environmental conditions and carnivore conflicts. Range degradation is avoided by reduction of livestock concentrations near permanent homesteads by sending livestock to temporary bomas on a seasonal basis. Traditionally, Maasai bomas have large numbers of people that maintain the large numbers of livestock. Grazing patterns in the surrounding area are dictated by season due to the threat of wildlife–livestock diseases, and thus grazing patterns differ between cattle and small stock (goats and sheep).

The research suggests that different husbandry techniques are used for livestock protection in homesteads, in the grazing fields, and at different times of the year. Traditional bomas in the study area are made either by use of native thorn bushes (*Acacia spp.*) or by planting trees

(*Commiphora spp.*). The boma provides a protective enclosure against predators at homesteads. Livestock is a major wealth determinant for pastoralists, and the larger the numbers of livestock a person owns the wealthier the person is thought to be. Results from this study suggest that wealth status did not influence the type of livestock protection measures used by individuals. This means that livestock protection measures are not determined by wealth status of an individual but rather experiences of attack does. Furthermore, other factors such as ethnic group and education levels did not influence the type of preventive measure that an individual used to protect livestock.

Studies in Kenya and Namibia found that the presence of domestic dogs helped to improve livestock security at homesteads and in grazing fields (Ogada *et al.*, 2003; Hemson, 2004). However, this research suggests that people with or without domestic dogs experienced equal predation incidents. Domestic dogs were effective only in alerting when sighting a predator at the boma at night or in the field during the day, but this did not appear to improve livestock security significantly beyond that without dogs. Unlike the study by Ogada *et al.* (2003) that showed the number of people in a homestead may deter predators from attacking livestock (i.e. larger number of people in a boma were associated with lower predation rates), results from this study do not support this conclusion: the number of people in a boma did not prevent attacks with the majority of boma members being children and women who cannot defend livestock from predation. Households with both small and large numbers of people experienced predation equally. Similarly, people who used a combination of measures such as dogs and thorn bush enclosures, dogs and planting trees, staying inside a boma with dogs for cattle and donkeys, for goats and sheep, and for calves, kids and lambs all experienced livestock attacks at homesteads, suggesting that the techniques used are not effective in preventing attacks, although pastoralists in the area thought that their livestock are well secured with the techniques used. The exception was a few individuals who used chain-link fences and bricks to protect the smaller stock i.e. calves, kids and lambs that did not experience any attacks although the sample size was too small to allow a conclusive analysis. Studies in Botswana have indicated that livestock losses to predators are not influenced by the structure/size of the enclosure, number of people, or presence

and number of dogs but rather by the number of livestock an individual owns (Hemson *et al.*, 2009).

To evaluate the effectiveness of chain-link fences in preventing livestock attacks, bomas reinforced with chain-link fences along with respective control bomas not reinforced with chain-link fences were monitored on a monthly basis, and the preliminary results suggests that bomas reinforced with chain-link fences are more effective in preventing predation than traditional bomas. This implies that, for effective livestock security in bomas, pastoralists need to adopt new techniques such as the use of chain-link fences. Kissui (2008) found that communities kill predators in relation to the number of predation events on livestock by the predators. Hence, implementation of any practice that will reduce the vulnerability of livestock is critically important to reduce retaliatory killing by pastoralists of carnivores, especially lions. The benefit of reinforced bomas for carnivore conservation can only be realized if the technique is adopted by the majority of pastoralists in the Maasai steppe. The greatest constraint in using chain-link fences appears to be the cost associated with purchase of materials.

In the grazing fields, the attentiveness of herders and the number of herders present are the major factors influencing livestock protection against predation. Protection of livestock on grazing grounds is also affected by the observation, behaviour, and activity of the herdsman (Ogada *et al.*, 2003). The strategies currently used to protect livestock in the field by pastoralists for all stock types include: splitting livestock herds (i.e. cattle and donkeys from goats and sheep), groups of herders grazing their livestock together, herders carrying weapons (spears/sticks), and herders staying among livestock herds. By comparison, a group of herders grazing their livestock together was the only strategy that appeared to be effective towards improved livestock security in the field for cattle and donkeys as well as goats and sheep. This might be the case because the number of herders in the field may increase the alertness and probability of predator detection. Predators may be deterred by weapons the herdsman carry along with them (spears or sticks) and noise. In contrast, calves, kids and lambs that are not driven away from homesteads are closely attended by the young boys left at the boma, hence increasing their security. Nevertheless, in

some cases, pastoralists have experienced kids and lambs being attacked by jackals during the day. Ogada *et al.* (2003) also concluded that human activities at homesteads may deter the incidence of predation. Splitting of livestock herds into smaller groups is used to reduce the risks of attacks on livestock depending on the environmental conditions in a particular area that allow herders to manage only a small, rather than a large, number of livestock. When livestock splitting increases during the dry season and there is a shortage of labour, cooperative herding is practised, especially for poor families, or employment of a herder is resorted to for wealthier families (Bekure *et al.*, 1991). However, Bekure *et al.* (1991) state that employing herders is a recent development in pastoral communities, and employing herders was not observed in the Maasai steppe, and splitting livestock increased during the dry season due to scarcity of grazing pasture.

Pastoralists in the Maasai steppe adapt their husbandry practices in relation to the seasons and to the availability of pasture and water. Pastoralists' mobile lifestyle helps them to deal with the seasonally fluctuating resources (Bekure *et al.*, 1991). In the Maasai steppe all members within a household take some responsibility for livestock herding (i.e. females and males of different age classes), although the majority of herders are males. As a strategy for improving livestock protection, relatively more *morán* participate in herding livestock during the dry season while *layón* herd livestock during the wet season. The need for *morán* to participate in herding activities during the dry season is partly due to the need for being able to walk long distances for pasture and water. Long walks during the dry season in search of pasture and water will expose livestock to more risk of predation and the young boys cannot survive the long walks.

It was observed from the study that *layón* are the major herders of all stock types, whereas *morán* are partly responsible for herding livestock during certain seasons and during adverse conditions, such as drought. However, Ikanda (2006) in his study on traditional husbandry techniques by Maasai communities against predation in the Ngorongoro Conservation Area concluded that *morán* provided better livestock protection than *layón* and that predation rates were significantly lower in livestock herds attended by *morán* than *layón*, though the analysis was restricted to

incidence of predation by lions. Although this study did not explicitly assess incidence of predation on herds attended by *moran* versus *layon*, respondents indicated that more livestock losses were associated with herds attended by *layon* than *moran*. This is consistent with findings from other study sites (Ikanda, 2006; Mwebi, 2007). Results from this study indicate that most livestock losses were associated with herding by *layon* because of carelessness by either sleeping or playing, confirming that livestock attacks are more likely to occur when herding is done by *layon*. Other reasons for losing livestock in the field include mingling of livestock herds. Mingling of livestock can occur during grazing at water points and when livestock scatter in the field, especially when herded in thick vegetation. Respondents confirmed that losing livestock contributed to increased incidence of predation on livestock, suggesting that more killings by pastoralists to large carnivores are likely to occur under these circumstances.

Pastoral communities in the Maasai steppe are forced to move their livestock from permanent to temporary bomas in search of grazing pasture and water at certain times of the year. In temporary bomas, which are mostly in the grazing fields, various techniques are employed to protect livestock from predation. These techniques include thorn bush enclosures to protect livestock, herders staying among livestock during the night as well as during the day when attending livestock, herders carrying weapons such as spears/sticks, larger numbers of people go to temporary bomas to defend livestock, making frequent noise while in the field and making fires at night to scare predators. Results suggest that no single technique was more effective in protecting livestock from risk of predation than other techniques. Since this result was primarily based on responses by interviewees, a more quantitative comparative study of the different techniques is needed to identify techniques that have the potential to improve livestock security in temporary bomas.

5.2 Herding challenges faced by pastoralists in the Maasai steppe

Pastoral communities in Maasai steppe face various challenges that increase the risks of predation on livestock in the field. One of the challenges facing herders is the long distances that have to be travelled to take livestock from permanent to temporary bomas where they spend

between three to six months depending on climatic conditions. Herders need to move long distances in search of pasture and water thus exposing livestock to more risk of attack by predators. Livestock security in the field depends on the alertness and behaviour of herders, and herding in thick vegetation requires more close attention and monitoring of livestock movement. The other challenge is livestock sickness in the field. Livestock that are sick are normally left behind because of inability to keep up with the rest of the herd during long distance movement, making the sick livestock especially vulnerable to predators.

Health of herders is another challenge. Most of the livestock herds in the field are attended by one or two people, thus when a herder falls sick it means less attention is paid to livestock, and this in turn poses more risk of losing livestock to predators. Losing livestock in the grazing field is another challenge contributing to increased predation on livestock in the Maasai steppe. Livestock losses in the field occur in three situations: firstly, when livestock are herded in thick vegetation, secondly, when livestock mingle on grazing grounds or water points, and thirdly, when herders are sleeping or playing. However, herders in the study area said they normally seek assistance from colleagues to search for the lost livestock, but in most cases the livestock are not found hence they are left in the bush exposed to predators and this leads to increased predation.

5.3 Attitudes of pastoralists toward insurance schemes and willingness to participate in schemes to improve livestock security

Evaluating communities' tolerance and attitudes toward conservation of carnivores and insurance schemes for livestock predation is complex due to varying and conflicting values with regards to livestock losses to predation. The negative attitude resulting from livestock losses to predators influences communities' perception towards insurance schemes for predation on livestock and willingness of pastoralists to improve livestock security (such as the use of chain-link fences). The research findings indicate that 87% of respondents were willing to participate in insurance schemes for predation on livestock and 91% were willing to improve security of their livestock by using chain-link fences. One respondent during the household interviews stated:

“.....the idea of chain-link fences to improve livestock security is good and serves a lot to preserve our environment from destruction due to frequent repairs of our traditional bomas (thorn bush enclosures and trees), but the problem is our low purchasing power to afford the fence”.

In addition, one would expect that there would be a strong relationship between the number of attacks on livestock of an individual and the willingness to participate in an insurance scheme or an individual's awareness of insurance scheme which would influence participation level, but this was not the case. The two variables (i.e. number of livestock attacks and awareness of insurance schemes) were not significantly different, suggesting that whether an individual had prior experience of attacks on livestock or whether an individual was aware or not of the meaning of insurance did not affect the willingness to participate in the scheme. However, there were varying opinions amongst respondents towards insurance schemes: one respondent during the household interviews commented on the applicability and efficiency of insurance schemes in the area if they were to be implemented saying:

“.....insurance schemes for livestock predation will definitely help solve/reduce the current human–carnivore conflicts in our surroundings by replacing our attacked stock, but my concern is the sustainability of the scheme and it may create room for corruption to our village leaders, hence the scheme should be supervised by outsiders, otherwise it will be a waste time and resources.”

To further investigate whether an insurance scheme for predation on livestock would reduce retaliatory killings by pastoralists of large carnivores, especially for lions, the findings indicated that 66% of respondents thought that killing of lions would be reduced. However, 44% of respondents thought the insurance scheme for predation on livestock would not reduce retaliatory killings of lions because they would still be attacking livestock. During the household interviews with some elders, there were conflicting opinions on whether killings of lions would be reduced with the introduction of insurance schemes for predation on livestock, and one elder commented that:

“.....lions are not human beings that learn from their previous mistakes, once a lion attacks livestock it should be terminated otherwise it will come back for the rest of the

livestock, after all they take our livestock without our consent, hence they deserve to get punished.”

The other elder who thought killing of lions would be reduced with the introduction of insurance schemes for predation on livestock mentioned:

“.....if our livestock are insured and paid back after any livestock attack we have no reasons to go after the lions to kill them, we only do that to get rid of the anger of losing our livestock to predators and nothing is done about it.”

Successful livestock security improvement and a sustainable carnivore conservation strategy will depend on a combination of strategies including: herders grazing livestock in groups and in open areas with high visibility and improving livestock enclosures at homesteads (i.e. change from using traditional thorn bush enclosures to sturdier materials such as chain-link fences). However, attitudinal changes through conservation awareness programmes among pastoral communities can play a bigger role in reducing predation on livestock together with the initiation of and support for schemes such as insurance for predation on livestock. Improving livestock husbandry can reduce the incidence of predation (Marker *et al.*, 2003; Ogada *et al.*, 2003; Woodroffe, 2005), but changes in husbandry practices need to consider the affordability of any initiative in order to increase the willingness to participate by pastoral communities and the acceptance of the initiative.

Although this study suggests that most pastoralists are willing to participate in schemes for improving livestock protection, other studies have shown that compensation and insurance schemes may have negative implications in that pastoralists become less likely to attend livestock knowing that there will be replacement for loss (Dyar and Wagner, 2003; Nyhus *et al.*, 2003; Swenson and Andren, 2005). There has been criticism against the sustainability of insurance and compensation schemes that such schemes do not change pastoralists' tolerance towards carnivores (Naughton-Treves *et al.*, 2003; Nyhus *et al.*, 2005; Hazzah *et al.*, 2009), and do not stop retaliatory killings of carnivores by pastoralists. Some programmes, such as the predator compensation fund at Mbirikani Group Ranch in Kenya, have produced mixed results with some community members being satisfied with the programme while others were not

(Hazzah *et al.*, 2009; MacLennan *et al.*, 2009). Certainly, the success of insurance and compensation schemes depends on institutional plans and acceptability by local communities. However, it is important to note that people's attitude towards PAs and conservation are shaped by an individual's perception that in most cases is determined by the level of interaction among conservationists, wildlife, and local communities in the surrounding PAs (Newmark and Leonard, 1993; Fiallo and Jacobson, 1995; Ite, 1996 in Holmes, 2003). Also, a positive attitude of a community does not always ensure positive conservation efforts (Naughton-Treves, 1997). Bagchi and Mishra (2006) concluded that attitude and tolerance of pastoralists towards carnivores depend on the socio-economic significance of livestock. Therefore, it is crucial to develop ways that strengthen the role of pastoralists in conservation to ensure sustainable carnivore conservation in the Maasai steppe through efficient livestock herding practices that will minimize livestock predation.

5.4 Conflict mitigation strategies in the Tarangire-Manyara ecosystem by TANAPA

In Tanzania, wildlife is owned exclusively by the state, and the revenue accrued from wildlife-related activities has been, until recently, spent nationally rather than locally (MNRT, 1998). Historically, the creation of National Parks isolated local people from resources and their traditional lands on which they depended, hence causing conflicts with park management systems (Borner, 1985). However, the National Parks are not large enough to accommodate wildlife throughout the year suggesting that communal lands are vital in wildlife conservation. Seasonal wildlife migration to communal lands leads to increased human-wildlife conflicts. Therefore, evaluating conservation agency's efforts in addressing the human-wildlife (specifically human-carnivore) conflicts is crucial. The number of human-carnivore conflicts in the Maasai steppe is known to be very high and has detrimental impacts on conservation of large carnivores (over 200 lions were killed from January 2004 to June 2010 from retaliatory killing by pastoralists (Table 3.1), and this threatens conservation initiatives in the area. Local communities often perceive conservation practices as being a threat to their land use rights and land tenure (Igoe and Brockington, 1999).

TANAPA does not have any strategies in place that deal directly with human–carnivore conflicts, and according to its officials there are no specific laws within the organization that protect large carnivores from retaliatory killings in the area. The organization has a general wildlife law that prohibits the killing of wildlife though TANAPA does not have legal power over wildlife beyond park borders. However, Wildlife Division (WD) have legal mandate over wildlife occurring outside National Parks (NPs), hence, there is a need to develop joint laws that will directly protect large carnivores from retaliatory killings to conserve the remaining carnivore population in the Maasai steppe ecosystem and Africa at large.

TANAPA, through its outreach programmes (formerly known as Community Conservation Services - CCS), aims at winning local communities' support in conservation initiatives by building a positive relationship between National Parks and local communities surrounding PAs through a benefit-sharing process. PAs' outreach programmes have been the major approach towards achieving community conservation in East Africa (Bergin, 1995). The economic justification behind the benefit-sharing strategy for community conservation (CC) is that local communities should benefit from biodiversity if they are to conserve it. However, efforts at benefit-sharing should not be viewed as a replacement for conservation initiatives to minimize the costs local people incur by living with wildlife but rather as a way to address the human–wildlife conflicts that directly impact on communities' livelihoods. Over the long term, CC may not lead to improved community well-being or biodiversity conservation if its programmes are not restructured to address the actual problems local communities incur and which directly impact on communities' livelihoods such as livestock predation and crop damages (Hulme and Murphree, 2001). Benefit-sharing is essential, but may not be a sufficient condition, for local communities to engage in conserving wildlife. Involving local communities in conservation initiatives has become a major feature of conservation policy, both in Africa and other continents, although the research findings illustrate otherwise: local communities in the Maasai steppe are not fully involved in conservation initiatives (Table 4.13). TANAPA has a well-developed and long-established programme to share benefits with the communities surrounding the National Parks (i.e. support for schools, health centres, and water projects) to win their support in conservation.

The researcher interviewed TANAPA officials to understand the effectiveness of outreach programmes in addressing human–carnivore conflicts in the area, and the findings suggest that the programmes are not effective (Table 4.13). Outreach programmes focus on communities through benefit-sharing processes by supporting activities for village development rather than activities at the individual level that focus on the cost of livestock predation a homestead incurs from large carnivores. This makes outreach programmes ineffective in promoting positive attitudinal change among individual local community members towards conservation agencies (Berkes, 2004).

The protection of biological resources depends on the positive attitude of local people towards conservation agencies. CBNRM is an approach that involves local communities in Natural Resource Management (NRM). There are growing concerns about CBNRM worldwide. The major concern is how to devolve power to local communities over the access and control of resource use and the management of natural resources. The motive behind the idea of CBNRM is to conserve natural resources and to enhance rural livelihoods. CBNRM addresses conservation and development initiatives by allowing local communities to benefit from the use of NR. The benefits from CBNRM programmes are believed to be few and not equally distributed among communities which may result in conflict and mistrust among stakeholders i.e. government, private sectors, and local communities (Berkes, 2004). Also, varying cultural values towards resource use may lead to increased conflicts among community members resulting in the depletion of resources.

There are debates surrounding the principles of communal support that PAs cannot survive without the positive support of the local neighbours; this again influences many discussions related to community conservation (Berkes, 2004). The appealing ideology is that local communities surrounding PAs would value the biological resources as theirs, and these biological resources need local communities' protection, otherwise wildlife policies will fail

(Bell, 1987). Giving authority to local communities will pose more negative impacts for the future of conservation initiatives.

5.5 Conclusion

The research findings indicate that the husbandry practices that pastoralists in the Maasai steppe use are not effective in protecting livestock from predation either at homesteads or in the field. The use of chain-link fences and grazing livestock in groups were the most effective measures to protect livestock against predators at homesteads and in the field. Herders in the area face many challenges that place livestock more at risk of attack because of their nomadic grazing lifestyle which is the result of the seasonal variation in resources that exposes both herders and livestock to predators. Pastoralists in the area are willing to improve their mode of livestock protection at homesteads through the use of chain-link fences, but the past concern is their low purchasing power for the required material. The majority of pastoralists in the area are also willing to participate in insurance schemes for predation on livestock.

TANAPA does not have any strategies in place to deal with human–carnivore conflicts in the surrounding communities, and there are no specific laws to protect large carnivores from retaliatory killings by pastoral communities. TANAPA does not involve local communities in their conservation initiatives through their outreach programmes other than supporting development activities in communal lands. This calls for a change in conservation strategies by conservation agencies such as TANAPA and WD to involve all conservation stakeholders (i.e. local communities and private sectors) to achieve conservation goals.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Maintaining viable populations of carnivores in landscapes that are increasingly dominated by humans is currently one of the biggest challenges to conservationists. Balancing the needs of communities and conservationists is increasingly becoming more complicated. Large carnivores have always suffered from human-induced mortality. Conflicts continue where large carnivores interact with people, and conflict between predators and livestock will exist as long as carnivore and livestock ranges overlap. Carnivores and predation on livestock creates an economic and emotional burden for pastoralists who depend on livestock keeping to sustain their livelihoods. Pastoralists in the Maasai steppe rely on their customary husbandry techniques in order to coexist with carnivores in the area. Predation on livestock often results in dislike for large carnivores and diminishes tolerance during conflicts by pastoralists. Local communities surrounding PAs bear the cost of living with wild animals that surpasses the benefits they receive (Mynott, 2005); hence, finding solutions to minimize the number of livestock killed by large carnivores is a critical conservation priority.

Attaining solutions that minimize livestock losses while maintaining sustainable carnivore populations will require reliable knowledge on ecology, demography, and human–carnivore conflicts that only research can provide. Using information generated from research, conservation agencies, such as TANAPA, WD, and other stakeholders, can focus on addressing the problems such as human–carnivore conflicts, to reduce retaliatory killing of large carnivores by pastoralists. Benefit-sharing approaches are crucial, but are not entirely satisfactory to convince local communities to engage in biodiversity conservation, and should not be a replacement for conservation initiatives that minimize the costs local people incur by living with wildlife. Incorporating local communities into conservation at all levels (decision making, implementation, monitoring, and evaluation), is an alternative to the more traditional stronghold conservation approach to conserving wildlife. Livestock are safer with larger number of herders

in the grazing fields, whereas at homesteads chain-link fences can improve livestock security. Seasonal movement of herders in search of grazing pasture and water, however, increases the risks of predation on livestock, suggesting further studies are needed on how best to improve livestock security in temporary bomas.

There is a growing awareness of the ecological and economic benefits provided by carnivores and wildlife at large. Insurance schemes for predation on livestock are also important to increase pastoralists' tolerance towards losses. However, human-wildlife conflicts stand in the way of carnivore recovery and must be overcome if carnivores and people are to coexist. Involving local communities in conservation practices is crucial to achieve conservation. Outreach programmes can be successful if they offer alternative use of biological resources. Increasing and diversifying activities that generate income for the community can offer motivation for conservation by local communities.

6.2 Recommendations

Conflicts arise due to attacks on humans and livestock, where carnivores and human-beings interact. More lions, because of their predation on livestock, are being killed by pastoralists (Table 3.1) than ever before. It is important to address such conflicts to attain conservation goals. However, achieving conservation goals needs a combination of efforts by all stakeholders i.e. governments, local communities, and private sectors.

6.2.1 Local community participation

Community involvement in conservation activities is crucial to achieve long-term successes in conservation. Local communities surrounding PAs are isolated from conservation activities globally (Barrow and Murphree, 1998), and pastoralists in the Maasai steppe are not involved in conservation initiatives in any form by TANAPA.

TANAPA's outreach programmes do not address the particular conflicts in communal lands, such as predation on livestock and crop damage. The benefit-sharing approach by TANAPA does not help to change communities' behaviour and attitude towards conservation or reduce predation on livestock and retaliatory killing of large carnivores by pastoralists; hence, the outreach programmes by TANAPA are not doing much to achieve conservation objectives. One of the problems of TANAPA's outreach department in the Maasai steppe is that it has insufficient manpower to address the human-wildlife issues in the area (i.e. one senior staff for the entire ecosystem). Conservation agencies such as TANAPA and WD need to establish local institutions in communal areas that will create a co-operative participation in decision making towards conservation initiatives that directly influence pastoralists' livelihood.

6.2.2 Conservation awareness

TANAPA, through outreach programmes, has an awareness component that is inadequately implemented with insufficient manpower. Creating conservation awareness in local communities is an important aspect towards achieving conservation goals. Conservation agencies (i.e. TANAPA and WD) can improve this aspect by establishing conservation education programmes in communal lands to encourage local communities to appreciate the value of wildlife and to show how communities can benefit by preserving the resources in question. It is also important for conservation agencies to make local communities aware that they have a role to play in conservation. Arranged field visits for local communities to National Parks by TANAPA and WD would help to increase communities' appreciation of carnivores and wildlife at large. Education would also serve to eradicate the mistrust existing between conservationists and pastoral communities.

To reduce livestock losses at homesteads and in grazing fields, effectiveness of husbandry should be improved. Conservation education should emphasize to communities the importance of improving their husbandry techniques to increase livestock security (i.e. changing from traditional thorn bush enclosures to chain-link fences) and improving herding practices. The use of chain-link fences would help preserve resources of the environment from being used so much

for frequent repairs of the traditional thorn bush enclosures. However, communities' education is needed on the benefits of maintaining small livestock herds that are not labour-intensive and can be maintained within village lands throughout the year. This would eliminate the need for seasonal movement of livestock in search of grazing pasture and water and would go a long way to reducing significant risks of attack by predators to livestock and herders.

6.2.3 Land use plans

Local governments (i.e. villages) in the Maasai steppe need to create plans for land use at a regional level by zoning the areas in the villages according to resource availability (grazing pasture and water) by season and avoiding areas where predators concentrate. This would reduce human–carnivore conflicts and need for walking long distances in search of grazing pasture which increases the risks of predation on livestock. Better land use plans would also improve resource preservation in communal areas and reduce environmental destruction.

6.2.4 Insurance schemes

Insurance schemes, if well implemented, have the potential for addressing the incidence of predation on livestock and reducing the retaliatory killings of large carnivores by pastoralists. Prior to the initiation of insurance schemes, pastoral communities need to be informed on how the insurance scheme would operate in the context of pastoral communities and on the roles that communities play in the implementation of the schemes.

6.2.5 Role of conservation agencies

Conservation agencies (i.e. TANAPA and WD) need to restructure their community conservation programmes towards addressing the current human–wildlife conflicts in the Maasai steppe. The current implementation of community conservation programmes targets village levels but does not focus on addressing the immediate conservation problems such as predation on livestock at the household level. Conservation agencies need to introduce community

programmes that directly address human–wildlife (carnivore) conflicts at an individual household level, and this is likely to change communities’ attitudes towards conservation in general in the Maasai steppe. Pastoralists in the Maasai steppe have a negative attitude towards conservation agencies as is illustrated by one of the interviewees during household survey who expressed his feelings towards the operations by of TANAPA:

“.....TANAPA is only concerned with their wildlife but not our livelihoods. When we report livestock attack incidents to them nothing is being done, but when we kill their lions after any livestock attack, that is when they show up for questioning. We do not see the value of wildlife apart from threatening our social capital (livestock) that we depend on for our livelihood; we are going to kill all lions in the area by spearing and poisoning them.”

Conservationists need to design and enforce laws that prosecute individuals who kill or participate in killings of large carnivores.

6.3 Concluding remarks

The research aimed to understand the role of traditional husbandry practices of pastoral communities in the area in reducing predation on livestock, challenges that herders face that place livestock more at risk of attack, willingness of pastoralists to improve livestock security, and conservation agencies’ (TANAPA) efforts in addressing human–carnivore conflicts. The results indicate that the current preventive measures used by pastoralists in the area are not effective in preventing incidences of attack on livestock either at homesteads or in the field. However, the use of chain-link fences at homesteads and the practice of grazing in groups were the most effective measures to reduce predation on livestock in the area. Hence, pastoral communities need to adopt such measures. Losing livestock in the field contributed to predation on livestock, resulting in possible increased killings of large carnivores in the area. Pastoralists’ nomadic lifestyle due to the seasonal variation of resources places livestock and herders at relatively more risk of attack by predators because herders and their livestock travel long distances. The research suggests that land use planning according to resource availability by season in communal lands would help reduce livestock losses and consequent predation by avoiding long walks in search of grazing pasture and water.

TANAPA does not have any strategies in place to reduce predation on livestock in the area and there are no specific laws that protect large carnivores from retaliatory killings by pastoralists. TANAPA's outreach programmes (CCS) focus on benefit-sharing by supporting development activities in communal lands rather than focus on immediate problems (i.e. predation on livestock and crop damage). Also, local communities in the area are not involved by TANAPA in conservation initiatives in any way. Therefore, it is suggested that there is a restructuring of TANAPA's outreach programmes to address the human–carnivore conflicts and to involve local communities in conservation initiatives. Conservation awareness regarding communal lands also needs to be emphasized by TANAPA to improve local communities' attitude towards conservation. Conservation cannot be achieved by isolating key stakeholders surrounding PAs (i.e. local communities). Effective management of the problem of predation is a conservation issue, and measures to lessen conflicts between humans and predators are required. Local communities surrounding PAs need to understand that they have a role to play in achieving conservation goals.

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APPENDICES

APPENDIX I

QUESTIONNAIRE FOR HOUSEHOLDS

A: Questions to the household and household details:

Village: Oltukai [1] Olasiti [2] Makuyuni [3] Loiborsoit [4]

Emboreet [5] Loiborsiret [6]

Sub-village: _____

District: Monduli [1] Simanjiro [2] Babati [3]

Ward: Esilalei [1] Minjingu [2] Emboreet [3] Loiborsiret [4] Makuyuni [5]

Name of interviewee: _____

Date: _____ Start Time: _____ End Time: _____

1. a) GPS location of household: _____

Gender and age of interviewee:

Male [0]	Female [1]	Age class
		15 – 25 [1]
		26 – 35 [2]
		36 – 45 [3]
		Above 45 [4]

Occupation:

___ Pastoralist [1] ___ Farmer [2] ___ Business [3]

___ Agro-pastoralist [4] ___ Agro-pastoralist & Business [5]

Others [specify] _____

b) How many households are in the boma? _____

c) Number of people in the boma

Male	Female	Age class
		0-10 [1]
		11-20 [2]
		21-30 [3]
		31-40 [4]
		Above 41 [5]

B: Questions on herding practices

2. a) Have you experienced any livestock attack over the last 2 years?

___ No [0] ___ Yes [1]

b) How do you perceive that as a problem?

___ Big problem [1]

___ Small Problem [2]

___ Not a problem [3]

c) Boma Information

Type	Distance from		Wall		No. of dogs	Years Used
	Others	Park border	Height	Width		

d) Are the livestock in the boma shared among relatives or owned by a single individual?

___ Shared [1]

___ Single Individual [2]

e) How often do you change your boma materials in a year?

___ Once [1] ___ Twice [2] ___ Three times [3] ___ Four times [4]

3. a) What measures do you use to prevent livestock attacks in your boma?

Livestock type	Thorn bushes [1]	Poles & thorn bushes [2]	Stay inside a boma [3]	Plant trees for enclosure [4]	Poles & chain-link fence [5]	Use of domestic dogs [6]	Moran guarding livestock at night [7]	Assistance from parks people or Govt. [8]
Cattle & Donkeys [1]								
Goats & sheep [2]								
Calves, baby goats and baby sheep [3]								

b) If you plant trees for enclosure what type of trees do you use?

c) Does your livestock sometimes break out of the boma at night?

___ No [0] ___ Yes [1]

d) If yes how often? Why?

e) What measures do you use to prevent livestock attacks on grazing grounds?

Livestock type	Use of domestic dogs [1]	Splitting livestock in groups [2]	Grazing in groups [3]	Morans to graze livestock[4]	Layon to graze livestock [5]	Herder among livestock groups [6]	Graze within the village [7]	Carry weapons for protection [8]
Cattle and Donkeys [1]								
Goats & sheep [2]								
Calves, baby goats and baby sheep [3]								

4. a) Do you have special areas for livestock grazing in your village?

___ No [0] ___ Yes [1]

Season	Livestock type	Where	Distance from your boma (kms)
Dry [0]	Cattle & Donkeys [0]		5 – 10 [1], 11 -20 [2], Above 20 [3]
Wet [1]	Goats & sheep [1]		
Whole year [2]	Calves, Baby goats and baby sheep [2]		

b) If no, why?

c) Who herds your livestock? How many people herd your livestock?

Livestock type	Who	No. of people	Season	Age Class
	Layon [1] Moran [2] Makaa/landisi [3] Women[4] Moran & layon [5]		Dry [0] Wet [1] Wet & Dry [2]	5-15 [1] 16-25 [2] Above 30 [3]
Cattle and Donkeys [1]				
Goats and sheep (Shoats) [2]				
Calves, baby goats and baby sheep [3]				

d) Does your livestock sometimes get lost in the grazing fields?

___ No [0] ___ Yes [1]

If yes, how often?

___ Daily [1] ___ Weekly [2] ___ Once a month [3]

___ Once/twice a year [4]

e) Why does livestock get lost?

f) Do you think this contributes to livestock predation? ___ No [0] ___ Yes [1]

g) Between cattle, goats and sheep which one gets lost more often?

___ Cattle [1]

___ Goats and sheep [2]

___ Goats [3]

Sheep [4]

All [5]

h) Do you sometimes employ a herder who gets paid? If yes why? If not, why?

No [0] Yes [1]

i) If you employ a herder and he loses livestock, what actions do you take?

j) Are there areas where you would not take your livestock for grazing? Why?

No [0] Yes [1]

5. a) Do you normally take livestock to temporary bomas on certain times of the year? If no go to Q. 5m)

No [0] Yes [1]

b) If yes, when does this normally happen every year?

Wet Season [1]

Dry Season [2]

Wet & Dry seasons [3]

c) Why do you take livestock in temporary bomas?

For pasture [1]

For water [2]

For pasture and Water [3]

d) How do you protect livestock in temporary bomas?

e) Who owns the areas where you move your livestock temporarily? Are these areas easily accessed with no restrictions or conflicts?

f) Do you take livestock to the same areas every year you move? Why? Why not the same areas? ___ No [0] ___ Yes [1]

g) How long do livestock stay in temporary bomas?

___ 1 month [1] ___ 2 months [2] ___ 3 months [3]

___ Over 3 months [4]

h) Do you lose livestock to predators in temporary bomas?

___ No [0] ___ Yes [1]

i) If yes, how often do you lose livestock in temporary bomas to predators?

___ Daily [1] ___ Weekly [2] ___ Monthly [3] ___ Once in two years [4]

___ Once in five years [5]

j) Who takes your livestock to temporary bomas?

___ Moran [1]

___ Moran and Layoni [2]

___ Moran and Landisi [3]

k) Are dogs also taken to temporary bomas? Why

___ No [0] ___ Yes [1]

l) Do you think more livestock are lost to predators in temporary bomas than in permanent bomas at home? Why? Why not? ___ No [0] ___ Yes [1]

m) What are the major problems you face related to livestock herding? (List starting with the most important problem).

C: Questions on Socio-economic impacts of livestock predation

6. What is the main reason for keeping livestock?

___ Cultural, sign of wealth [1]

___ Cultural, for food & business [2]

Others [specify] _____

7. How many livestock (cattle, goats, sheep, donkeys and dogs) do you own?

10 – 100 [1] 110 – 250 [2] 560 – 700 [5] Above 850 [7]

260 – 400 [3] 410 -550 [4] 710 – 850 [6]

8. Do you have any other income generating activities apart from livestock keeping?

___ No [0] ___ Yes [1]

If yes what are the activities?

___ farming [1] ___ Employed [2] ___ Business [3] ___ Others [4]

D: Livestock predation and attitude towards predators

9. a) If your livestock or a person from your household is attacked by a predator what do you do?

___ Report to wildlife authority [1]

___ Report to village leaders [2]

___ Inform Villagers & hunt down the animal [3]

___ Hunt down the animal [4]

___ Poison the animal [5]

___ No action [6]

___ Others [specify] _____ [7]

b) Who decides whether to hunt down the predator or not? How?

c) If you opt to inform the village leaders or wildlife authority what are their responses?

- No responses [1]
- Scare the animals [2]
- Help with human injures during the hunt [3]
- Attempt to hunt down the animal [4]
- Others [specify] _____ [5]

10. a) Do you receive any benefits from wildlife in your area?

- No [0] Yes [1]

b) If yes, what are the benefits?

Park Authority (Tanzania National Parks)	Hunting Companies	Tourism Investors	Others (specify)

c) What kind of benefits from wildlife would you consider beneficial?

Park Authority (TANAPA)	Hunting Companies	Tourism investors	Others (specify)

11. Has your village ever been visited by any wildlife authority?

- No [0] Yes [1] I don't know [2]

If yes, what was the purpose of their visit?

- I don't know [1]
- Assist village projects [2]
- Anti-poaching activities [3]
- Others (specify) [4]

12. a) Are there any village initiatives used to reduce human-wildlife problems?

No [0] Yes [1]

b) If yes, what are the initiatives and how effective are they in reducing the problem?

c) If no, why?

- Lack of knowledge [1]
- Lack of resources [2]
- Others (specify) [3]
- I don't know [4]

13. a) Are you aware of the chain-link fence to improve livestock security at homesteads?

No [0] Yes [1]

b) Do you have a boma reinforced with materials such as chain-link fence to improve your livestock security?

No [0] Yes [1]

c) If yes, how effective is the fence?

d) If no, are you willing to participate/contribute in conflict mitigation programme like use of chain-link fences?

No [0] Yes [1]

14. a) Do you understand what is an insurance? (*if no, the interviewer should describe what insurance mean and go to question 4b*)

___ No [0] ___ Yes [1]

b) If yes, describe it briefly:

___ not at all [0]

___ well understood [1]

___ slightly understood [2]

c) If an insurance scheme for livestock predation is initiated, would you be ready to participate? (*Interviewer to provide some details regarding insurance schemes*)

___ No [0] ___ Yes [1]

d) If yes, how do you think it will benefit you?

e) If no, what will make you participate?

15. If an insurance scheme was to be initiated, do you think livestock owners will not hunt down the predators killing livestock especially lions?

___ No [0] ___ Yes [1]

If no, why?

16. What do you personally do when you know any of the following predators (lion, hyena, leopard, cheetah, jackal, wild dogs) is close to your boma or livestock in the field?

___ Chase the animal [1]

___ Kill the animal [2]

___ Nothing [3]

17. What are your views regarding carnivore (wildlife) conservation in the surrounding areas?

18. Any suggestions that you think the park authority (Tanzania National Parks) or the District Council, Wildlife Division should do regarding the existing human-wildlife (carnivore) problem existing in the area? Would you be willing to talk directly with these authorities to find solutions?

APPENDIX II

QUESTIONNAIRE FOR HERDERS

Village: Oltukai [1] Minjingu [2] Makuyuni [3] Loiborsoit [4]
 Emboreet [5] Loiborsiret [6]

Sub-village: _____

District: Monduli [1] Simanjiro [2] Babati [3]

Ward: Esilalei [1] Minjingu [2] Emboreet [3] Loiborsiret [4]

Name of Interviewee: _____

Date: _____ Start time: _____ End time: _____

GPS Location: _____

Gender:

Male [0]	Female [1]	Age class	No. of herders	No. of Dogs
		5 - 15 [1]		
		16 – 25 [2]		
		26 – 35 [3]		
		Above 35 [4]		

1. What is your relationship with the livestock owner?

___ Own livestock [1] ___ Brother [2] ___ Others [5] _____
 ___ Father [3] ___ Boss [4]

2. What time do you normally take livestock out for grazing?

___ 6.00 am [1] ___ 7.00 am [2] ___ 8.00 am [3] ___ 9.00 am [4]

3. What time do you take livestock back to the boma/temporary boma?

___ 4.00 pm [1] ___ 5.00 pm [2] ___ 6.00 pm [3] ___ 7.00 pm [4]

4. Herd size

Livestock type	Number
Cattle	
Donkeys	
Goats and Sheep	

5. How do you decide where to take the livestock?

6. Are there areas where you would not take livestock for grazing? Why?

7. What do you normally do when you are out here?

8. What measures do you use to prevent livestock attacks when you are out here?

9. a) Have you ever lost livestock while grazing?

___ No [0] ___ Yes [1]

b) If yes, how often?

___ Daily [1] ___ Weekly [2] ___ Once a month [3] ___ Once/twice a year [4]

c) Why does livestock get lost?

d) Do you think this contributes to livestock predation? ___ No [0] ___ Yes [1]

10. What do you do when your livestock is lost?

11. Between cattle, goats and sheep which one gets lost more often? Why?

- Cattle [1]
- Goats and sheep [2]
- Goats [3]
- Sheep [4]
- All [5]

12. Do you sometimes herd in groups? Why?

- No [0] Yes [1]

13. Have you ever taken livestock to temporary bomas on certain times of the year?

- If no, go to Q24. No [0] Yes [1]

14. If yes, when does this normally happen every year?

- Wet Season [1]
- Dry Season [2]
- Wet & Dry seasons [3]

15. Why do you take livestock in temporary bomas?

- For pasture [1]
- For water [2]
- For pasture and Water [3]

16. How do you protect livestock in temporary bomas?

17. Do you take livestock to the same areas each year you move? Why? Why not the same

- areas? No [0] Yes [1]

18. How long do livestock stay in temporary bomas?
- ___ 1 month [1] ___ 2 months [2] ___ 3 months [3]
- ___ Over 3 months [4]
19. Do you lose livestock to predators in temporary bomas?
- ___ No [0] ___ Yes [1]
20. If yes, how often do you lose livestock in temporary bomas to predators?
- ___ Daily [1] ___ Weekly [2] ___ Monthly [3] ___ Once/twice a year [4]
- ___ Once in two years [5] ___ Once in five years [6]
21. Are dogs also taken to temporary bomas? Why?
- ___ No [0] ___ Yes [1]
22. Do you think more livestock are lost to predators in temporary bomas than in permanent bomas at home? Why? Why not?
- ___ No [0] ___ Yes [1]
23. Has any of these predators (lion, hyena, leopard, cheetah, wild dogs) ever attacked livestock while you are herding/in temporary boma? ___ No [0] ___ Yes [1]
- If yes what did you do?
- ___ Killed it [1]
- ___ Attempted to kill it but not successful [2]
- ___ Called for assistance [3]
- ___ Chased it [4]
- ___ Nothing [5]

24. What do you personally do when you see any of these predators (lion, hyena, leopard, cheetah, jackal, wild dogs) is close to your livestock in the field/temporary boma?

___ Chase the animal [1]

___ Kill the animal [2]

___ Nothing [3]

25. What do you do when a predator attacks a livestock in the field/temporary boma?

___ Chase the animal [1]

___ Kill the animal [2]

___ Call for assistance [3]

___ Nothing [4]

26. What are the major problems you face related to livestock herding? List starting with the most important problem.

APPENDIX III

QUESTIONNAIRE FOR TANAPA OFFICIALS

Department of interviewee: _____

Title of interviewee: _____ Specialty: _____

Responsibilities: _____

How long have you been in the area? _____

Date: _____ Start time: _____ End time: _____

1. How do you perceive to be the level of human–carnivore conflicts in the Maasai steppe ecosystem?

(1=Very low, 2= Moderate, 3=Very high)

1	2	3
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2. What impacts do human–carnivore conflicts have to large carnivore conservation?

(1=No impact, 2=Small impact, 3=Big impact, 4=very big impacts)

1	2	3	4
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3. a) What strategies does TANAPA have in dealing with human–carnivore conflicts when they occur?

b) How effective are they? (1=not effective, 2=somehow effective, 3=very effective, 4=N/A)

1	2	3	4
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4. a) Are there specific law(s) within the organization protecting carnivores from retaliatory killings by pastoralists? (0=No, 1=Yes)

1	2
---	---

- b) If No, why and what changes in the law(s) would you like to see in the future?

5. a) How effective are the Community conservation programmes (outreach) in resolving the human–carnivore conflicts? (1=not effective, 2=somehow effective, 3=very effective)

1	2	3
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- b) To what level are communities involved in addressing the human–carnivore conflicts? (1=Not at all, 2=Somehow involved, 3=Involved to a large extent)

1	2	3
---	---	---

6. Could you suggest possible solutions towards addressing the human–carnivore conflicts in the Maasai steppe ecosystem?