THE NEEDS OF EMERGING COMMERCIAL FARMERS IN NAMIBIA IN RELATION TO HUMAN-CARNIVORE CONFLICT

by

BONNIE SCHUMANN

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Supervisor: Mr. V. Harley
Co-supervisors: Dr. J.L. Walls and Dr. R.G. Snyman

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DECLARATION

I, Bonnie Doreen Schumann, declare that the contents of this thesis represent my own unaided work, and that the thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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Signed Date

ABSTRACT

Carnivore species globally are on the decline and population extinctions continue despite intensive conservation efforts. In Namibia, although 13.6 % of the country falls under the protection of national parks or game reserves, most of these protected areas are situated along the coastline and are desert habitat. The majority of Namibia's cheetah population (over 90 %), which is also the world's largest free-ranging population, occurs on privately owned farmland situated primarily in the north-central cattle-farming region of the country. Also occurring here are leopard, brown hyaena, caracal, and jackal and in some areas African wild dog, spotted hyaena and lion. Given the extensive nature of livestock and wildlife farming in Namibia, the low human density in rural areas and the persistence of wildlife outside protected areas, there is still considerable scope for carnivore conservation on the Namibian freehold farmlands, provided human-carnivore conflict can be managed.

Great strides have been made in Namibia in developing strategies to address human-carnivore conflict issues with formerly advantaged freehold farmers. However, since Namibia's independence in 1990, land reform has resulted in a new category of farmer entering the freehold farming sector, the emerging commercial farmer. No data has been gathered regarding emerging commercial farmers' attitudes and perceptions towards carnivores, the levels of carnivore-conflict and livestock management practices in relation to livestock losses to carnivores. Emerging commercial farmers' numbers are steadily increasing on freehold farmland. It is thus imperative to gather base-line data on human-carnivore conflict experienced by this sector so that conflict resolution strategies can be developed for to ensure the survival of carnivores on freehold farmland.

This study therefore investigated the key components driving conflict between the emerging commercial farmers and carnivores living on the north-central farmlands, including a) the attitudes and perceptions of emerging commercial farmers towards carnivores; b) the levels of human-carnivore conflict emerging commercial farmers are experiencing; c) livestock management practices used by emerging commercial farmers in relation to losses to carnivores; and d) the assistance required by emerging commercial farmers from support services regarding human-carnivore conflict issues. Interviewer administered and unassisted surveys were conducted during this research.

An increase in negative attitude and an increase in livestock loss were both positively associated with an increase in carnivore conflict. Emerging commercial farmers reported high levels of human-carnivore conflict, confirming the need for conflict mitigation strategies. The loss of goats to predation was found to serve as an important indicator of carnivore conflict.

Strategies to reduce human-carnivore conflict need to extend beyond the farm owner as in many cases (31.70 %) multiple people are responsible for identifying a carnivore problem on the farm. Often farmers (19.50 %) relied on their farm workers to identify a carnivore problem on their farms.

Despite significant levels of human-carnivore conflict, 28.1 % of farmers liked having carnivores on their farms and 48 % recognised the ecological role carnivores play on their farms. Over 90 % of the farmers expressed a desire to become involved in the process of mitigating carnivore conflict by wanting to learn more about livestock management to reduce losses to carnivores.

Farmers cited a lack of information as the most common reason for not implementing livestock management techniques related to improving productivity and decreasing losses to carnivores. Mitigation strategies therefore need to address education on farm management to improve productivity as well as management to reduce losses to carnivores. A variety of formats will need to be used to disseminate information as high numbers of farmers identified both radio (47 %) and specific training (54 %) as very important sources of farming information.

What also emerged from this study was the need to train emerging farmers in utilising wildlife to supplement incomes, while ensuring that such use is done in a sustainable manner within the framework of conservancies.

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DEDICATION

To those Namibian farmers who, despite all the challenges they face, still manage to fit carnivore conservation onto their agendas.

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GLOSSARY

1. Categories of farmers

1.1 Affirmative action or emerging commercial farmers: formerly disadvantaged Namibians who purchase their own land, with or without assistance from the government affirmative action loan scheme.

1.2 Resettled farmers: formerly disadvantaged Namibians who are resettled by the government with various land tenure agreements (Anon, 2003). For the sake of clarity, these categories will simply be referred to as emerging commercial farmers, incorporating all formerly disadvantaged farmers on freehold land versus communal farmers.

1.3 Communal farmers: farming on government owned land in designated communal areas.

1.4 Commercial farmers: formerly advantaged Namibians farming on freehold (commercial) farmland.

2. Definitions

2.1 Conservancy: A conservancy may be defined as a legally protected area of a group of *bona fida* land-occupiers practicing co-operative management based on: 1) a sustainable strategy; 2) promoting conservation of natural resources and wildlife; 3) striving to re-instate the original biodiversity with the basic goal of sharing resources amongst all members (CANAM, 1996).

2.2 Human-carnivore conflict: Human carnivore conflict may be defined as any action by humans or wildlife that has an adverse impact upon the other (Conover, 2002).

3. Acronyms

3.1 AALS: Affirmative Action Loan Scheme

3.2 CANAM: Conservancy Association of Namibia

3.3 CCF: Cheetah Conservation Fund

3.4 DRFN: Desert Research Foundation of Namibia

3.5 ECFSP: Emerging Commercial Farmers Support Programme

3.6 ICEMA: Integrated Community-based Ecosystem Management

3.7 IRDNC: Integrated Rural Development and Nature Conservation

3.8 MET: Ministry of Environment and Tourism

3.9 MAWF: Ministry of Agriculture, Water and Forestry

3.10 NAU: Namibia Agricultural Union

3.11 NGO: Non-Government Organisation

CHAPTER ONE: INTRODUCTION

1.1 Background

Human-wildlife conflict, defined by Conover (2002) as any action by humans or wildlife that has an adverse impact upon the other, has received considerable attention over the years and a plethora of publications and conferences have addressed this issue (Gittleman *et al.*, 2001; Woodroffe *et al.*, 2005). However, not withstanding localised expansions of some populations in response to protection, carnivore species overall are still on the decline and population extinctions continue, despite intensive conservation efforts (Sillero-Zubiri & Laurenson, 2001; Woodroffe, 2001). Species may be classified into the following categories: indicator species; keystone species; umbrella species; flagship species and vulnerable species. Not only do many single carnivore species fit all of these labels, but there are entire carnivore clades that match these criteria. The fact that carnivore species play such a pivotal role in ecosystem functioning makes their conservation a priority (Gittleman *et al.* 2001).

In Namibia, 13.6 % of the country falls under the protection of national parks or game reserves (Krugmann, 2001). However, most of these protected areas are situated along the coastline and are desert habitat (Baker, 1997). In recent years, a number of key species have been threatened with extinction in Namibia. Large mammals have become virtually extinct in the communal north-central districts (Richardson, 1998).

Namibia is known as the "cheetah capital" of the world, as it is home to the world's largest free-ranging population of cheetah (*Acinonyx jubatus*), estimated at about 3 000. However, over 90 % of this population occurs on privately owned farmland situated primarily in the north-central cattle-ranching region of the country. In addition, leopard (*Panthera pardus*), brown hyaena (*Hyaena brunnea*), jackal (*Canis mesomelas*), and caracal (*Felis caracal*) and in some areas lion (*Panthera leo*), spotted hyaena (*Crocuta crocuta*) and African wild dog (*Lycaon pictus*) occur on this north-central freehold farmland (Marker *et al.*, 1996). Given the extensive nature of livestock and wildlife farming in Namibia, the low human density in rural areas (Erb, 2004) and the persistence of wildlife outside protected areas particularly in the north-central farmlands (Krugmann, 2001; Marker, 2002; Erb, 2004), there is still considerable scope for carnivore conservation, provided human-carnivore conflict can be managed.

In order to mitigate the human-carnivore conflict that is prevalent on these farmlands (Lines, 2006; Marker, 2006; Stander, 2006), it is necessary to understand the complex factors associated with this conflict and develop appropriate strategies. The diverse nature of the

land users in Namibia (Erb, 2004; Vigne & Motinga 2005) compounds the development of strategies to mitigate human-carnivore conflict. This is particularly pertinent as it is not yet understood how the needs of the different land users differ, or if in fact they do.

1.2 Attitudes and perceptions towards carnivores

Human-carnivore conflict is a complex issue, the causes of which, according to Dickman (2005), are still not fully understood. Tolerance levels and attitudes towards carnivores vary greatly, as rural landowners are a diverse group and are not bound by a single land philosophy (James, 2002). The poor understanding of, and intolerance towards carnivores prevalent in most cultures, often exacerbates the problem (Bothma & Glavovic, 1992).

According to James (2002) sociological research has shown that many rural people are sympathetic to and interested in environmental conservation efforts. However, their actions are often in direct contradiction to this expressed interest, making it important for conservationists to understand the reasons behind this contradiction between attitudes and actions (Kellert *et al.*, 1996; James, 2002; Dickman, 2005). Research has shown that a variety of factors affect attitudes and actions of communities towards carnivores, necessitating the application of a variety of strategies when attempting to reduce levels of conflict (Sillero-Zubiri & Laurenson, 2001, Dickman, 2005).

Strategies to mitigate human-carnivore conflict that are best suited and most effective for a particular situation will depend on the needs and inherent attitudes of the target community, as their attitudes naturally determine their actions (Kellert *et al.*, 1996; Dickman, 2005). According to Kellert (1985), attitudes towards carnivores seem to have become the symbolic focus of the ongoing debate surrounding the goals of wildlife management and our ethical and moral relatedness to the non-human world. This author found that even where wolves constituted a negligible to non-existent factor in livestock predation, sheep producers and cattlemen expressed very negative attitudes towards wolves. This suggests that a historically ingrained attitude affects human actions taken towards carnivores.

Most people support conservation efforts, but would choose not to do so if it means diverting funds from socio-economic projects such as health care, education and a decent standard of living (Shogren *et al.*, 1999). Financial and personal freedom are highly valued, more so than conservation (James, 2002; Brook *et al.*, 2003). According to Shogren *et al.* (1999), economics matters, because human behaviour in general and economic parameters in particular, help determine the degree of risk to a species. In other words, the economic capacity of farmers to withstand the impact of predation can have a positive effect on

tolerance levels. Dickman (2005) corroborates this viewpoint with evidence from pastoralists in Tanzania, reflecting that wealthier pastoralists tolerate losses better than poorer pastoralists. Nonetheless, farmers as a sector of society continue to view wildlife mainly in utilitarian terms and tend to be most concerned about how wildlife affects them economically. Given the impact wildlife damage can have on their livelihoods, this is not surprising (McIvor & Conover, 1994; Messmer, 2000).

The relationship of people to their environment is not only material, but is also informed by social and cultural traditions and values (Melber, 2002; Hinz, 2003). The extent to which the attitudes of people vary towards large carnivores appears to be based partly on the degree to which different species conflict with human interests and partly on inherent human prejudices (Bjerke & Kaltenborn, 1999; Lindsey *et al.*, 2005). Attitudes are influenced by factors such as age, sex, level and source of income and culture (Kellert, 1985; Dickman, 2005). Generally, younger better educated landowners with an outside source of income are more willing to adopt environmentally friendly practices (James, 2002; Dickman, 2005; Lindsey *et al.*, 2005). At the same time, public protectionist sentiment places restrictions on direct (lethal) control of carnivores, hampering conflict resolution in cases where the lethal removal of an animal may be required, for instance in the case of habitual livestock killers (McIvor & Conover, 1994; Mech, 1995; Messmer, 2000).

Carnivores exert a profound influence on biological communities through predation and interspecific competition (Treves & Karanth, 2003) and serve as important indicators of ecosystem function and productivity (Sillero-Zubiri & Laurenson, 2001; Fox & Papouchis, 2005). Despite this fact, it is particularly difficult to promote carnivore conservation amongst rural communities living off subsistence farming as poverty creates pressure for unsustainable resource use and results in the loss of both habitat and biodiversity (Bothma & Glavovic, 1992; Jones, 1996). The sustainable and efficient use of natural resources is therefore often not in the immediate financial interest of the individual (Ashley *et al.*, 1997).

Many local people in Africa view carnivores as a nuisance and see very little value in them, be it aesthetic or financial (Stander *et al.*, 1997; Lines, 2006). Many farmers believe large carnivores have no place on livestock farmland or where game is farmed commercially and many do not understand or appreciate the ecological role that carnivores play (Kellert, 1985; Conover, 1994; Marker *et al.*, 1996; Lines, 2006).

Research by Caro *et al.* (2003) found that in the field of conservation education, being educated about conservation has a strong influence on the extent to which students become committed to arguments for conserving species and habitats, and this depends to a large

extent on the type of teaching to which they are exposed. The positive influence of conservation education highlights the importance of knowledge of conservation issues in engendering sympathy for different conservation arguments. Caro *et al.* (2003) however also emphasise that the way such knowledge is presented strongly influences the extent to which people subscribe to classic arguments for wildlife conservation.

Since Namibia's independence in 1990, the face of the farming community on the freehold farmland has been changing due to land reform initiatives. Formerly disadvantaged Namibians are moving onto the freehold farmland, with some 52 % of farmers joining the so-called Affirmative Action Loan Scheme during 2001 to 2004 (Vigne & Motinga, 2005).

Many of these farmers have no formal agricultural training and are hampered by the lack of skills and the knowledge necessary to run a commercial operation (Vigne & Motinga, 2005). Although several agricultural training needs assessments have been carried out (Anon, 1999; Desert Research Foundation of Namibia, 2005; Vigne & Motinga, 2005), none of these have addressed human-carnivore conflict issues. Nothing is known about the attitudes and perceptions of these farmers towards carnivores. In addition, the levels of conflict have not been quantified, nor have the livestock management practices used by these farmers been examined in relation to losses to carnivores. This study investigated the key components driving conflict between the emerging commercial farmers and carnivores living on these farmlands.

1.3 Factors relating to human-carnivore conflict

Carnivores around the world may come into direct and indirect conflict with humans by posing a threat to human life and/or economic stability (Nowell & Jackson, 1996; Vucetich & Creel, 1999; Sillero-Zubiri & Laurenson, 2001; Treves & Karanth, 2003). According to Treves *et al.* (2004), expanding human populations, accompanied by habitat loss have resulted in the contraction of the ranges of most carnivore species. Probably as a result of this, encounters of humans, livestock and carnivores are increasing in some areas. Treves *et al.* (2004) maintain that the associated increase in the cost of carnivore conservation is raising concern, particularly as this cost is often disproportionately high when compared to the conservation of other species (Gittleman *et al.*, 2001).

As carnivores vanish from landscapes around the world, the emphasis has shifted from the eradication of carnivores as vermin to the search for ways to resolve human-carnivore conflict (Linnell *et al.*, 1999; Sillero-Zubiri & Laurenson, 2001; Treves & Karanth, 2003). The single greatest cause of most large carnivore species mortality is persecution by humans,

both in and outside protected areas (Woodroffe & Ginsberg, 1998). Today, all wild species of cat are threatened by a loss of habitat, and many of them are also endangered by conflict with humans and a declining prey base (Sunquist & Sunquist, 2002).

On the Southern African continent, the battle lines were drawn as early as 1656 when Governor Jan Van Riebeeck declared the lion (*Panthera leo*), spotted hyaena (*Crocuta crocuta*) and leopard (*Panthera pardus*) as vermin. Many other carnivore species soon followed suit and were also treated as vermin (Pringle, 1982). As recently as 1979, African wild dogs (*Lycaon pictus*) were shot as vermin in some protected areas (Fanshawe *et al.*, 1997; Rasmussen, 1999).

The change in game utilisation rights on freehold farmland in 1967, whereby farmers were granted utilisation rights, resulted in a turn-around in the fortunes of wildlife on this type of land. Landowners realised the economic benefits of wildlife, so that their numbers, then showing a steady decline, started to increase (Erb, 2004). By 2001, over 90 % of the country's wildlife occurred on freehold (commercial) farmland (Krugmann, 2001). Although this increase in wildlife is viewed as favourable by both the conservation and farming sectors (Marker *et al.*, 1996; Krugmann, 2001, Erb, 2004), the increase in the carnivore component is not viewed positively, and this is reflected in the figures relating to cheetah removals from farmland (Marker *et al.*, 1996). Between 1980 and 1991, CITES records reflect that 6 818 cheetahs were removed from the Namibian farmlands, while non-government organisations (NGOs) estimate this figure to be as high as 10 000 (Marker *et al.*, 1996). In Namibia, agriculture (crops and livestock) is described as the main habitat-displacing activity (Richardson, 1998). Despite this, the full guild of Namibia's large carnivores, lion, leopard, cheetah, spotted and brown hyaena and African wild dog, are represented on the north-central freehold farmlands and their presence has given rise to human-carnivore conflict (Marker *et al.*, 1996; Lines, 2006; Schumann, 2006; Stander, 2006).

Prior to 1990, when Namibia gained independence, formerly advantaged commercial farmers almost exclusively owned the north-central farmlands (Sachikonye, 2004), with up to 43 % of Namibia's land surface being exploited as privately owned freehold farmland (Barnes & De Jager, 1996). The activities of formerly disadvantaged farmers were then restricted to the communal farmlands where much of the wildlife, including large carnivores, had been extirpated (Hinz, 2003; Henghali, 2006). The land reform process, undertaken since Namibia's independence in 1990, has resulted in these formerly disadvantaged farmers moving onto the freehold farmlands. Here, in addition to adapting their farming practices to the competitive commercial sector, they also have to contend with carnivore-conflict issues. Many of these farmers are simply not equipped to cope with the inevitable human-carnivore

conflict caused by livestock loss to carnivores, mainly due to a lack of knowledge concerning carnivores, and the inadequate application of livestock management practices aimed at improving productivity and reducing losses to carnivores (Schumann & Fabiano, 2006).

1.3.1 Livestock predation

Carnivores come into conflict with livestock farmers around the globe, from Argentina where cougars (*Felis concolor*) kill goats and sheep, the Swiss Alps where lynx (*Lynx lynx*) kill sheep (Lindsey, 2003), to the African plains where lions kill cattle (Hemson, 2001). Sillero-Zubiri and Laurenson (2001) maintain that the root of a deeply ingrained hatred for carnivores around the world is predation by carnivores on all forms of domesticated animals, from chickens to cattle. However, actual conflict levels and the real economic impacts thereof are difficult to assess. Firstly, the reporting rates for carnivore removals are low, and secondly, there is inherent exaggeration in interview responses regarding livestock herd sizes and livestock and game loss (Marker *et al.*, 1996; Rasmussen, 1999; Arnold, 2001; Johnson *et al.*, 2001; Suich, 2003; Lines, 2006).

While actual livestock losses are often below those of perceived losses, the impact on individual households can still be devastating (Oli *et al.*, 1994; Thirgood *et al.*, 2005). "Average loss" data do not reflect the true extent of the impact in many cases, as losses are not equally distributed (Wade, 1982; Cozza *et al.*, 1996; Lines, 2006). Nonetheless, animals perceived as incompatible with agricultural activities are often too easily condemned to the status of "problem animal," when in fact the real cause of the human-wildlife conflict is improper agricultural practices (Bothma & Glavovic, 1992).

While disease, drought, bad husbandry and a global economy may all be more significant in the lack of profitability of farming livestock, carnivores continue to be persecuted for both the real and perceived depredations (Cozza *et al.*, 1996; Ginsberg, 2001; Lines, 2006). Sillero-Zubiri and Laurenson (2001) found in their survey (a questionnaire sent to scientists involved in carnivore research or conservation) that predation on livestock was the most prevalent cause of conflict. In a survey conducted by Conover (1994), 89 % of respondents (occupational farmers who were grass-roots leaders of the agricultural community) reported wildlife damage, and 56 % reported this damage to be higher than they were willing to tolerate. The economic losses caused by carnivores, when weighed against economic gains, are increasingly recognised as a determining factor affecting tolerance levels and decisions to reintroduce carnivores to areas (Ministry of Environment & Tourism, 2004). Sunquist and Sunquist (2002) maintain that predation by big cats on livestock remains one of the biggest public relation problems facing cat conservation.

In Namibia, livestock are central, both economically and culturally in most of the communal areas and make a significant contribution to virtually all household needs (Ashley, 1995; Ashley & La Franchi, 1997; Richardson, 1998; Arnold, 2001). As wildlife numbers increase in communal areas, so does human-carnivore conflict, as predators move into these areas in response to the growing prey base (Arnold, 2001; Murphy, 2001; Stander, 2006; Stander & Esterhuizen, 2006) In addition, resolving human-carnivore conflict has been the focus of concerted carnivore conservation efforts on the freehold farmlands for 15 years (Marker, 2005). Despite this, predation of livestock remains one of the biggest threats facing carnivores outside protected areas in Namibia (Marker, 2002).

1.3.2 Wildlife predation

The wildlife industry in southern Africa has grown exponentially over the last 30 years. As a result, carnivores are coming into conflict with farmers because of predation on wildlife which is increasingly being seen as a valuable asset by game farmers (Cilliers, 2002; Marker, 2005.)

Sillero-Zubiri and Laurenson (2001) found that predation on game was the second biggest cause of human-carnivore conflict. A survey conducted in Namibia by Marker *et al.* (1996), reported that although game farmers represented only 19 % of the survey sample, they were responsible for over 45 % of the reported cheetah removals. This reflects the high level of intolerance by game farmers in Namibia. Similar levels of persecution of cheetah are reported in South Africa (Cilliers, 2002; Lindsey *et al.*, 2005).

Game farming offers an economically viable proposition, either as a complementary activity to livestock farming or as an alternative farming option (Barnes & De Jager, 1996). However, where game farming activities take place in fenced areas with valuable and exotic game or where wildlife populations on state land are used for hunting purposes, the potential for human-carnivore conflict is high (Gasaway *et al.*, 1992; Marker *et al.*, 1996; Marker & Schumann, 1998; Thirgood *et al.*, 2000). Game farmers are intolerant of losses to "their" game populations, and as the value of the game takes on new dimensions, even losses to common game result in the removal of predators (Marker *et al.*, 1996; Marker & Schumann, 1998). In addition, when management is aimed at the production of a few economically valuable species, the species composition and functioning of ecosystems may be altered, causing conflict between the aims of using wildlife and conserving biodiversity. Predators are not tolerated in these altered environments and are summarily removed (Marker *et al.*, 1996; Marker & Schumann, 1998; Richardson, 1998).

Opposition by hunters to the reintroduction of carnivores may have a significant impact on the success of such reintroduction attempts. The reintroduction of lynx into the Swiss Alps is under pressure as illegal shooting remains a significant cause of mortality to the small population (Breitenmoser *et al.,* 2001). In the Canton Valais in Switzerland hunters opposed the reintroduction of wolves into former range areas because of the conflict with (predation of) huntable game (Lindsey, 2003).

In Namibia, game farmers cite the high installation and maintenance costs involved in preventative measures, such as electric fencing, for their failure to apply these management techniques. Instead, lethal and non-lethal measures are used to remove the cheetahs after they have entered the game camp (Marker *et al.,* 1996; Schumann, 2006).

1.3.3 Fear factor

Fear of carnivores is an important factor in human-carnivore conflict as it is a strong emotion that often drives the actions of people in human-carnivore issues (Herrero, 1985; Saberwal *et al.,* 1994). According to Delgado *et al.* (2006) fear can be characterised by anxiety and agitations due to the expectation of impending danger and indeed intense conflict is generated when predators attack humans (Herrero, 1985; Nowell & Jackson, 1996; Saberwal *et al.,* 1994). Additional wildlife conflicts include human illness and fatalities resulting from wildlife-related diseases, wildlife bites, attacks, deer-automobile collisions, and bird-aircraft strikes. It is estimated that annually in the USA alone, these wildlife-related incidents result in some 5 000 people being injured or taken ill, while approximately 415 people die (Messmer, 2000).

As humans encroach on remaining habitat, people will increasingly come into contact with predators, and an increase in conflict and attacks can be expected. This trend has been documented with mountain lion attacks in the USA (Beier, 1991). Negative perceptions towards wolves (*Canis lupis* and *Canis rufus*) and coyotes (*Canis latrans*) can be traced to the perceived threat they pose to humans, their damage to human property, and their predatory and carnivorous nature. Also, wolves exemplify the wilderness and have acquired cultural and historical antipathies (Kellert, 1985; Fox & Papouchis, 2005).

Predators, however, are a statistically insignificant cause of human mortality, and the perception of their threat to humans is greater than their real threat (Ginsberg, 2001). Nonetheless, as a result of the perceived danger humans tend to persecute carnivores regardless of density, number, or threat to their person or livelihood (Ginsberg, 2001). Kellert (1985) found in a survey of animal-related attitudes, knowledge and behaviour, those

respondents who disliked predators not only had significantly lower scores on topics related to nature, but tended to be uninterested in and afraid of other animals too. On the other hand, a positive attitude towards wolves and coyotes strongly correlated with a general affection for animals and a desire to protect wildlife and natural habitats. Roskaft *et al.* (2003) reported a similar trend: people who expressed an interest in outdoor activities, such as hunting and mountain hiking, and who had more education, were less inclined to fear predators.

Regardless of the actual level of threat posed by large predators, conservation programmes should address the perceived threat if they are to succeed in reducing human-carnivore conflict (Ginsberg, 2001; Thirgood *et al.*, 2005).

1.3.4 Human-carnivore conflict and conservation outside protected areas

Protected areas, such as National Parks, offer a refuge to most large carnivore species. Stuart *et al.* (1985) argue that in the case of large carnivore species, such as lion, protected areas are the only option for conservation in the face of settled agriculture. Some species, however, such as cheetah and African wild dog, require additional conservation efforts if they are to survive. Most protected areas are too small to accommodate viable populations of these species and interspecific competition with other large predators may exclude them from survival in protected areas (Woodroffe & Ginsberg, 1998; Blackie & Tarr, 1999; Woodroffe, 2001). Although formally protected areas are critical, alone they are not sufficient to conserve biodiversity (Ottichilo *et al.*, 2000; Infield & Namara, 2001). It is also becoming increasingly clear that developing countries do not have the resources required to rely solely on a model of centralised regulatory control to protect biodiversity (Mehta & Kellert, 1998).

Some carnivore species can persist outside protected areas despite human disturbance. Whether or not this co-habitation is tolerated by humans depends on many factors, in particular the extent of human-carnivore conflict (Stuart *et al.*, 1985; Kellert *et al.*, 1996; Marker *et al.*, 1996). According to Kellert *et al.* (1996), efforts to save large predatory species such as grizzly bears (*Ursus arctos*), wolves (*Canis lupis, Canis rufus*) and mountain lions (*Felis concolor*) depends as much on social acceptance by the regional public as on biological variables. The needs of human communities should receive the same emphasis as that placed on maintaining habitat integrity (Kellert *et al.*, 1996). The task of managing human-wildlife conflict in an environment that is continually being reshaped by social, cultural and political forces, and where the diversity of stakeholders has created new management dilemmas in the use of traditional approaches, is increasingly complex. Wildlife managers will

need to recognise, embrace and incorporate different stakeholder values, attitudes and beliefs in the policy-making process (Messmer, 2000).

The wide-ranging nature of some carnivores, such as cheetah, African wild dog and spotted hyaena can result in the actions of a few people impacting a carnivore population over a wide area by creating a sink effect (Hofer *et al.*, 1993; Ottichilo *et al.*, 2000; Thirgood *et al.*, 2000; Frank *et al.*, 2005; Lines, 2006). This has been well demonstrated by the actions of farmers towards African wild dogs in South Africa (Lindsey *et al.*, 2005), and individual farmers in Namibia who report removing high numbers of cheetah (Marker *et al.*, 1996). Translocation of carnivores involved in conflict offers an alternative to lethal removal, however, this is a temporary solution and is dependent on public opinion and participation and is typified by high predator mortality rates (Sunquist & Sunquist, 2002; Treves & Karanth, 2003).

Education programmes aimed at reducing intolerance and misconceptions of private landowners, particularly those of individual farmers with a negative attitude towards predators, should be a priority in promoting carnivore conservation on privately owned land (Rabinowitz, 1996; Lindsey *et al.*, 2005). In many cases the law does not offer much of a deterrent to carnivore removals by farmers (Marker *et al.* 1996). Ultimately, education programmes that are able to alter attitudes and persuade farmers to adopt viable alternatives, such as improved management strategies to protect their livestock, are needed to ensure carnivore survival outside protected areas (Sillero-Zubiri & Laurenson, 2001; Naughton-Treves *et al.* 2003; Ogada *et al.* 2003).

1.3.5 Community involvement in approaches to carnivore conservation

Incorporating the needs and aspirations of local people into a community-based conservation approach has been the most practical approach to stem biodiversity loss. This approach emphasises the management of biodiversity by, for and with local communities (Lewis *et al.*, 1990; Mehta & Kellert, 1998; Noss & Cuéllar, 2001; Sillero-Zubiri & Laurenson, 2001). According to Breitenmoser *et al.* (2001) and James (2002), conservationists will never succeed in protecting biodiversity without effective interaction with private landowners. Given that over 90 % of Namibia's wildlife is found on privately-owned farmland (Krugmann, 2001), this conclusion is particularly relevant to Namibia.

Community-based conservation should be implemented cautiously as this approach does not always deliver what is promised (Kellert *et al.*, 1996). These authors stated that, in some cases, even though local people benefit economically from nature, tangible benefits in conserving biodiversity do not necessarily occur. Building a conservation ethic around

economics alone, without taking into account other factors such as cultural values is problematic (Kellert *et al.* 1996). In some instances, landowners will avoid involvement in conserving threatened species, or act negatively towards them, if they feel their landownership rights or benefits are threatened in any way (Brook *et al.*, 2003). Furthermore, few occupational groups have as much direct contact or as great an impact on wildlife resources as do farmers around the world (Conover, 1994).

In Namibia, much emphasis has been placed on community-based natural resource management in the communal areas by government and non-government institutions such as the Integrated Rural Development and Nature Conservation (IRDNC) (Ashley & Garland, 1994; Ashley *et al.*, 1994; Ashley, 1995; Jones, 1995; Long, 2004). The transference of conditional rights over wildlife and tourism to communities, through the communal conservancy approach, is the most radical of its kind in Africa (Blackie, 1999).

Wildlife resource management outside communal and protected areas on freehold farmland has been the domain of the Ministry of Environment and Tourism, sub-division Wildlife Utilisation and Permit Control, with the focus on administering wildlife quotas, live sales and any other form of consumptive use (Erb, 2004). Human-carnivore conflict has been the focus of NGOs, with the emphasis on human-carnivore conflict resolution, environmental education and research (Marker, 2005).

In Namibia, wildlife-based tourism has become the fastest growing sector of the economy, with land use increasingly being diversified to include wildlife utilisation (Jones, 1995; Ashley & La Franchi, 1997; Krugmann, 2001; Hamavindu, 2002). Barnes and De Jager (1996) reported that the aggregate economic value of wildlife use on private land rose by some 80 % between 1972 and 1982. Erb (2004) found a similar rise in the economic value of wildlife. However, the value of carnivores has not risen proportionately with that of other wildlife, as they have tended to come into conflict with wildlife utilisation activities (Marker *et al.*, 1996, Schumann, 2006).

1.3.6 The conservancy approach to managing wildlife resources

The development of the conservancy concept, whereby natural resources are managed collectively, both on communal and freehold farmland, has attained much success in Namibia and provides a structure that enables community participation in an organised manner (Long, 2002). Freehold conservancies represented a combined area of approximately 432 250 km^2 or 24 % of commercial large-stock area by 2003 (Erb, 2004).

Human-carnivore conflict can be largely mitigated through adaptive livestock and wildlife management and can be further promoted within the framework of conservancies (Barnes, 1998; Schumann, 2006). Thus, wildlife can have a complementary, rather than competitive role to play in relation to agriculture (Barnes, 1998). However, human-wildlife conflict, and the risk conflict poses to people's livelihoods is regarded as a serious threat to the legitimacy of conservancies, as communities increasingly see solving human-wildlife conflict as the conservancy's responsibility (O'Connell-Rodwell *et al.,* 2000; Long, 2004). Compounding this situation is the fact that communal conservancies in many cases do not have the authority to deal with human-wildlife conflicts, while the Ministry of Environment and Tourism has the authority, but not the capacity (Esterhuizen, 2004; Long, 2004). However, the proposed Parks and Wildlife Bill has an underlying intention to devolve authority over wildlife to the lowest possible level (Erb, 2004).

In an evaluation of conservancy management plans on freehold farmlands, the topic of carnivore management featured poorly, demonstrating the lack of a structured approach by freehold farmers in dealing with carnivore issues on farmland (Schumann, 2006). In addition, on freehold farmland, conservancies have seen little interest from emerging commercial farmers, a fact that needs to be addressed if these farmers are to be drawn into the collective management of wildlife resources for sustainability in the freehold farming areas (Erb, 2004).

1.4 Livestock management strategies to reduce human-carnivore conflict outside protected areas

Despite diversification of farmland use and the growing importance of tourism related activities, livestock farming remains an integral part of Namibia's culture (Ashley, 1995; Ashley & La Franchi, 1997; Richardson, 1998; Arnold, 2001; Hamavindu, 2002). As such, livestock predation by carnivores remains one of the biggest threats facing carnivores in this country. Mitigation of this conflict is crucial if carnivores are to survive outside Namibia's protected areas (Schumann, 2006).

Numerous studies have shown that modifications of human or livestock behaviour, such as changes in livestock husbandry and the employment of guard animals are effective in reducing losses and can therefore help reduce conflict levels (Rasmussen, 1999; Schneider-Waterberg, 2000; Ogada *et al.*, 2003; Treves & Karanth, 2003; Lindsey *et al.*, 2005; Schumann, 2006). However, the adoption rate of recommended agricultural practices has been found to be very slow despite the fact that the management problems are well known and addressed through programmes, training and agricultural extension services (Louwrens, 2004; Schumann, 2006). In most cases, socio-economic and practical constraints make the

application of highly technical intervention impractical in developing countries and rural areas (Treves & Karanth, 2003).

Livestock farmers in Namibia have developed various management practices to reduce livestock losses to carnivores. These include strict management of controlled calving seasons, kraaling calves under the age of three months, kraaling small stock at night and using dogs and herders (Marker *et al.*, 1996, Schneider-Waterberg, 2000; Schumann & Schroeder, 2004).

These livestock management practices aimed at reducing losses to carnivores are strongly advocated by Namibian carnivore conservation NGOs, but receive varying levels of support from the farming community in general (Marker *et al.*, 1996; Schumann & Schroeder, 2004). One survey found that over 60 % of farmers interviewed did not use any form of livestock protection (Marker *et al.*, 1996). Conflict with livestock farmers was responsible for nearly half the deaths of lions when they ventured from the Etosha National Park onto neighbouring cattle farms (Stander, 1991). A determined carnivore is not impeded by most barriers for long and correct design and techniques are required to provide effective obstruction (Treves & Karanth, 2003; Schumann & Schroeder, 2004). With the exception of the total exclusion of predators, no method, lethal or non-lethal, used singly or in combination, is consistently effective in protecting livestock (Wade, 1982).

Nevertheless, successfully modifying the way and frequency with which activities of humans and their domestic animals intersect the activities of carnivores could enable carnivores and humans to co-exist for decades to come (Treves & Karanth, 2003). Thus, a viable option in reducing human-carnivore conflict whilst maintaining the carnivore component is to place the emphasis on improved or alternative livestock management (Sunquist & Sunquist, 2002; Treves & Karanth, 2003).

However, methodologies to reduce livestock losses should not only be effective, but also cost-effective and practical for farmers (Breitenmoser *et al.*, 2005). Measures should include non-lethal and indirect approaches, such as promoting a sufficient natural prey-base for carnivores and mitigating the economic consequences of predation (Linnell *et al.*, 1999; Breitenmoser *et al.*, 2005).

1.5 The evolution of landownership in Namibia

More than 90 % of Namibia's wildlife occurs on privately owned farmland, while most of its big game species such as buffalo and elephant occur on communal land (Krugmann, 2001).

In order to understand who is involved in human-wildlife conflict it is necessary to look at the *evolution of land ownership in Namibia.*

Land reform has been undertaken in many African countries, notably Kenya, Zimbabwe, South Africa and Namibia, and has been a common government policy across Asia and Latin America. This policy is usually adopted to reverse historical injustices and to reduce rural poverty (Anon, 1999). Achieving the objective of reducing rural poverty through land reform is, however, questioned by Werner (2001) and Mudge (2004).

Two broad models of land reform exist. The most common, as implemented in Namibia and Zimbabwe, is to resettle people on land bought by the government (Sachikonye, 2004). The Namibian government instituted a land reform programme in 1990. This aims to resettle people on communal land and on commercial farms bought by the government and hence improve the quality of life of resettled communities (Anon, 1999; Hunter, 2004; Sachikonye, 2004). Land reform should thus not be seen as an end to itself, but also require that farmers who are resettled use the land in a sustainable and productive way (Undi, 2003). At the same time the people put on the land must be provided with essential support mechanisms to ensure they can stand on their own (Sachikonye, 2004). The main target groups in Namibia have been ex-combatants, the San community, landless people, the disabled and retrenched farm workers (Anon, 1999; Sachikonye, 2004).

Less common, but gaining acceptability internationally, is the market-based model by which the government provides financial support and services to allow people to buy land themselves and establish small farms (Anon, 1999; Vigne & Motinga, 2005). This approach was piloted in Brazil, Colombia and South Africa (Anon, 1999). In Namibia the market-based model takes the form of the Affirmative Action Loan Scheme (AALS) and is administered by the Agricultural Bank of Namibia. The AALS is regarded as very important in the land reform process because it encourages the emergence of African entrepreneurs (Sachikonye, 2004).

While the acquisition of freehold agricultural land by formerly disadvantaged Namibians was dramatically accelerated by the passing of the *Land Reform Act* in 1995 (Anon, 2003), many Namibians consider this pace still too slow (Werner, 2001; Melber, 2002). However, Vigne and Motinga (2005) report that 52 % of AALS farmers bought farms during 2001 - 2004, compared to only 13 % joining the scheme in its first four years (1992 -1995). Figure 1.1 shows the distribution of land ownership in Namibia, including the protected areas.

The key wildlife distribution areas outside protected areas continue to undergo a change in landownership due to land reform processes. The communities owning the land vary in

culture, attitudes towards wildlife, tolerance levels towards human-wildlife conflict and in wildlife utilisation levels. Addressing human-wildlife conflict issues is thus a complex process requiring that all the cultural group's aspirations and needs be taken into account (Sillero-Zubiri & Laurenson, 2001).

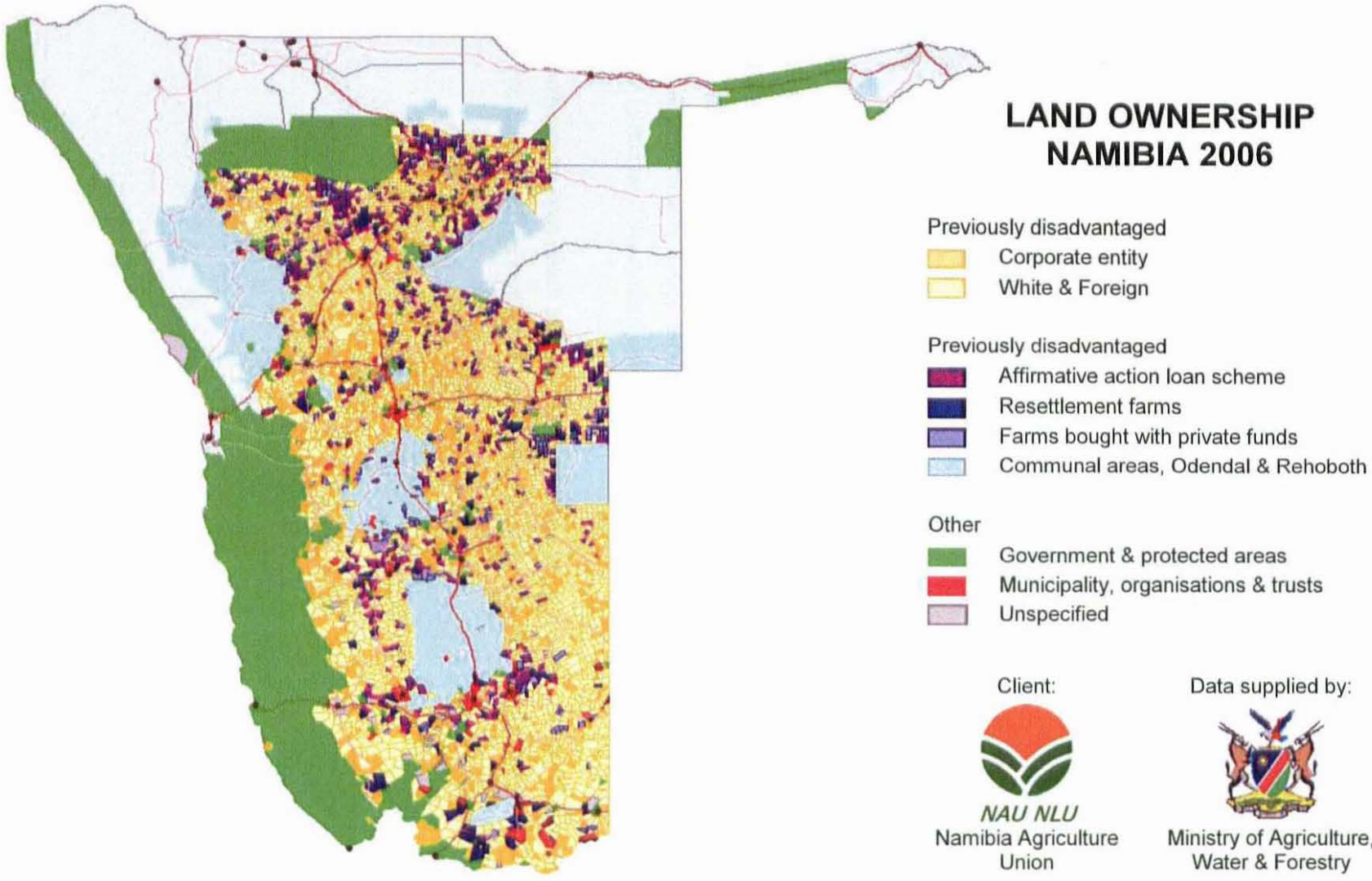

Figure: 1.1: Land ownership in Namibia (Ministry of Agriculture, Water and Forestry, 2006)

1.6 The status of carnivores on the Namibian north-central freehold farmlands

Over 90 % of Namibia's cheetah population (approximately 3 000, about 20 % of the world's population) occurs on the north-central freehold farmlands (Figure 1.2), making the cooperation and tolerance of farmers vital to the survival of this species, both nationally and internationally (Marker *et al.*, 1996). Although listed as vulnerable or endangered by the IUCN (CITES Appendix I), in 1992 CITES allowed limited trade in Namibian cheetahs by allocating an annual quota of 150 cheetahs (CITES, 1992; Schumann, 2006). Leopards are also widely distributed on these farmlands, with their numbers estimated at 8 039 (Stander, 2004). Namibia has an annual quota for the utilisation of 250 leopards (Predator Conservation Trust, 2006).

Research on brown hyaenas in Namibia has focused primarily on the coastal population, with the farmland populations receiving little attention. However, from anecdotal information and the carnivore atlas (Stander, 2004) it would appear that they too are widely distributed throughout the north-central farmlands (Figure 1.2).

Lion, African wild dog and spotted hyaena occur only on the periphery of the north-central freehold farming areas (Figure 1.2), but where they do occur, reported levels of conflict are high and incursions into the freehold or communal farmland usually result in these carnivores being swiftly eradicated (Mills & Hofer, 1998; Lines, 2006; Mfune *et al.*, 2006; Stander, 2006; Stander & Esterhuizen, 2006). Stander (2004) estimates the Namibian lion population to be from 562 to 894, and the African wild dog population between 300 and 600 dogs.

The smaller carnivores, such as jackal and caracal are also widely distributed and regularly come into conflict with farmers in the north-central region (Marker *et al.*, 1996).

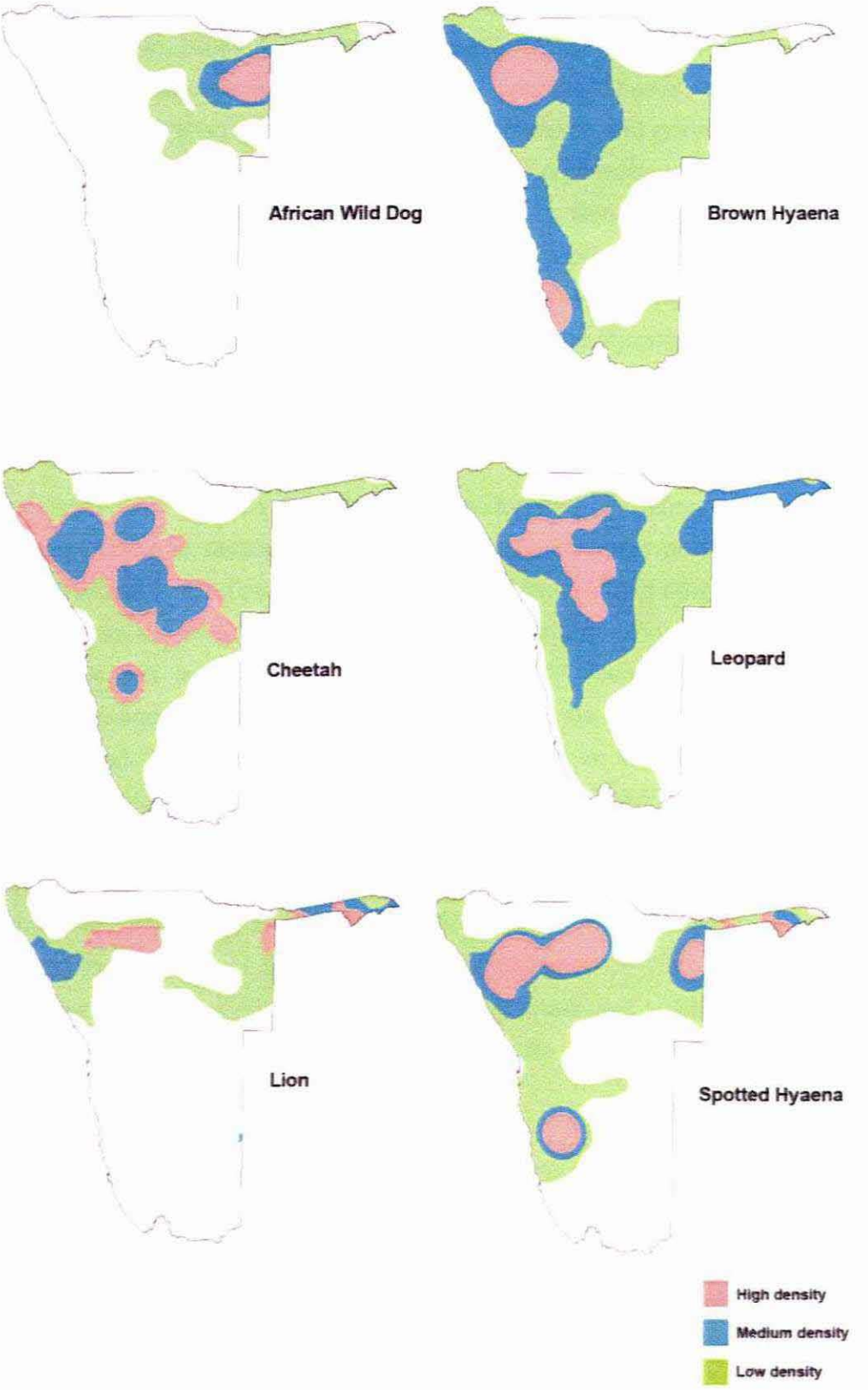

Figure 1.2: The distribution of large carnivores in Namibia (Stander, 2004)

1.7 Human-carnivore conflict resolution initiatives in Namibia

Human-wildlife conflict is receiving increasing attention at the government level in Namibia (Murphy, 2001; Ministry of Environment & Tourism, 2006; Mfune *et al.*, 2006; Stander, 2006; Stander & Esterhuizen, 2006). Aside from the Namibian Ministry of Environment and Tourism (MET), two carnivore conservation NGOs, Africat and the Cheetah Conservation Fund (CCF), have been operating in the fields of carnivore research and environmental education for the last 15 years in Namibia (Marker, 2005). Both organisations focus their attention primarily on the issues surrounding cheetah and leopard conservation and conflict issues on freehold farmland, where these predators occur in their highest density (Marker *et al.*, 1996). More recently emphasis has shifted to communal farmers (Nangulah, 2006), as the development of communal conservancies and projects aimed at community conservation of wildlife resulted in the increase of wildlife numbers and consequently carnivores (Esterhuizen, 2004).

Carnivore conservation NGOs in Namibia have focused on human-carnivore conflict resolution approaches to reduce conflict through advocating improved livestock and game management. Model farming practices are identified, evaluated and advocated. Carnivores trapped by farmers are collected, assessed and relocated accordingly, either to captivity, to reserves or released back onto farmland (Marker, 2002; Sunquist & Sunquist, 2002). Education and awareness programmes are undertaken at the school, graduate and farmer level (Marker *et al.*, 1996). The media, newsletters and farmer training guides disseminate information and integrated livestock and wildlife management training courses are held for farmers (Schumann, 2003).

In the communal conservancy areas, the IRDNC (Integrated Rural Development and Nature Conservation) has developed the "Human Animal Conservancy Compensation Scheme" (HACCS). This scheme has completed the initial pilot phase and is limited to members of communal conservancies but is showing promising results as a feasible method to mitigate conflict (Esterhuizen, 2004).

Formerly disadvantaged farmers have expressed a great need for more information concerning farming techniques (Vigne & Motinga, 2005) including methods to reduce losses to carnivores and information regarding carnivores on farmland (Nangulah, 2006; Schumann & Fabiano, 2006). The levels of formal farming training that emerging commercial farmers have been exposed to varies from none to basic (Vigne & Motinga, 2005), while resettled people for the most part are sorely lacking in the agricultural skills needed to make them self-sufficient (Werner, 2001). Research regarding resettled communities has shown that very

little cooperation exists between ministries responsible for resettlement and agricultural services at the national, regional or local levels (Werner, 2001). This author asserted that training in various methods of agriculture is imperative if resettlement is to succeed.

In most cases capacity building within the farming community is critical if new landowners in Namibia are to achieve sustainable farming and wildlife management practices (Anon, 1999; Undi, 2003), both of which are essential to maintaining biodiversity and are objectives embodied in the Namibian Government's Vision 20/30 document (Government of the Republic of Namibia, 2004). Carnivores are key components in the farmland ecosystem. If they are to survive in this commercial farming setting, human-carnivore conflict resolution efforts will need to be expanded at all levels within the agricultural sector. The primary causes of human-carnivore conflict within all the different farming sectors (communal, emerging commercial, resettlement and freehold farmers) will need to be evaluated and solutions sought to resolve the conflict in order to achieve Vision 20/30's biodiversity conservation goals.

1.8 Significance of the study

Great strides have been made in Namibia in addressing human-carnivore conflict issues with formerly advantaged freehold farmers (Marker, 2002). However, the changing face of the farming community, brought about by land reform since independence, necessitates an evaluation of the extent of human-carnivore conflict amongst a new sector of the farming community, the emerging commercial farmers. To date nothing is known about their attitudes and perceptions towards carnivores, levels of conflict or livestock management practices in relation to livestock losses to carnivores. Base-line data is needed to help develop strategies to ensure the survival of carnivores on freehold farmland, while taking into account the economic stability of the emerging commercial farmers. Emerging commercial farmer numbers are steadily increasing making the development of these strategies imperative.

While various training needs assessments have been carried out on emerging commercial farmers (Anon, 1999; Desert Research Foundation of Namibia, 2005; Vigne & Motinga, 2005), information is urgently needed on what these farmers require from support services regarding carnivore conflict issues. This is especially urgent given that over 90 % of cheetahs in Namibia range on the freehold farmlands, together with leopard, brown hyaena, caracal, and jackal and in some areas African wild dog, spotted hyaena and lion. At present, none of the training needs assessments has produced a workable and structured approach to meeting the training requirements of these farmers.

This study focuses on the key aspects of conflict between Namibia's emerging commercial farmers and the carnivores residing on their farms. Solutions are sought and recommendations are made to support structures for their implementation.

1.9 Aims and objectives

a) To assess the attitudes and perceptions of emerging commercial farmers towards carnivores.

b) To assess the levels of conflict with carnivores and the key factors driving this conflict.

c) To assess the models, methods and the level of implementation of livestock management and husbandry practices that can reduce losses to carnivores and improve the economic productivity for the emerging commercial farmers.

d) To assess the training needs of emerging commercial farmers in relation to human-carnivore conflict resolution.

1.10 Hypotheses

Attitudes and perceptions of emerging commercial farmers towards carnivores

1. Negative attitudes amongst emerging commercial farmers will increase as farmers lose more livestock to carnivores.

Factors relating to human-carnivore conflict

2. The level of human-carnivore conflict emerging commercial farmers experience will increase with increased livestock loss.
3. Farmers with higher livestock losses to carnivores will remove more carnivores.

Livestock management

4. Livestock losses will increase where fewer management practices related to reducing livestock loss to carnivores are applied.

Training

5. The emerging commercial farmers' desire for training (to manage carnivore conflict) will increase with increasing carnivore conflict.

CHAPTER TWO: STUDY AREA

2.1 The biophysical characteristics of the study area

The study area comprises the north-central freehold farmland in Namibia (Figure 2.1). The mean annual rainfall for this area is 467 mm and the temperatures vary from below 0 °C in winter to over 50 °C in the summer (Marker, 2002). Vegetation is mainly characterised by thornbush, highland and camel thorn savannah (Byers, 1997). The northern limits of the study area merge with mountain savannah and Karstveld around Tsumeb, Grootfontein and Otavi (Byers, 1997; Strohbach-Fricke, 1997). Highland savannah in the south of the study area covers the Khomas Hochland and Windhoek bergland up to Rehoboth (Strohbach-Fricke, 1997).

Much of the north-central area is bush encroached. This encroachment is attributed to factors such as the suppression of veld fire, the absence of mega-herbivores, overgrazing and poor management of livestock. Shrubs and trees such as *Dichrostachys cinerea, Acacia tortillis* and *Acacia mellifera* gradually replace grasses, often creating impenetrable thickets and limiting the carrying capacity and production of the area. The extent of bush encroachment is widespread with the district areas of Grootfontein 80 % encroached, Tsumeb 90 % and Otjiwarongo 75 %. The districts of Outjo, Okahandja, Gobabis and Omaruru are all approximately 50 % infested (Lange *et al.*, 1997).

Three broad land-use forms are found in Namibia, freehold farmland (44 % of the area), communal farmland (42 %) and formal conservation areas (14 %) on state land (Erb, 2004). Vigne and Motinga (2005) estimated that about 15 % of freehold land is owned or occupied by black farmers and maintained that this represents the potential total caseload for programmes supporting emerging commercial farmers. Vigne and Motinga (2005) found that AALS farm beneficiary farmers were farming about 9.28 % of the total 34,362,744 hectares of freehold farmland in the country. However, the approximately 623 AALS farms were not distributed evenly, but were notably concentrated in the northern districts, especially in the Grootfontein district (Vigne & Motinga, 2005).

Cattle are raised for beef production primarily in northern Namibia, with sheep, goats and wildlife supplementing incomes (Erb, 2004). Vigne and Motinga (2005) found that most AALS farmers sold weaners and small stock to maintain cash flow, but indicated that they were attempting to move towards an ox-cow production system.

According to Erb (2004) wildlife population estimates over larger areas in Namibia are *unreliable as data has been collected opportunistically and not in a planned systematic way.* However Marker (2002) reports that the results of a survey of livestock and countable wild game in her study area in the north-central freehold farmlands revealed 376,506 head. Sixty-six percent of the animals were livestock (cattle, goats, sheep) and the remaining 43 % were game. Marker (2002) considered these ratios as representative of the entire north-central commercial farmlands.

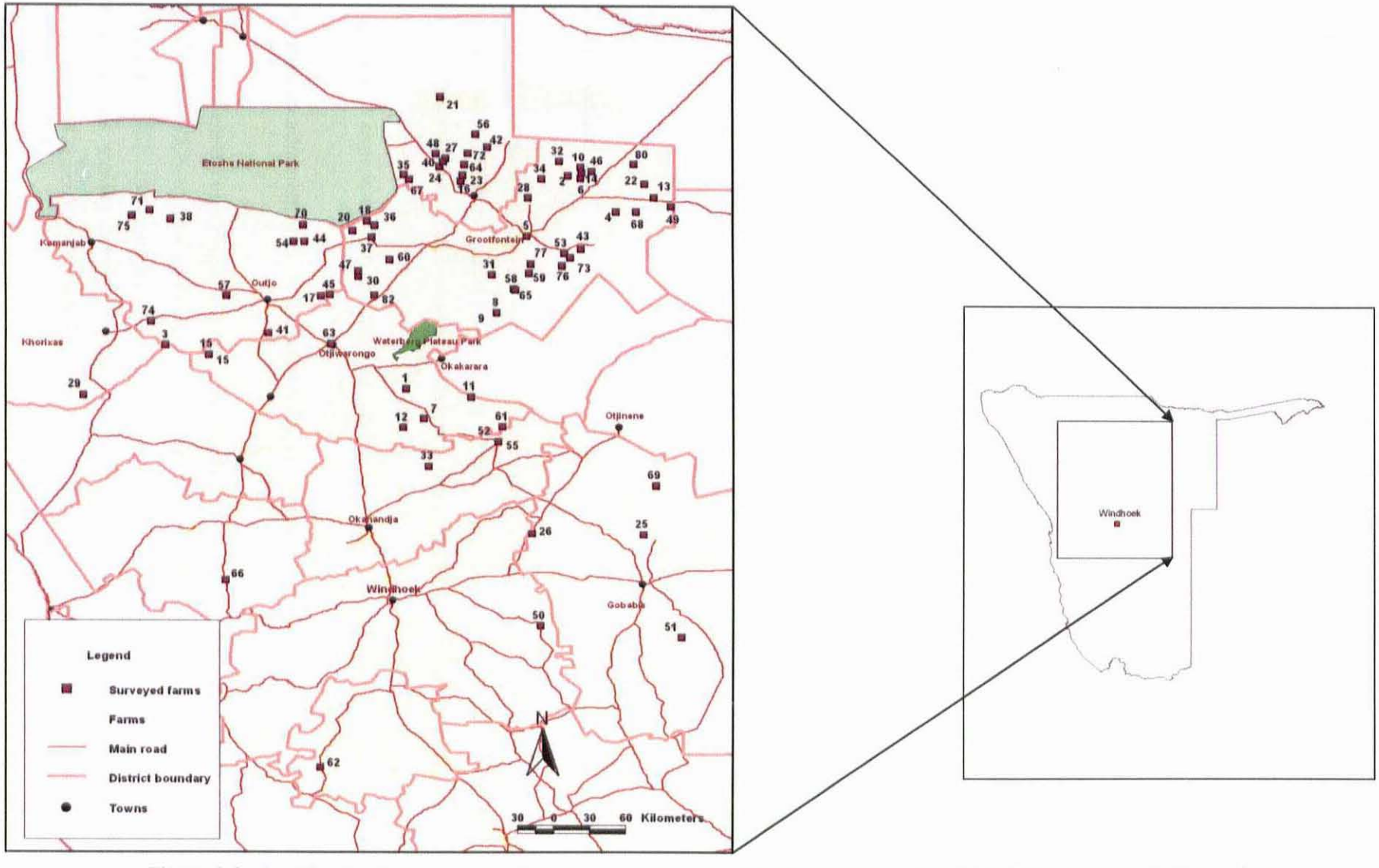

Figure 2.1: Map showing the locations of respondents' farms on Namibian north-central freehold farmland (CCF data base)

CHAPTER THREE: MATERIALS AND METHODS

3.1 Survey structure and content

Interviewer administered and unassisted questionnaires (Appendix) were carried out. The survey was pre-tested on 41 farmers attending training courses at the Cheetah Conservation Fund to ensure clarity before use. Lickert scale (sliding scale) and open ended questions (Dillman, 1991; Foddy, 1993) were used to investigate and assess the attitudes and perceptions, levels of conflict, livestock management practices, and needs of emerging commercial farmers. Farmers were accessed through Cheetah Conservation Fund (CCF) training courses, farmer information days and Agricultural shows. Photos used for Question 46 (See Appendix) were sourced from the Cheetah Conservation Fund photo library.

This study focused on conflict between emerging commercial farmers and carnivores on the freehold farmland primarily in the north-central region of Namibia. Information was gathered on the attitudes and perceptions of farmers towards carnivores. In addition, the levels of farmer-carnivore conflict were assessed. The levels of livestock lost to all causes as well as carnivores, the trend in carnivore numbers and carnivore removals were also investigated. A basic training needs assessment was carried out to assess what kind of training farmers required to help them solve carnivore problems. The types of organisational support and sources of farming information farmers were using were investigated.

3.2 Target group

Emerging commercial farmers were targeted during the study and altogether 82 respondents were surveyed. Where possible the farm owner, regarded as the decision maker in this study, was surveyed, but in some instances a representative of the farm owner, often the farm foreman or a relative sharing the farming responsibilities was surveyed. Table 4.1 provides an overview of the respondents' characteristics.

3.3 Survey administration and evaluation of responses

Interviews were conducted in person either by the author or by one of four other staff members of CCF. In cases where groups of farmers were interviewed such as during training courses at CCF, respondents were partially assisted by the principal investigator or another staff member, moving amongst the group to answer queries. Several assisted surveys were carried out at Agricultural shows. In addition two postal surveys were received from a mailing

to over 200 farmers informing them about training courses at the Cheetah Conservation *Fund.*

3.4 Data analysis

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 12.0. The alpha level of 0.05 (or 5 % significance level) for statistical tests was used (Bryman & Cramer, 2001). While some argue that parametric tests can be used for ordinal data since the test applies to numbers and not to what those numbers signify, variables in psychological and sociological research are basically ordinal in nature (Bryman & Cramer, 2001). Data was tested for normality using Kolmogorov-Smirnov test and non-parametric statistics were used where the assumptions of normality were violated. Chi-square tests were applied to compare the distribution of data between categories.

Correlations between and within questions containing non-parametric ordinal and nominal data with non-normal distributions and unequal variances were examined using Spearman's rho (Spearman's ρ). A correlation statistic of up to 0 to 0.19 was described as very weak, 0.20 to 0.39 as weak, 0.4 to 0.69 as modest, 0.7 to 0.89 as strong, while 0.9 to 1 was described as a very strong correlation. Reliability and validity tests were carried out using factor analysis, Cronbach's alpha and Guttman's split-half coefficients, where applicable. Factor analysis was carried out to interpret the underlying structure of the data for common themes and to determine the most important components (Bartholomew *et al.* 2002). In addition, factor analysis served as a Harman's single factor test of common method bias (Podsakoff *et al.*, 2003). Common method bias is a measurement of both the predictor and criterion variable as was the case here. Since multiple factors emerged from the data, it can be concluded that common method bias did not overly influence participants' responses. Principal component analysis with Varimax rotation was used in the factor analysis.

Percentages used in graphs and text accounted for distribution of total responses, in other words, missing and non-applicable responses were dropped from the analysis.

Ordinary least square regression analysis was used to investigate associations between constructs. Analysis of variance (ANOVA) was used to test the statistical significance of the regression equation. Normal probability plots were used to assess the normality of residuals. Where residuals were found to be non-normal, the dependent variable was transformed to normalise distribution. In addition, a scatter plot of predicted values against residuals was run to assess for constant variance or homoscedasticity.

To assess the impact of livestock losses to carnivores, the categories for losses were converted to real numbers by taking the mean of the category (1 - 50 = 25). Average herd sizes and number of carnivores removed were calculated in the same way. The mean numbers of livestock lost to all causes were compared to those lost to carnivores in relation to herd size to assess the impact of the loss. The impact of calf losses attributed to all causes versus carnivores could not be calculated as the proportions of calves in the herds were not known.

Where respondents were asked how important or unimportant certain topics were or how strongly they agreed or disagreed, "strongly agree" and "agree" were combined as "agree" during analysis. Similarly "very important" and "important" were combined as "important". The same approach was taken in the case of negative responses.

CHAPTER FOUR: RESULTS

4.1 Profiles of respondents

The majority of respondents were male (90.2 %) and were the owners of farms, or farm foremen. Of the females, some were owners and others represented their fathers or husbands. The remaining respondents described themselves as "other," which included relatives representing owners, and farmers renting land as well as one manager and one partner of an AALS farmer (Table 4.1).

Altogether 40 respondents specified that they were Affirmative Action Loan Scheme farmers (n = 82) (Table 4.1). The majority of respondents (47.69 %) reported that their home language was Herero. The mean number of years spent on the farm was 6.2 ± 4.60 years and ranged from just one year to 24 years.

4.2 Farm characteristics

Median farm size was 4 600 hectares, and ranged from one of 300 hectares (resettled farm) to 11 000. The mean number of people living on the farm throughout the year was 13.15. A summary of the profiles of respondents and their farm characteristics is provided in Table 4.1.

Table 4.1: Summary of the profiles of respondents (n = 82; 2006) and their farm characteristics. Figures in parentheses indicate standard deviation (SD)

Characteristic	Number	%	Mean (±SD)
Mean farm size (1 000 ha)			4.60 (±5.00)
Years on farm			6.20 (±4.60)
Males	74	90.20	
Females	8	9.80	
Number people on farm			13.15 (±12.29)
Category of farmer			
AALS	40	48.78	
ECF	35	42.68	
Other	7	8.54	
Role on farm			
Owner	53	64.60	
Foreman	16	19.50	
Other	13	15.90	
Home language			
Herero	39	47.60	
Owambo	17	20.70	
Damara	15	18.30	
Afrikaans	7	8.50	
Other	4	4.90	

The farms included in the survey were situated in eight regions in 11 districts (Figure 2.1 & Table 4.2). The majority of the farms were located in the Grootfontein district (31), followed by the Tsumeb (16) and Otjiwarongo (11) districts (Table 4.2). One farm was located in the Rundu district, and although located in communal land, was a demarcated fenced farm to which the owner had title deed.

Table 4.2: Summary by region and district of the location of farms included in the survey

Region	District	Number of farms
Erongo	Karibib	1
Hardap	Rehoboth	1
Khomas	Windhoek	1
Kunene	Khorixas	1
	Outjo	10
Okavango	Rundu	1
Omaheke	Gobabis	4
Oshikoto	Tsumeb	16
Otjozondjupa	Grootfontein	31
	Okahandja	5
	Otjiwarongo	11
Grand Total		82

4.3 Attitudes and perceptions of emerging commercial farmers towards carnivores

The attitudes and perceptions of emerging commercial farmers towards carnivores were examined. Who they felt was responsible for solving farmer-carnivore conflict, respondents'

perceptions towards carnivores as well as at what point respondents would take action to remove carnivores were assessed.

4.3.1 Responsibility for solving carnivore problems and attitude towards carnivores

Respondents were asked who they felt was responsible for solving farmer-carnivore conflict. MET was most often identified as responsible for solving carnivore problems. Altogether 76.8 % of respondents agreed that this was the case. People who thought that MET should solve farmer-carnivore conflict also wished to have all carnivores removed off farmland (Spearman's ρ: 0.309, $p = 0.005$), and believed that the only way to reduce livestock losses was to remove all carnivores from their farm (Spearman's ρ: 0.299, $p = 0.007$).

Altogether 53 % of respondents agreed that they themselves were responsible for solving carnivore problems on their farms ($\chi^2 = 10.2$, $df = 4$, $p = 0.037$), a statistically significant result, and they were also less likely to want all carnivores removed off farmland (Spearman's ρ: -0.326, $p = 0.003$). Altogether 30.5 % of respondents agreed MAWF and 43.3 % agreed that NGOs were responsible for solving farmer-carnivore conflict.

4.3.2 Respondents perceptions of carnivores

Altogether 48 % of respondents agreed that carnivores had an ecological role to play on their farms ($\chi^2 = 13.85$, $df = 4$, $p = 0.008$). When asked to agree or disagree on whether they liked having carnivores on their farms, 28.1 % responded that they liked having carnivores on their farms and 39 % that they did not like having carnivores on their farm, a statistically significant result ($\chi^2 = 13.24$, $df = 4$, $p = 0.01$). Respondents who thought that carnivores had an ecological role to play on their farms were less likely to want them all removed from farmland (Spearman's ρ: -0.606, $p = 0.01$) and more likely to agree that they liked having carnivores on their farms (Spearman's ρ: 0.403, $p = 0.01$), both of which were statistically significant.

Altogether 86.4 % agreed they could reduce livestock loss by adjusting their livestock management ($\chi^2 = 35.48$, $df = 4$, $p = 0.01$), a statistically significant result. In contrast, 32.1 % of respondents thought the only way to reduce livestock losses was to remove all carnivores but this was not statistically significant ($\chi^2 = 5.11$, $df = 4$, $p = 0.276$). Altogether 40.8 % of respondents wanted all carnivores removed off farmland ($\chi^2 = 11.28$, $df = 4$, $p = 0.024$), a statistically significant result.

A factor analysis was carried out (using principal component analysis with Varimax rotation) on what respondents thought about carnivores. The measurement items loaded onto two

underlying principal components, or factors, and all loadings were above the 0.5 cut-off point used in social science research (Bartholomew *et al.*, 2002). Both factors had Eigenvalues over one and a visual assessment of the scree plot confirmed that both factors should be considered in the analysis. The factors explained approximately 76 % of the variance. Results are given in Table 4.3.

Table 4.3: The relationship between various variables relating to respondents' perceptions towards carnivores as per the results of a factor analysis

Factors		Items pertaining to respondents perceptions of carnivores
1	2	
0.89	-0.14	I want all carnivores removed off farmland.
0.86	0.22	The only way to reduce losses is to remove all carnivores off my farm.
-0.81	-0.06	Carnivores have an ecological role to play on my farm.
-0.71	0.31	I like having carnivores on my farm.
-0.01	**0.97**	I can reduce livestock losses by adjusting my livestock management.

Note: Items pertaining to attitude loaded together on factor one and one item pertaining to livestock management loaded on factor two.

Results show that although four items load together on factor one that appears to represent attitudes towards carnivores, but this was a bi-polar factor with items loading in opposite directions. Measurement items pertaining to wanting carnivores removed off the farmland and indicating the only way to solve carnivore problems is to remove the carnivore loaded in the opposite direction to respondents who thought carnivores have an ecological role and respondents who like having carnivores on their farm. These results indicate that farmers who wanted carnivores removed off farmland were also likely to view the removal of the carnivore as the solution to carnivore problems. On the other hand, farmers who understood that carnivores have an ecological role to play were more likely to like having carnivores on their farm. Only one item loaded on the second factor pertaining to management of livestock indicating that livestock management was seen as a separate issue to attitudes towards carnivores.

4.3.3 Perceptions of carnivore problems versus action taken by respondents

Respondents were asked how they decided when they had a carnivore problem and were then presented with several scenarios. Altogether a significant number (42.7 %) of respondents said they had a problem when one livestock kill was made, and 46.9 % said they would take action at this point. The perception and the action in this case were positively and significantly correlated (Spearman's ρ: 0.224, p = 0.045). In contrast 75.8 % of respondents said they had a problem when several kills were made and 70.3 % said they would take action at this point, although no correlation could be found between the perception of a problem in this case, and taking action (Spearman's ρ: -0.067, p = 0.550). Since a positive correlation was expected but not found, the responses were investigated.

Several outliers were found who said they had a problem when several kills were made, but would not take action at that point. These responses appear unusual and are difficult to explain since a moderate correlation was found between perception and action taken when only one livestock kill was made.

Altogether 56.1 % of respondents said they had a problem when carnivore tracks were seen and 42.7 % of respondents said they would take action at this point. A high positive correlation was found between the perception of a problem and the point at which action would be taken (Spearman's ρ: 0.538, $p = 0.01$) when carnivore tracks were seen. When seeing a carnivore, 54.9 % of respondents said they had a carnivore problem and 50 % of respondents said they would take action. A high positive correlation was found between the perception of a problem and the point at which action would be taken (Spearman's ρ: 0.582, $p = 0.01$). About 44 % of respondents said they had a carnivore problem if their livestock came home without their calves/kids and 42.7 % said they would take action at this point. A high positive correlation was found between the perception of a problem in this case and the point at which action would be taken (Spearman's ρ: 0.506, $p = 0.01$).

Altogether 45.2 % said they had a problem if they found game that had been killed and 40.3 % said they would take action at this point. A moderate positive correlation was found between the perception of a problem in this case and when action would be taken (Spearman's ρ: 0.425, $p = 0.01$). Factor analysis on items used to assess perceptions and actions in relation to carnivore problems was carried out using principal component analysis with Varimax rotation. The twelve measurement items were reduced to four factors with Eigenvalues above one and confirmed via a visual analysis of the scree plot. All items had loadings higher than 0.5 and all loaded in the same direction (uni-polar). The four factors explained 68.3 % of the variance. Results are given in Table 4.4.

Table 4.4: The relationships between various variables related to the perception of carnivore problems versus action taken by respondents' as per the results of a factor analysis

Factors				Items pertaining to the perception of carnivore problems versus action taken by respondents
1	2	3	4	
0.85	0.10	0.15	-0.19	Action taken when carnivores are seen.
0.76	0.17	0.23	0.06	Action taken when carnivore tracks are seen.
0.74	0.13	0.31	0.11	Problem when carnivores are seen.
0.70	0.00	0.41	0.19	Problem when carnivore tracks are seen.
0.23	**0.87**	0.07	0.02	Action taken when livestock return without calves/kids.
-0.50	**0.61**	0.24	-0.20	Action taken when several livestock kills are made.
0.56	**0.59**	-0.12	0.17	Action taken when one livestock kill is made.
0.16	**0.55**	0.40	0.29	Problem when livestock return without calves/kids.
0.33	0.07	**0.71**	0.06	Problem when game killed by carnivore.
0.24	0.13	**0.67**	-0.17	Action taken when game killed by carnivore.
0.06	0.01	-0.17	**0.81**	Problem when several livestock are killed.
0.00	0.17	0.51	**0.65**	Problem when one livestock kill is made.

Note: Items pertaining to the perception of a problem and when action is taken with regards to carnivores loaded together on factor one; items pertaining the perception of a problem and when action is taken with regards to livestock loss loaded together on factor two; items pertaining to the perception of a problem and when action is taken with regards to game loss loaded together on factor three; items pertaining to the perception of a problem when one or several livestock are killed loaded together on factor four.

Results indicate that very little distinction is made between the perception of a problem and when action is taken as related items within questions pertaining to perception and action taken tended to load onto the same factor. In addition, there appeared to be three distinct categories in identifying carnivore problems and when action was taken: one pertains to the livestock itself, the second pertained to the carnivore and the third pertained to game. The separate loading of factor four suggests that the perception of a problem, versus people taking action when one or several livestock kills are made does not follow the same trend as for the other three factors.

Cronbach's alpha and Split-half reliability tests were carried out on the combined questions. The output for alpha suggests that identifying a carnivore problem and when action is taken is in fact internally reliable since the coefficient is 0.803 and the Guttman's Split-half reliability coefficient is 0.727, which is only just short of the 0.8 criterion and would be regarded as internally reliable for most purposes.

4.4 Factors relating to human-carnivore conflict

4.4.1 Extent of carnivore problem

Figure 4.1 represents the extent of carnivore problems farmers had experienced since owning the farm. Approximately 43 respondents (52.4 %) reported that carnivores were a big or very big problem since owning the farm, while 37 respondents (45.1 %) reported

carnivores were a small or very small problem. Two respondents (2.4 %) reported that carnivores were no problem.

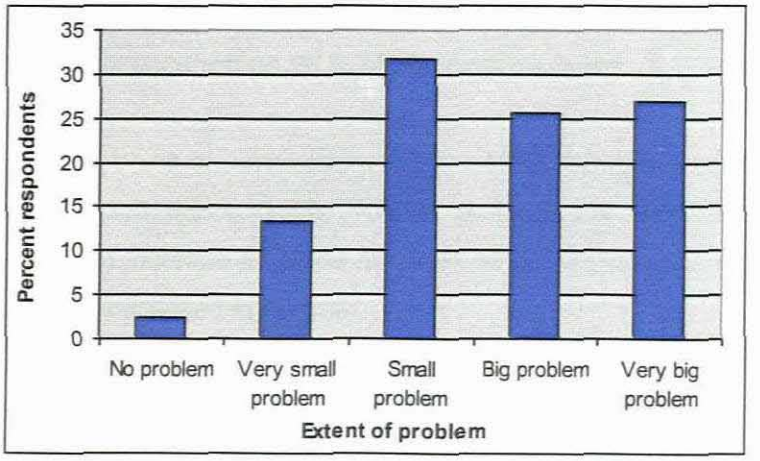

Figure 4.1: The extent of carnivore problems experienced by respondents since owning their farms

4.4.2 Most serious cause of livestock loss identified by respondents

Respondents were asked to rank in order of importance the most serious cause of livestock loss on their farm. (1 = most important, 6 = least important). As can be seen from the results in Figure 4.2, the majority of respondents identified carnivores as the most serious cause of loss, followed in order of importance by diseases.

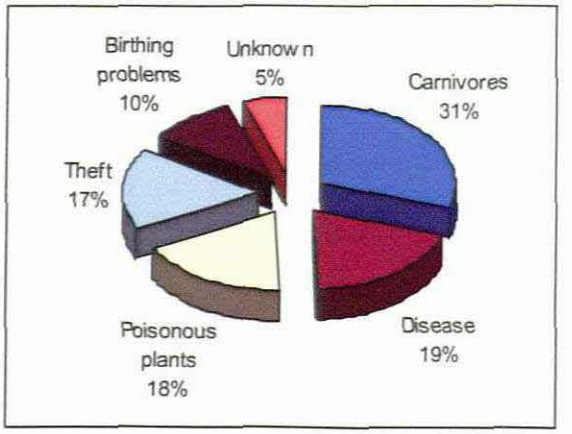

Figure 4.2: The most serious causes of livestock loss in order of importance as identified by respondents

4.4.3 Carnivore removals by respondents in relation to the trend (increase/decrease) in carnivore numbers

The number of carnivores removed by respondents during 2005 was investigated in relation to the trend (increase/decrease) in carnivore numbers since owning the farm. The mean length of time that respondents had owned farms was just over 5 ± 4.6 years.

There was a wide variation in the occurrence of species on respondents' farms making the comparison of removal rates difficult. Less than 40 % of respondents reported that African wild dog, brown hyaena, lion and spotted hyaena occurred on their farms (Table 4.5), compared to over 50 % of respondents reporting the presence of caracal, cheetah and leopard. In contrast jackal occurred on 96 % of respondents farms.

Jackal notably bore the brunt of removals, with over 40 % farmers reporting they removed almost three jackals each during 2006. This is perhaps not surprising as over 50 % respondents reported an increase in jackal numbers since owning their farms. Caracal and cheetah also reportedly increased in number.

A subset of the data was examined, looking at the mean number of carnivores removed by respondents, excluding respondents who reported removing zero carnivores and those who did not have the species on their farm (Table 4.5). The mean number of removals of African wild dog, jackal and spotted hyaena was relatively high at around five, compared to other species at a mean of around two to three removed during 2005. Although few farmers reported having lion on their farm, over half of the respondents reported removing them.

Table 4.5: Carnivore removals reported by respondents during 2005 in relation to the trend in carnivore numbers since owning the farm. Also included is the percentage of farmers' correctly identifying, using picture identification, the various carnivores. Figures in parentheses indicate standard deviation

Carnivore	Respondents on whose farms species occurred (%)	Number of respondents on whose farm species occurred (n)	Overall mean number of carnivores removed excluding respondents who did not have species on farm	Mean number of carnivores removed excluding respondents who did not remove and who never had species on farm	Overall respondents removing carnivores (%)	Respondents removing carnivores excluding those who did not have species on their farm (%)	Respondent reporting increase in carnivores (%)	Respondents reporting decrease in carnivores (%)	Respondents correctly identifying carnivores (%)
African wild dog	27.50	22	0.80 (±2.23)	5.83.. (±2.89)	3.75	13.63	3.80	11.39	89.90
Brown hyaena	40.00	32	0.71 (±2.02)	2.50.. (±0.00)	5.00	14.28	8.75	12.50	54.40
Caracal	68.40	54	0.51 (±1.02)	2.50.. (±0.00)	13.92	20.37	17.11	14.47	86.10
Cheetah	62.50	50	0.54 (±1.04)	2.50.. (±0.00)	12.50	20.00	17.28	8.64	94.90
Jackal	96.20	76	2.73 (±5.17)	5.93.. (±6.27)	44.30	44.73	53.75	12.50	100.00
Leopard	54.40	43	0.41 (±0.93)	2.50.. (±0.00)	8.86	16.27	10.13	15.19	85.90
Lion	25.00	20	1.88 (±2.28)	3.41.. (±2.02)	13.75	55.00	4.94	9.88	98.70
Spotted hyaena	35.00	28	0.70 (±1.14)	5.00.. (±2.89)	11.30	28.12	12.50	13.75	55.70

4.4.4 Livestock loss to carnivores compared to losses to all causes

Table 4.6 reflects the numbers (range intervals of 5) of livestock lost by respondents to carnivores and to all causes. When looking at livestock loss specifically to carnivores, altogether 24 respondents lost a mean of 4.8 cattle each, and 40 respondents lost a mean of 5.2 calves each to carnivores during 2005 (Table 4.6). Altogether 60 respondents lost a mean of 9.6 goats each and 43 respondents lost a mean of 8.8 sheep each to carnivores during 2005. The mean loss was calculated by taking the mean of each category of loss (e.g. the loss of sheep in the 1 - 5 category = 2.5).

Table 4.6: The number and type of livestock lost by respondents (%) during 2005 to carnivores and to all causes

Number of livestock lost	% Respondents and type of livestock lost to carnivores				% Respondents and type of livestock lost to all causes			
	Cattle (n = 78)	Calves (n = 78)	Goats (n = 73)	Sheep (n = 69)	Cattle (n = 81)	Calves (n = 81)	Goats (n = 74)	Sheep (n = 70)
None	69.23	47.44	17.81	34.78	9.88	17.28	6.76	18.57
1-5	24.36	34.62	34.25	28.99	60.49	50.62	16.22	22.86
6-10	2.56	12.82	15.07	10.14	12.35	18.52	18.92	14.29
11-15	1.28	2.56	12.33	11.59	8.64	3.70	5.41	8.57
16-20	1.28	0.00	5.48	8.70	6.17	3.70	22.97	15.71
>20	1.28	2.56	15.07	5.80	2.47	6.17	29.73	20.00

Note: n = total number of respondents reporting per type of livestock lost

Altogether 73 respondents lost a mean of 5.7 cattle and 67 respondents lost a mean of 6.2 calves each during 2005 to all causes. When it came to small stock, 69 respondents lost a mean of 14.2 goats each, compared to 56 respondents who lost a mean of 12.1 sheep each to all causes during 2005. Results in Table 4.6 show that number of large stock (cattle and calves) lost is less than the number of small stock (goats and sheep) lost in both cases.

In order to assess whether the difference in mean losses to carnivores and mean loss to all causes experienced between the different types of livestock were statistically significant, a one way analysis variance (ANOVA) was run. The results displayed in Table 4.7 show that the differences in the losses of livestock to carnivores and livestock lost to all causes between the different groups of livestock are similarly statistically significant between cattle and small stock, and between calves and small stock. There was no statistical difference between the difference in losses of cattle and calves or between sheep and goats. Thus significantly more small stock are lost than large stock to carnivores as well as to all causes.

Table 4.7: One way Scheffe test comparing the mean number of livestock loss to carnivores across different groups of livestock and losses to all causes across different groups. Standard error (*S.E.*) and significance (Sig.) are indicated

		Mean loss to carnivores	Cattle		Calves		Goats	Mean loss to all causes	Cattle		Calves		Goats
1	Cattle (mean/diff.)	0.95						4.31					
	(*S.E.*)												
	(Sig.)												
2	Calves	2.62	1.68					4.47	0.15				
			1.43						*2.08*				
			0.71						1.00				
3	Goats	7.71	6.76	*	5.08	*		13.87	9.56	*	9.40	*	
			1.46		*1.46*				*2.13*		*2.13*		
			0.00		0.01				0.00		0.00		
4	Sheep	8.64	7.69	*	6.01	*	0.93	15.78	11.47	*	11.31	*	1.91
			1.51		*1.51*		*1.54*		*2.20*		*2.20*		*2.25*
			0.00		0.00		0.95		0.00		0.00		0.87

Note: * $P \leq 0.05$

4.4.5 The impact of livestock losses in relation to herd size

In order to understand the impact of the numbers of livestock losses to farmers, livestock loss was related to herd size (See section 4.5.1 & Figure 4.4 for herd sizes), for both loss to carnivores and loss to all causes. The impact of cattle losses to all causes was 4.3 %, compared to the impact of cattle losses to carnivores which was only 0.9 %. As such, carnivores accounted for 21.1 % of all cattle losses. The impact of calf losses attributed to all causes versus losses to carnivores could not be calculated as the proportion of calves in the herd was not known. The impact of goat losses to all causes was 13.9 %, compared to the impact of goat losses to carnivores which was 7.7 %. Carnivores therefore accounted for 55.6 % of all goat losses. The impact of sheep losses to all causes was 15.8 %, compared to the impact of sheep losses to carnivores which was 8.6 %, and as such carnivores accounted for 54.7 % of sheep losses.

In order to assess whether the variance in impact of losses to carnivores and the impact of losses to all causes experienced between the different types of livestock was statistically significant, a one way analysis of variance (ANOVA) was run. The results in Table 4.8 show the variance in impact of losses to carnivores between the different groups of livestock is statistically significant between cattle and small stock, but not between sheep and goats in relation to herd size. The same trend is seen in the impact of losses to all causes.

Table 4.8: One way Scheffe test comparing the impact of livestock loss to carnivores across different groups of livestock and the impact of losses to all causes across different groups. Standard error (*S.E.*) and significance (Sig.) are indicated

		Mean loss to carnivores				Mean loss to all causes			
			Cattle		Goats		Cattle		Goats
1	Cattle (mean/diff.)	0.91				4.31			
	(*S.E.*)								
	(Sig.)								
2	Goats	7.71	6.8	*		13.87	9.56	*	
			1.57				*2.33*		
			0.00				0.00		
3	Sheep	8.64	7.73	*	0.93	15.78	11.47	*	1.91
			1.63		*1.66*		*2.41*		*2.46*
			0.00		0.86		0.00		0.74

Note: $P \leq 0.05$

The impact of loss of calves could not be calculated as the percentage of calves in the herd was not known.

4.4.6 Techniques used by respondents to remove carnivores from their farms

When asked what kind of techniques respondents used to remove carnivores, only 10 % of respondents favoured using poison while most other techniques were used by close to half of all respondents in each category, except other unspecified techniques which 7 % of the respondents reported using (Table 4.9). Fifty-six percent of respondents used multiple techniques listed in Table 4.9 to remove carnivores.

Table 4.9: The techniques used by respondents to remove carnivores from their farms and the percentage of respondents making use of particular techniques

Technique	% respondents	n = respondents
Shooting	56.10	46
Trap cages	48.20	39
Dogs	44.40	36
Poison	10.00	8
Gin traps	48.80	40
Other	7.00	4

4.4.7 Carnivore identification by respondents

Respondents were shown pictures of carnivores and asked to name them, either in English, Afrikaans or in their own language.

Overall respondents fared well and perhaps not surprisingly 100 % (n = 79) of respondents correctly identified jackal. Recognition of the two spotted cats was high, with 85.9 % of

respondents correctly identifying leopard and 94.9 % of respondents' correctly identifying *cheetah* (*Table* 4.5).

In contrast, just over half the respondents recognised brown and spotted hyaena respectively. Respondents often incorrectly called brown and spotted hyaena "wolf" or simply hyaena, in neither case making a distinction between the two species.

4.4.8 Identification of carnivore problems on farms

Respondents were asked who identified a carnivore problem on their farm. Altogether 26 (31.7 %, n = 82) respondents said multiple people identified the problem, in many cases the owner and workers together decided when there was a problem. A further 19 (23.2 %) respondents said they themselves identified the problem, while 13 (15.9 %) said the owner identified the problem. Altogether 16 (19.5 %) said their workers identified when there was a carnivore problem. Seven (8.5 %) of respondents said the foreman identified the problem, and one (1.2 %) respondent said "other" (i.e. everyone on the farm).

4.4.9 The associations between constructs relating to carnivore removals

4.4.9.1 Livestock loss versus carnivore removals

Whether or not livestock losses were associated with carnivore removals was investigated using ordinary least square regression in order to help determine whether or not carnivore removals were indiscriminate or related to actual livestock losses. In order to investigate this association, it was hypothesised that farmers with higher livestock losses to carnivores would remove more carnivores. Independent variables of livestock loss were measured using the mean loss to carnivores for cattle, calves, goats and sheep. Since the original survey had ranges of loss, the mean for each range was calculated. The dependent variable, carnivore removals, was calculated in a similar way. An aggregate number of removals was constructed to include all carnivores. The dependent variable was not normally distributed so a square root was taken to transform and normalise the variable.

Various controls were included in the model. The location of the farm (longitude and latitude) was included to control for the fact that farms were located throughout a wide area, and therefore the distribution and density of carnivores would be expected to differ. The trend in carnivore numbers since owning the farm was controlled for as it could be expected that an increase in carnivores could lead to an increase in livestock loss and also carnivore removals.

Prior to running the models, the variables were assessed for correlations using Spearman's ρ. Significant weak positive correlations were found between carnivore removals and cattle loss (Spearman's ρ: 0.250, p = 0.027) and between carnivore removals and calf loss (Spearman's ρ: 0.262, p = 0.021). This would suggest more carnivores are removed in response to higher livestock losses.

A significant weak negative correlation was found between the further east a respondent's farm was situated and the mean trend in carnivore numbers (Spearman's ρ: -0.327, p = 0.003). This would suggest that less livestock loss to carnivores should occur the further east one goes due to declining carnivore numbers (Figure 1.2). This assumption is reflected partly in the results in that cattle loss to carnivores showed a significant negative correlation (Spearman's ρ: -0.265, p = 0.021) as did sheep loss to carnivores (Spearman's ρ: -0.299, p = 0.013) to easterly locations. The mean trend in carnivore numbers showed a significant weak positive correlation to cattle loss (Spearman's ρ: 0.350, p = 0.002), calf loss (Spearman's ρ: 0.303, p = 0.007), goat loss (Spearman's ρ: 0.330, p = 0.004) and sheep loss (Spearman's ρ: 0.315, p = 0.009). Thus, with increasing carnivore numbers, an increase in livestock loss was experienced. Furthermore, if loss was experienced to one type of livestock, invariably losses were being experienced with other types of livestock as well. Cattle, calf, goat and sheep losses correlated positively to one another in most cases (Table 4.10).

Table 4.10: The correlations between variables associated with livestock loss versus carnivore removals as per the results using Spearman's ρ. The dependent variable of carnivore removals was calculated using the mean number of carnivore removals. Significance (Sig.) is indicated

	Variables	Carnivores removed	East	South	Mean trend in carnivore numbers	Cattle loss to carnivores	Calf loss to carnivores	Goat loss to carnivores
1.	Carnivores removed (Square Root)							
2.	East	0.017						
	(Sig.)	0.884						
3.	South	0.114	0.188					
		0.315	0.095					
4.	Mean trend in carnivore numbers	0.152	-0.327 (**)	-0.104				
		0.177	0.003	0.362				
5.	Cattle loss to carnivores	0.250 (*)	-0.265 (*)	0.119	0.350 (**)			
		0.027	0.021	0.308	0.002			
6.	Calf loss to carnivores	0.262 (*)	-0.161	0.003	0.303 (**)	0.430 (**)		
		0.021	0.165	0.978	0.007	0.000		
7.	Goat loss to carnivores	0.142	-0.169	0.028	0.330 (**)	0.241 (*)	0.305 (*)	
		0.230	0.158	0.815	0.004	0.043	0.010	
8.	Sheep loss to carnivores	-0.171	-0.299 (*)	-0.030	0.315 (**)	0.081	0.259 (*)	0.682 (**)
		0.163	0.013	0.808	0.009	0.518	0.036	0.000

Note: * P ≤ 0.05, ** P ≤ 0.01

Three models were run to assess the associations. The first model included only the control variables (Model 1, Table 4.11). This model explained 2.7 % of the variance and none of the coefficients were statistically significant. The second model (Model 2, Table 4.11) included only the hypothesised variables (cattle, calves, goats, sheep losses to carnivores). As a whole this model explained 32.5 % of the variance, and goat (t = 3.853, p = 0.01) and sheep losses (t = -3.814, p = 0.01) were significantly associated with carnivore removals. While goat losses were positively and significantly associated with carnivore removals as expected, sheep losses were negatively and significantly associated. This would appear to suggest that with fewer sheep losses more carnivores were removed. It is possible that farmers who farmed with sheep also farmed with goats. In fact the correlation between the two variables was high and positive (Spearman's ρ: 0.575, p = 0.01) and statistically significant. In addition, the impact of losses to goats and sheep was similar. For this reason the model was re-run including the variable of interaction effect between goats and sheep. When this variable was added to the model, goat losses remained a significant explanatory variable, but sheep losses did not. The possibility of potential multi-colinearity (highly correlated) problems between the two variables was investigated, but the analysis suggested this was not a problem. Thus, no reason could be found for why farmers would remove more carnivores in response to less sheep loss.

The third model (Model 3, Table 4.11) was run using all the control variables as well as the hypothesised variables. Results were consistent with model 2 and the variance explained increased slightly to 35.9 % and the regression equation was statistically significant (F = 4.401, p = 0.001).

Table 4.11: Factors influencing carnivore removals as per the results of ordinary least square regression analysis. The dependent variable of carnivore removals was calculated using the mean number of carnivore removals. Standard error (*S.E.*) and significance (Sig.) are indicated

	Carnivore Removals (Square Root)					
	Model 1		**Model 2**		**Model 3**	
Variables	Beta Coefficient	Sig.	Beta Coefficient	Sig.	Beta Coefficient	Sig.
Constant	1.367		1.184	*	4.249	
(*S.E.*)	*4.887*		*0.262*		*4.962*	
East (latitude)	0.138				0.099	
	0.183				*0.188*	
South (longitude)	0.133				0.257	
	0.172				*0.186*	
Mean trend in carnivore numbers	0.269				0.269	
	0.230				*0.237*	
Cattle loss to carnivores			0.029		0.012	
			0.059		*0.062*	
Calf loss to carnivores			0.065		0.061	
			0.047		*0.047*	
Goat loss to carnivores			0.132	***	0.130	***
			0.034		*0.035*	
Sheep loss to carnivores			-0.147	***	-0.153	**
			0.038		*0.042*	
R-square	0.027		0.325		0.359	
F	694		6.978	***	4.401	***
	0.559		0.000		0.001	
n	79		63		63	

Two tailed t-tests: † P ≤ 0.100, * P ≤ 0.05, ** P ≤ 0.01, *** P ≤ 0.001

4.4.9.2 Factors influencing human-carnivore conflict

Whether or not carnivore conflict was associated with livestock loss was investigated using ordinary least square regression. To investigate this association, it was hypothesised that the level of conflict would increase with increased livestock loss. Independent variables of livestock loss, herd size, the trend in carnivore numbers and attitude towards carnivores were measured. The independent variable of negative attitude was measured by compiling the sum of scores for farmers who wanted all carnivores removed off farmland and believed that the only way to reduce livestock losses to carnivores was to remove all carnivores off their farm. Trend (increase/decrease) in carnivore numbers was obtained by averaging scores of the trend in the numbers of all carnivores. The dependent variable of carnivore conflict was measured according to how farmers rated their carnivore problem on a scale of 1 - 5, ranging from no problem to a very big problem.

Prior to running the models, the variables were assessed for correlations using Spearman's ρ (Table 4.13). A low positive correlation was found between home language and the mean trend in carnivore numbers. However, the results of a one way Scheffe test showed that the differences across groups (respondents grouped by home language) was insignificant in relation to the mean trend in carnivore numbers (increase/decrease) reported by

respondents (Table 4.12). In addition, the results of one way Scheffe tests showed that the differences across groups (respondents grouped by home language) was insignificant in relation to the extent of the carnivore problem (on a scale of 1 – 5 ranging from no problem to a very big problem) experienced by respondents and the number of carnivores removed by respondents. Thus, ethnic group does not appear to be an important indicator of human-carnivore conflict.

Table 4.12: One way Scheffe tests comparing the differences across language groups in the trend in carnivore numbers (increase/decrease), extent of carnivore problem and carnivore removals. Standard error (*S.E.*) and significance (Sig.) are indicated

		Trend carnivore numbers	Big/small problem				Carnivore removals								
			2	3	4	5		2	3	4	5		2	3	4	5
2	Afrikaans	0.82					3.29					3.57				
3	Owambo (mean/diff)	1.34	0.52				4.18	0.89				6.03	2.46			
	(S.E.)		*0.36*					*0.49*					*3.65*			
	(Sig.)		0.73					0.51					0.98			
4	Herero	1.70	0.87	0.35			3.46	0.18	0.72			4.81	2.46	1.22		
			0.33	*0.24*				*0.45*	*0.32*				*3.65*	*2.36*		
			0.15	0.65				1.00	0.22				0.98	0.99		
5	Damara	1.39	0.57	0.05	0.31		3.53	0.25	0.64	0.07		4.50	0.93	1.53	0.31	
			0.37	*0.29*	*0.25*			*0.50*	*0.38*	*0.33*			*3.72*	*2.88*	*2.47*	
			0.67	1.00	0.82			0.99	0.59	1.00			1.00	0.99	1.00	
8	Other	2.40	1.57	1.05	0.70	1.01	3.50	0.21	0.68	0.04	0.03	3.13	0.45	2.90	1.68	1.38
			0.51	*0.45*	*0.42*	*0.45*		*0.68*	*0.60*	*0.57*	*0.61*		*5.09*	*4.52*	*4.27*	*4.57*
			0.06	0.25	0.61	0.31		1.00	0.87	1.00	1.00		1.00	0.98	1.00	1.00

Note: $P \leq 0.05$

Other factors that could affect carnivore removals were also examined. Farm size showed a significant weak positive correlation to the mean trend in carnivores' numbers (Spearman's ρ: 0.360, $p = 0.001$) as well as to cattle herd size (Spearman's ρ: 0.320, $p = 0.003$) and goat herd size (Spearman's ρ: 0.261, $p = 0.024$). Thus, the larger the farm, the more likely respondents perceived an increase in carnivore numbers since owning the farm, and as would be expected, herd sizes were larger. The mean carnivore trend showed a significant positive weak correlation to overall livestock lost to carnivores (Spearman's ρ 0.344, $p = 0.002$), indicating that livestock losses reportedly increased with a trend of increasing carnivore numbers. The mean carnivore trend also showed a significant positive weak correlation to cattle herd size, reflecting that the respondents with larger herd sizes were more inclined to report that carnivore numbers had increased since they owned the farm (Spearman's ρ: 0.315, $p = 0.004$).

A negative attitude showed a significant positive weak correlation to goats being important as a source of cash income (Spearman's ρ: 0.290, $p = 0.009$) as well as sheep as a source of cash income (Spearman's ρ: 0.254, $p = 0.025$). Thus respondents viewing their small stock as an important source of cash income were more likely to have a negative attitude to carnivores. The total number of livestock lost to carnivores correlated positively and weakly with increasing cattle herd size (Spearman's ρ: 0.248, $p = 0.025$) and goat herd size (Spearman's ρ: 0.263, $p = 0.024$).

Cattle herd size showed a significant weak positive correlation to goat (Spearman's ρ: 0.313, $p = 0.006$) and sheep herd sizes (Spearman's ρ: 0.303, $p = 0.011$), reflecting that farmers with larger herds of cattle were also likely to have larger herds of small stock. Farmers with larger herds of goats were also more likely to have larger herds of sheep (Spearman's ρ: 0.575, $p = 0.01$). A significant weak positive correlation was found between cattle as an important source of income and goats as an important source of cash income (Spearman's ρ: 0.289, $p = 0.01$). A moderate significant positive correlation was found between goats and sheep as important sources of income (Spearman's ρ: 0.587, $p = 0.01$). Thus, where goats were farmed with cattle, both were likely to be viewed as important sources of income, and where both goats and sheep were farmed, both were likely to be viewed as important sources of cash income.

Table 4.13: The correlations between variables affecting human-carnivore conflict as per the results using Spearman's ρ. The dependent variable of carnivore conflict was measured according to how farmers rated their carnivore problem on a scale of 1 to 5, ranging from no problem to a very big problem. Significance (Sig) is indicated.

		1		2		3	4		5		6		7		8		9		10	11		12	
1	Carnivore conflict																						
2	Home language	-0.098																					
	(Sig.)	0.381																					
3	Time on farm	0.226	(*)	0.132																			
		0.045		0.245																			
4	Farm size (thousand hectares)	0.116		-0.065		0.081																	
		0.301		0.563		0.476																	
5	Mean carnivore trend	0.304	(**)	0.220	(*)	-0.005	0.369	(**)															
		0.006		0.049		0.964	0.001																
6	Negative attitude toward carnivores	0.241	(*)	-0.132		0.125	-0.025		-0.148														
		0.029		0.238		0.272	0.822		0.189														
7	Livestock loss to carnivores total	0.378	(**)	-0.080		0.209	0.148		0.344	(**)	0.057												
		0.000		0.476		0.066	0.188		0.002		0.614												
8	Cattle herd size	0.074		0.005		0.141	0.355	(**)	0.315	(**)	-0.011		0.248	(*)									
		0.510		0.962		0.214	0.001		0.004		0.919		0.025										
9	Goat herd size	-0.040		0.027		0.058	0.302	(**)	0.153		-0.146		0.263	(*)	0.313	(**)							
		0.736		0.820		0.629	0.008		0.189		0.213		0.024		0.006								
10	Sheep herd size	0.048		-0.147		0.154	0.206		-0.020		-0.124		0.109		0.302	(*)	0.575	(**)					
		0.690		0.222		0.211	0.084		0.867		0.304		0.368		0.011		0.000						
11	Cattle cash income	0.089		0.099		-0.058	0.063		-0.026		0.042		-0.143		0.022		0.096		-0.003				
		0.425		0.378		0.614	0.576		0.817		0.710		0.201		0.845		0.411		0.980				
12	Goats cash income	0.315	(**)	-0.208		0.055	-0.118		-0.039		0.290	(**)	0.170		-0.160		0.130		0.085	0.289	(**)		
		0.005		0.065		0.636	0.300		0.733		0.009		0.136		0.158		0.266		0.485	0.001			
13	Sheep cash income	0.223	(*)	-0.032		-0.126	0.012		0.077		0.254	(*)	0.064		-0.210		0.198		0.112	0.161		0.587	(**)
		0.049		0.778		0.283	0.915		0.502		0.025		0.581		0.065		0.093		0.352	0.159		0.000	

Note: * P ≤ 0.05, ** P ≤ 0.01

The first model (Controls) (Table 4.14) included only the control variables. This model explained 23.7 % of variance and the regression equation was statistically significant (F = 4.464, p = 0.001). This model showed that the mean trend in carnivore numbers (t = 2.514, p = 0.014) and negative attitude towards carnivores (t = 3.106, p = 0.003) were positively and significantly associated with carnivore conflict. As the number of carnivores on the farm increased, conflict increased. And, with a stronger negative attitude, conflict also increased. Weak evidence was also found for the positive association between the increase in the length of time the farmer had owned or lived on the farm (t = 1.875, p = 0.065) and carnivore conflict.

In the next three models (Table 4.14), three variables were added relating to loss of livestock to carnivores, the size of the herd and whether or not the livestock was used as a source of cash income by the farmer. Three models were run: one for goats, one for sheep and one for cattle. Although most farmers indicated they farmed with all three types of livestock, the spread (i.e. how many goats, sheep or cattle they owned) varied.

The second model (Model goats, Table 4.14) indicated that when it came to goats, loss of goats to carnivores, herd size and whether they were a source of cash income all played a role. This model explained 42.8 % of variance and the regression equation was statistically significant (F = 5.622, p = 0.01). There was a positive and significant association of loss of goats to carnivores (t = 3.812, p = 0.01) and source of cash income (t = 2.135, p = 0.037) with the extent of carnivore conflict. The larger the number of goats lost, the higher the conflict. If goats were an important source of cash income, farmers also perceived carnivores to be a bigger problem. On the other hand, herd size was weakly and negatively associated (t = -1.714, p = 0.092) with carnivore conflict. This suggests that the smaller the size of the herd, the bigger the conflict with carnivores. The fact that carnivores have a high impact on goat loss (Table 4.8) supports the view that farmers with smaller herds regard carnivores as a bigger problem. In this model, a negative attitude towards carnivores remained a strong predictor of conflict.

The third model (Model sheep, Table 4.14) tested the association of the variables related to sheep with carnivore conflict. In this model, loss of sheep to carnivores (t = 2.998, p = 0.004) was a significant and positive predictor of carnivore conflict. Herd size and sheep as a source of cash income were not significant. A negative attitude towards carnivores (t = 2.641, p = 0.011) was positively and significantly associated with conflict. The length of time the farmer owned or lived on the farm (t = 1.871, p = 0.067) showed a weak positive association with conflict.

In the fourth model (Model cattle, Table 4.14) none of the three variables related to cattle had a significant association with carnivore conflict. This model explained 25 % of variance and the regression equation was statistically significant (F = 5.622, p = 0.01). However, the control variables remained significant in the fourth model. The mean trend in carnivore numbers (t = 2.530, p = 0.014) showed a positive significant association to conflict as did a negative attitude (t = 3.120, p = 0.003). The length of time the farmer owned or lived on the farm (t = 1.682, p = 0.097) showed a weak positive association to conflict.

The results suggest that farmers with cattle were less likely to view carnivores as a big problem based on the losses to their cattle herd. Rather, the conflict was a result of attitudes and trend in carnivore numbers, which were all positively and significantly associated with carnivore conflict. In addition, the length of time the farmer had owned or lived on the farm was weakly associated with conflict. The impact of carnivores on cattle loss was found to be much lower than the impact of carnivores on goat and sheep loss (Table 4.8). This may explain part of the reason why the relationships of goats and sheep to carnivore conflict are more specifically tied to the herd; whereas, for cattle farmers carnivore conflict is related to personal characteristics and views/attitudes towards carnivores.

Table 4.14: The association between factors influencing human-carnivore conflict as per the results of ordinary least square regression analysis. The dependent variable of carnivore conflict was measured according to how farmers rated their carnivore problem on a scale of 1 to 5, ranging from no problem to a very big problem. Standard error (*S.E.*) and significance (Sig.) are indicated

	Carnivore Conflict (as Big/Small Problem)							
	Model controls		**Model goats**		**Model sheep**		**Model cattle**	
Variables	Beta Coefficient	Sig.	Beta Coefficient	Sig.	Beta Coefficient	Sig.	Beta Coefficient	Sig.
Constant	2.445	***	0.538		2.179	*	1.278	
(S.E.)	*0.514*		*0.923*		*0.818*		*2.425*	
Home Language	-0.119		0.044		-0.018		-0.089	
	0.092		*0.092*		*0.105*		*0.105*	
Time on Farm	0.045	†	0.033		0.047	†	0.043	†
	0.024		*0.023*		*0.025*		*0.026*	
Farm size (thou. ha)	0.003		0.005		-0.016		-0.014	
	0.055		*0.055*		*0.060*		*0.061*	
Trend in carnivore numbers	0.370	*	0.196		0.208		0.438	*
	0.147		*0.146*		*0.164*		*0.173*	
Negative Attitude	0.261	**	0.250	**	0.248	*	0.293	**
	0.084		*0.085*		*0.094*		*0.094*	
Loss to Carnivores			0.060	***	0.062	**	-0.058	
			0.016		*0.021*		*0.054*	
Herd Size			-0.003	†	-0.002		0.001	
			0.002		*0.002*		*0.002*	
Source of Cash Income			0.343	*	0.016		0.173	
			0.161		*0.144*		*0.484*	
R-square	0.237		0.428		0.355		0.255	
F	4.464	***	5.622	***	3.785	***	2.778	**
	0.001		0.000		0.001		0.010	
n	78		69		64		74	

two-tailed t-tests: † P ≤ 0.100, * P ≤ 0.050, ** P ≤ 0.01, *** P ≤ 0.001

4.5 Livestock management and sources of income

4.5.1 Livestock production systems

Almost all respondents (98.8 %) farmed with cattle, while 91.4 % farmed with goats and 85.2 % farmed with sheep (Figure 4.3). In addition 43.21 % of respondents reported that they farmed with game.

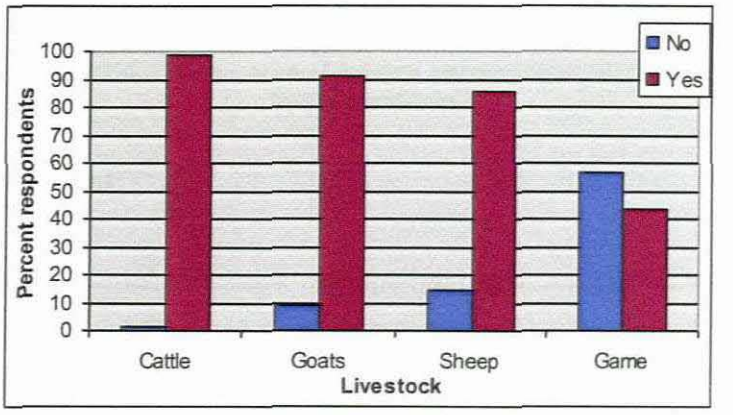

Figure 4.3: Livestock production systems employed by respondents

The mean number of livestock reported on the farms during 2005 was calculated using the mean of each category (range of herd size). Farmers reported having a mean of 150 cattle, 129 goats and 85 sheep (Figure 4.4).

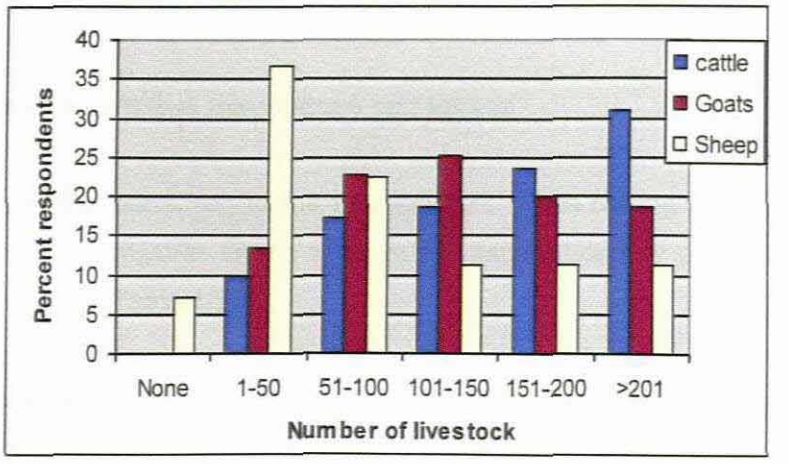

Figure 4.4: Mean number of livestock owned by respondents during 2005

The calving percentage was looked at to investigate productivity of the herds. The mean calving percentage was almost 59 % (Figure 4.5), which is above the national mean of approximately 52 % but well below the preferred mean of in the region of 80 - 90 %.

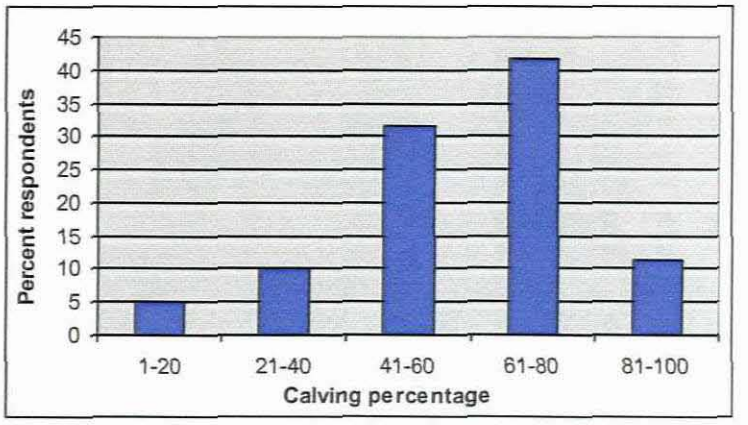

Figure 4.5: Mean annual calving percentages reported by respondents

4.5.2 Cattle management

The implementation of certain livestock management systems was investigated by asking respondents whether or not they used certain measures (Figure 4.6 and Figure 4.7). If they did not use a particular livestock management system, they were asked to indicate why they did not do so.

Not having enough information (45 %) was the reason cited most for not implementing livestock management practices. In addition, the cost (18 %) and the practical limitations of using management strategies (18 %) were cited as reasons for not implementing practices. "Other" unspecified reasons were cited 19 % of the time. Some respondents gave multiple reasons, but this number of respondents was negligible.

4.5.3 Cattle management that may reduce calf losses

Livestock management pertaining to the management of the calving herd was looked at in relation to calf loss to carnivores and to all causes to assess whether losses were affected by management practices (Table 4.15).

Over 70 % of respondents in both cases said they kept their calves in a kraal when very young and brought their cows to a particular camp to calve (maternity camp), while 81.3 % of respondents brought the cows closer to home to calve. The reasons cited by respondents for not bringing cows to a maternity camp were that it was not practical (χ^2 = 5.5, *df* = 3, *p* = 0.139) but this reason was not significant. Reasons cited for not bringing cows closer to home were insignificant (χ^2 = 0.2, *df* = 3, *p* = 0.978). Approximately 76.3 % of respondents said their workers carried out increased patrols during the calving season.

Table 4.15: One way Scheffe tests comparing calf loss to carnivores across different groups of livestock management practices and calf loss to all causes across different groups of livestock management practices. Standard error (*S.E.*) and significance (Sig.) are indicated

		Calf loss to carnivores					Calf loss to all causes				
			Kraal	Maternity camp	Calving close to home	Increased patrols		Kraal	Maternity camp	Calving close to home	Increased patrols
1	Kraal (mean/diff)	2.91					5.44				
	(S.E.)										
	(Sig.)										
2	Maternity camp	2.96	0.05				5.36	0.08			
			0.81					*1.12*			
			1.00					1.00			
3	Calving close to home	2.58	0.33	0.38			5.15	0.28	0.21		
			0.80	*0.78*				*1.11*	*1.08*		
			1.00	0.99				1.00	1.00		
4	Increased patrols	2.37	0.54	0.59	0.21		5.54	0.10	0.18	0.39	
			0.81	0.80	*0.79*			*1.13*	*1.11*	*1.09*	
			0.98	0.97	1.00			1.00	1.00	1.00	
5	Donkeys to protect herd	2.24	0.67	0.72	0.34	0.14	3.88	1.56	1.49	1.28	1.67
			1.16	*1.14*	*1.14*	*1.15*		*1.59*	*1.57*	*1.56*	*1.58*
			0.99	0.98	1.00	1.00		0.91	0.93	0.96	0.89

Note: P≤ 0.05

Respondents who did not have workers carry out increased patrols stated that they did not have enough information about this technique (χ^2 = 9.42, *df* = 3, *p* = 0.024). Only 24.7 % of respondents used donkeys to protect their livestock. A significant proportion of respondents did not know enough about this technique (χ^2 = 46.48, *df* = 3, *p* = 0.01) to implement it.

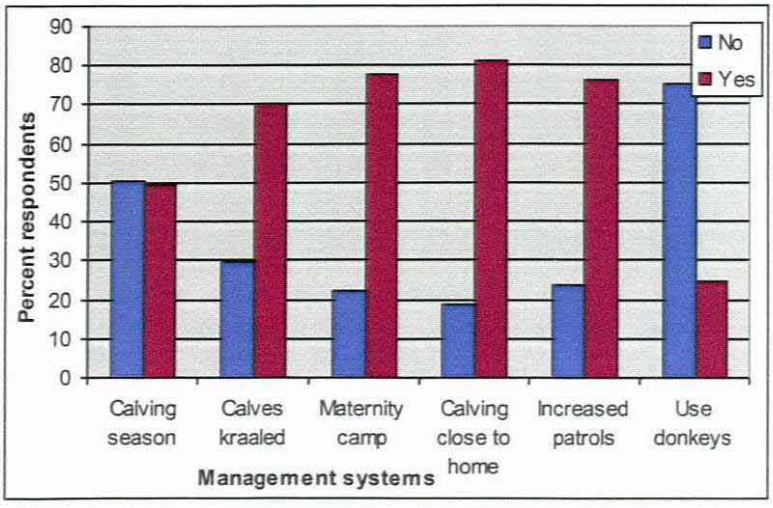

Figure 4.6: Percentage of respondents using or not using certain cattle management systems that may influence livestock loss to carnivores

4.5.4 Management affecting cattle productivity

Certain key techniques linked to improving reproductive success were examined by looking at the level of sophistication of livestock management employed by farmers. These techniques reflect on overall strategies relating to productivity employed to compete in the commercial sector which if employed successfully can place the farmer in a better economic position and can thus help buffer losses caused by predation.

Fewer than half of the respondents (49.4 %) used a calving season regulated by placing the bull with the herd for limited periods. Those farmers that did not implement a calving season most often reported that they did not have enough information about this technique as the reason for not doing so (χ^2 = 8.6, *df* = 3, *p* = 0.035).

When asked if bulls were tested for fertility and diseases when they were purchased, in both cases over half of the respondents answered yes (56.8 %), while the most common reason reported for not doing so was not having enough information (fertility testing: χ^2 = 15.65, *df* = 3, *p* = 0.001; disease testing: χ^2 = 17.55 *df* = 3, *p* = 0.001). About 61.7 % of respondents reported purchasing registered bulls, and not having enough information was significantly reported by respondents as the most common reason for not doing so (χ^2 = 14.72, *df* = 3, *p* = 0.002). Only 13.6 % of respondents reported carrying out pregnancy tests on their cows,

(Spearman's ρ: 0.412, p = 0.01) and those getting bulls tested for diseases (Spearman's ρ: 0.291, p = 0.009). These results suggest that farmers who apply more intensive management tended to implement multiple techniques.

4.5.5 Small stock management

Altogether 51 respondents (66.2 %, n = 77) reported having a herder that accompanied their small stock to veld daily, while 33 respondents (42.9 %) reported implementing a regulated lambing season whereby the ram was placed with the herd for limited periods (Figure 4.8). The reasons given for not using a herder were statistically insignificant (χ^2 = 2.00, df = 3, p = 0.572). However, not having enough information (χ^2 = 11.78, df = 3, p = 0.008) was cited as the most common reason for not implementing a lambing season and was a statistically significant result. Approximately 72 respondents (93.5 %) reported kraaling small stock at night while the reason cited for not kraaling at night was not enough information, but this results was not statistically significant (χ^2 = 5.00, df = 3, p = 0.172).

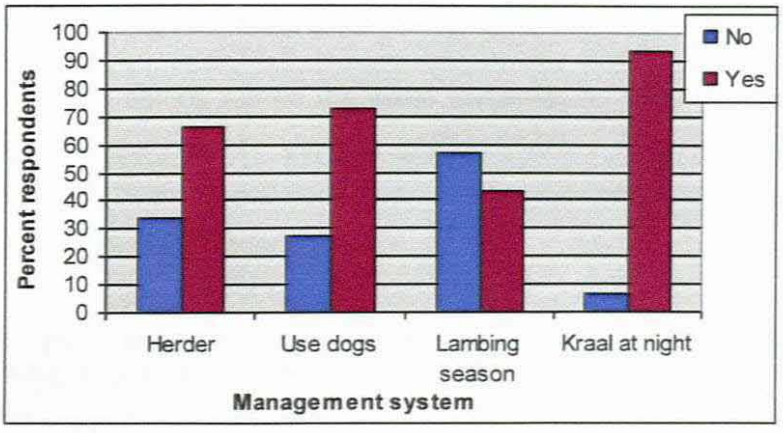

Figure 4.8: Percentage of respondents using or not using certain small stock management systems that may influence livestock loss to carnivores

Fifty-five respondents (72.4 %, n = 76) reported using livestock guarding dogs (LSGDs). Respondents were asked about the effectiveness of their dogs. Some 43.8 % of respondents felt that their dogs could protect their livestock against both large and small predators (χ^2 = 12.91, df = 4, p = 0.012). However, only 31.6 % of respondents said their LSGDs were effective against all predators (χ^2 = 12.91, df = 4, p = 0.012). Approximately 70.1 % of respondents said their LSGDs were only able to protect against small predators (χ^2 = 39.58, df = 4, p = 0.01). Altogether 43.8 % of respondents agreed their LSGDs prevented theft of their livestock, but this was not a statistically significant result (χ^2 = 5.72, df = 4, p = 0.221).

Respondents who said they did not use livestock guarding dogs were asked to identify in order of importance the most important reasons for not using livestock guarding dogs (1 =

most important, 6 = least important). Altogether 54 % of respondents cited not knowing how to train LSGDs as the most important reason for not using them, followed by 30 % of respondents who did not use LSGDs because they chased game (Figure 4.9). The fact that LSGDs can injure/kill small stock was not cited as the most important reason for not using them by any respondents.

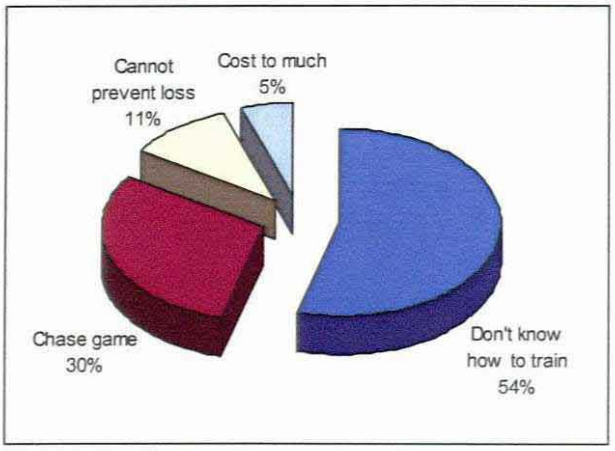

Figure 4.9: The reasons for not using livestock guarding dogs to protect small stock identified in order of importance by respondents (n = 20; 2006)

A factor analysis was carried out on the items pertaining to effectiveness of LSGDs using principal component analysis with Varimax rotation (Table 4.16). Four items loaded above 0.5 onto two factors with Eigenvalues over one confirmed by a scree plot, explaining approximately 67.37 % of the variance.

Table 4.16: The relationships between the various variables related to the effectiveness of livestock guarding dogs as per the results of a factor analysis

Factors		
1	**2**	**Items pertaining to the effectiveness of livestock guarding dogs**
0.83	-0.13	LSGDs very effective against all predators
0.83	-0.06	LSGDs prevent theft of livestock
0.02	**0.84**	LSGDs cannot prevent losses to big/small predators
-0.22	**0.73**	LSGDs only able to protect against small predators

Note: Items pertaining to the effectiveness of LSGDs loaded together on factor one and items pertaining to the failure of the dogs to protect against predators loaded together on factor two

Results show that items pertaining to the effectiveness or failure of the dogs load onto separate factors. Failure of the dogs to prevent losses to any predators and failure to prevent losses to large predators loaded together. On the other hand, effectiveness against all predators and against theft loaded together.

4.5.6 Sources of income: Direct cash or in support of livelihood

Respondents were asked how important or unimportant various sources of income were to them, either as a direct source of cash income or in support of their livelihood (own use, not for sale). The responses for the categories of "very important" and "important" were combined for each source of income to obtain the final percentage of respondents identifying the source of income as "important." The sources of income were then divided into three groups: livestock and employment off the farm; wildlife and tourism; agronomy. Finally, the averages of the percentages of respondents identifying the importance of these three categories were looked at to assess the overall importance to respondents of the different sources of income (Figure 4.15).

Cattle as a source of cash income was rated as important by 98.8 % of respondents (n = 82), followed by goats (84.81 %, n = 79) and sheep (75.64 %, n = 78). Sheep were rated as important for own use by 76.06 % of respondents (n = 71), followed by goats (74.7 %, n = 75) and cattle (62.82 %, n = 78). Just over half the respondents (53.25 %, n = 77) rated employment off the farm as an important source of cash income.

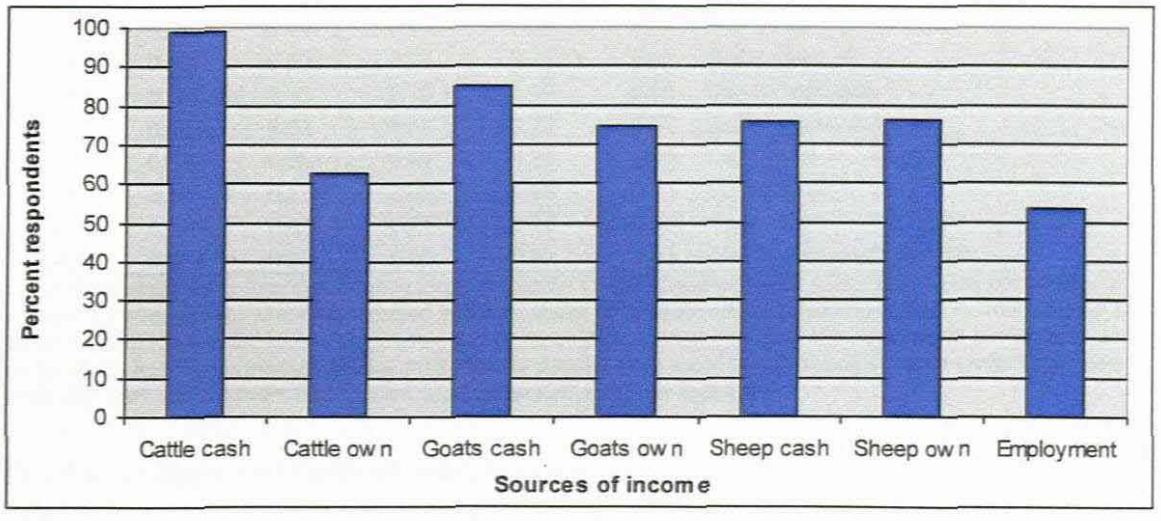

Figure 4.10: Sources of income both cash and in support of livelihoods (own use) derived from livestock and employment off the farm by respondents

A factor analysis was carried out using principal component analysis with Varimax rotation on the sources of income either as direct cash income or in support of livelihood (own use, not for sale). The seventeen items could be reduced to 6 components, confirmed *via* a scree plot. All items loading were above 0.5 and the six factors had Eigenvalues over one explaining approximately 71.27 % of the variance. Results are given in Table 4.17.

Results indicate that items that do not significantly contribute to cash income loaded together, as activities such as tourism and trophy hunting are not typically carried out by emerging farmers.

Items pertaining to income derived from the cultivation of vegetables or crops loaded together, while items pertaining to income derived from small stock and large stock loaded separately. Income from cattle in the form of cash or for own use loaded together with utilisation of game meat. Income derived from employment off the farm loaded separately.

Table 4.17: The relationship between the various variables relating to sources of income both cash and in support of livelihoods (own use) as per the results of a factor analysis

Factors						Items pertaining to sources of income
1	2	3	4	5	6	
0.83	-0.02	-0.17	0.00	-0.04	0.16	Trophy hunting: cash
0.72	0.17	0.22	-0.09	0.11	-0.19	Sale of charcoal: cash
0.67	0.12	-0.29	0.03	0.01	0.34	Tourism: cash
0.67	0.32	-0.22	0.08	-0.03	-0.05	Sale of game: cash
0.62	0.26	0.26	0.24	0.19	-0.10	Game meat: cash
0.22	**0.86**	0.15	0.01	-0.04	-0.07	Vegetable garden: cash
0.22	**0.82**	0.07	0.00	-0.05	-0.03	Crops: cash
0.13	**0.75**	0.18	0.13	0.15	0.02	Vegetable garden: own
-0.09	**0.58**	-0.09	0.52	0.14	0.17	Crops: own
-0.12	0.21	**0.84**	0.09	0.05	-0.18	Sheep: own
-0.08	0.13	**0.83**	0.16	0.11	0.14	Goats: own
-0.10	0.16	0.15	**0.79**	0.18	0.09	Game meat: own
0.25	0.05	-0.03	**0.62**	-0.23	-0.42	Cattle: cash
0.20	-0.08	0.38	**0.60**	0.22	0.03	Cattle: own
0.08	-0.15	0.15	0.02	**0.86**	-0.21	Sheep: cash
0.04	0.27	0.03	0.21	**0.78**	-0.02	Goats: cash
0.09	-0.03	0.00	0.02	-0.22	**0.85**	Employment off farm: cash

Note: Items not contributing significantly to cash income loaded together under factor one; items pertaining to income from vegetables and crops loaded together under factor two; items pertaining to own income derived from small stock loaded under factor three; while items pertaining to income derived from cattle and game meat loaded under factor four; items pertaining to a cash income derived from small stock loaded together under factor five; while one item, employment off the farm, loaded separately under factor six.

Cronbach's alpha and Split-half reliability tests were carried out on the combined questions. The output for alpha suggests that identifying sources of income is in fact internally reliable since the coefficient is 0.773 and the Guttman Split-half reliability coefficient is 0.614, both of which are short of the 0.8 criterion but would be regarded as internally reliable for most purposes.

4.5.7 Livestock sold

Respondents were asked what the average number of livestock was that they sold the previous year. The number of livestock sold was calculated using the mean of each category

(1 - 25 was taken as 12.5 and so on). Respondents (n = 37) reported selling a mean of 11.76 oxen, 31.65 weaner calves (n = 68) and 13.58 cows (n = 57) each (Figure 4.11).

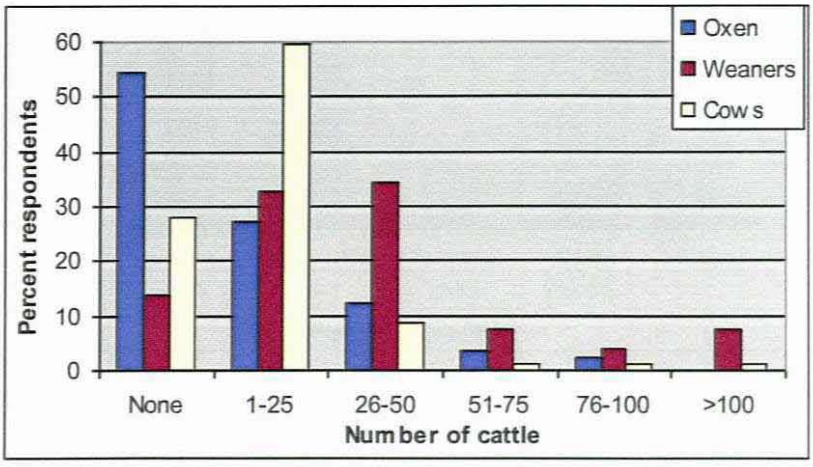

Figure 4.11: The mean number of cattle sold by respondents during 2005

Altogether 59 respondents reported selling a mean of 26.55 goats each, compared to 50 respondents who reported selling and a mean of 19.58 sheep each (Figure 4.12).

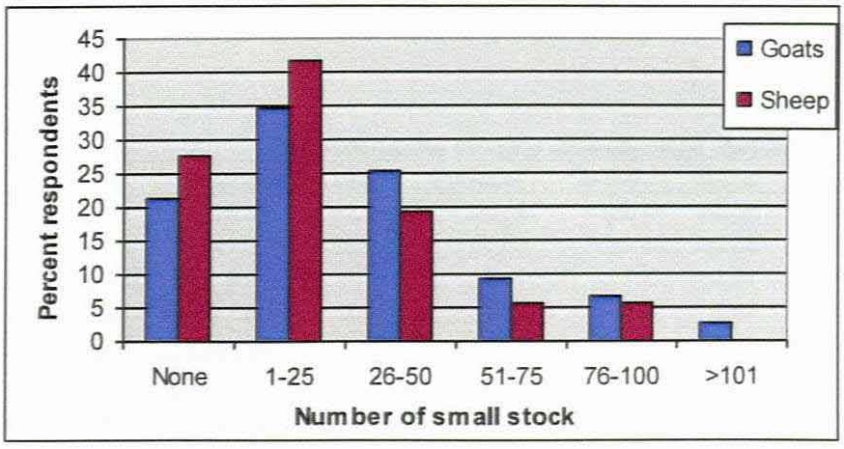

Figure 4.12: The mean number of small stock sold by respondents during 2005

4.5.8 Additional sources of income

In addition, sources of income related to wildlife and tourism were investigated. Altogether 46.75 % (n = 77) of respondents utilised game meat as a source of cash income compared to 71.05 % (n = 76) who utilised game meat for own use (Figure 4.13). Approximately 14.9 % (n = 74) of respondents reported selling live game as an important source of income compared to 10.96 % (n = 73) who said trophy hunting was an important source of income. In addition, 9.72 % (n = 72) of respondents said that tourism was an important source of income.

Figure 4.13: Sources of income both cash and in support of livelihoods (own use) derived by respondents from wildlife and tourism

4.5.9 Game utilisation

Altogether 10 respondents utilised no game at all (n = 79) during 2005. Of the remaining respondents, the majority utilised kudu, followed by warthog (Table 4.18).

Table 4.18: The mean number of the different game species utilised by respondents (%) during 2005

Number of game utilised by respondents	% Respondents utilising different game species							
	Kudu	Warthog	Duiker	Gemsbok	Steenbok	Eland	Other	Hartebeest
None	16.46	39.47	61.84	63.51	72.37	80.00	85.71	91.67
1-10	55.70	47.37	35.53	27.03	21.05	13.33	14.29	5.56
11-20	20.25	9.21	0	8.11	1.32	2.67	0	1.39
21-30	3.80	2.63	2.63	1.35	5.26	2.67	0	1.39
>30	3.80	1.32	0	0	0	1.33	0	0

4.5.10 Sources of income derived from crops, vegetables and charcoal

Utilising a vegetable garden for own use was rated as important by 54.7 % (n = 75) of respondents, followed by crops for own use (40.54 %, n = 74) (Figure 4.14). Altogether 37.7 % (n = 77) of respondents rated produce from their vegetable gardens as an important source of cash income followed by 28.95 % (n = 76) who viewed crops as an important source of cash income. Approximately 23.7 % (n = 76) of respondents viewed charcoal production as an important source of cash income.

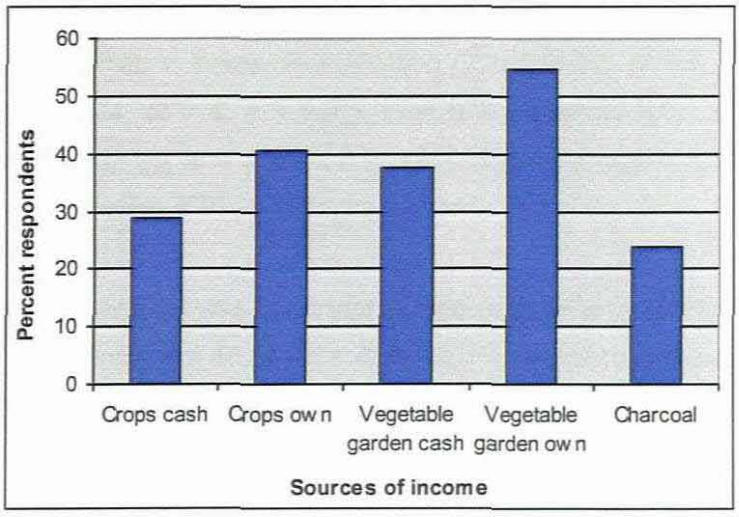

Figure 4.14: Sources of income both cash and in support of livelihoods (own use) derived by respondents from agronomy

When the averages of the number of respondents in the different groups were combined (Figure 4.15), livestock production was viewed as important by 78.8 % of respondents, followed by employment off the farm (53.25 %), agronomy (37.1 %) and lastly, wildlife and tourism (30.67 %).

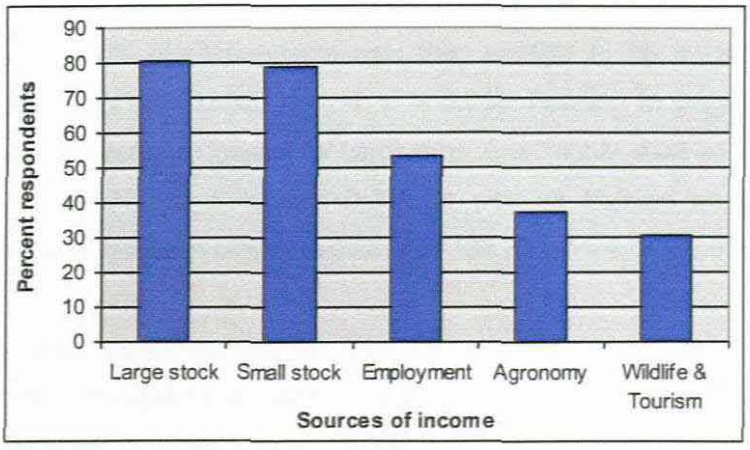

Figure 4.15: The value of the different sources of income (cash and own use combined) in order of importance. These were obtained by combining the percentages of respondents in the different income categories

4.6 Training needs of emerging commercial farmers in relation to human-carnivore conflict

4.6.1 Value of training topics

Respondents were asked how important they thought various training topics were. In all cases, the vast majority of respondents were highly in favour of the training topics they were

asked about and felt that each of the topics offered were important. Over 90 % of respondents viewed training in livestock production (χ^2 = 254.22, *df* = 4, *p* = 0.01), financial management (χ^2 = 194.74, *df* = 4, *p* = 0.01), livestock marketing (χ^2 = 146.42, *df* = 4, *p* = 0.01), mechanics (χ^2 = 126.05, *df* = 4, *p* = 0.01) and sustainable wildlife utilisation (χ^2 = 91.28, *df* = 4, *p* = 0.01) as important.

Over 80 % of respondents felt it was important to receive training in livestock management to reduce losses to carnivores (χ^2 = 13.12, *df* = 4, *p* = 0.01), identify carnivores (χ^2 = 93.75, *df* = 4, *p* = 0.01), learn how carnivores live and behave (χ^2 = 70.3, *df* = 4, *p* = 0.01) and produce crops (χ^2 = 70.07, *df* = 4, *p* = 0.01).

4.6.2 Assistance required by respondents in relation to carnivore problems

Results showed that all the responses to the kind of help respondents felt they needed with carnivore problems were found to be statistically significant. When asked if they felt an insurance scheme should be developed, 84.1 % agreed (χ^2 = 72.02, *df* = 4, *p* = 0.01), while 70.7 % of respondents felt there should be a compensation scheme that pays for livestock loss to carnivores (χ^2 = 43.36, *df* = 4, *p* = 0.01). Approximately 70.7 % of respondents wanted someone else to remove the carnivore when they experienced a problem (χ^2 = 36.78, *df* = 4, *p* = 0.01), but over 90 % of respondents said they wanted to be taught how to remove carnivores themselves (χ^2 = 103.85, *df* = 4, *p* = 0.01). Training in livestock management techniques to reduce livestock losses to carnivores was highly desired by over 90 % of respondents (χ^2 = 154.37, *df* = 4, *p* = 0.01) as well as training on general livestock management to reduce losses to other causes (χ^2 = 138.32, *df* = 4, *p* = 0.01).

A factor analysis was carried out on the kind of help respondents felt they needed with carnivore problems. Principal component analysis with Varimax rotation was used in the factor analysis. Three underlying factors with Eigenvalues over one were identified among the six items explaining 69.15 % of the variance. Results are given in Table 4.19

Table 4.19: The relationships between the various variables relating to the kind of help respondents felt they needed with carnivore problems as per the results of a factor analysis

Factors			Items pertaining to the kind of help respondents felt they needed with carnivore problems
1	2	3	
0.87	0.14	-0.12	Want to learn how to remove carnivores if a problem.
0.47	-0.02	0.21	Interested in a livestock insurance scheme.
-0.07	**0.91**	0.03	Training on livestock management to reduce losses to other causes.
0.56	**0.71**	0.07	Training on livestock management to reduce losses to carnivores.
-0.09	0.17	**0.87**	Interested in a compensation scheme to pay for livestock losses.
0.44	-0.15	**0.64**	Want someone else to remove carnivore if a problem.

Note: Items pertaining to wanting to learn to remove the carnivore themselves and interest in an insurance scheme loaded together on factor one; items pertaining to wanting training in livestock management loaded together on factor two; items pertaining to wanting someone else to solve carnivore problems loaded together on factor three.

Results indicate that items pertaining to learning how to remove carnivores if a problem occurs, load together with interest in an insurance scheme. The interest in a livestock insurance scheme item loaded below 0.5, but loaded more strongly on the first factor than any other factor and was therefore considered in the analysis. Items pertaining to training in livestock management loaded together, while items indicating someone else should solve the problem loaded together in the form of a compensation scheme and someone else removing carnivores when they caused problems.

These responses show that there are three distinct schools of thought regarding carnivore problems: that of "it is someone else's responsibility", as opposed to "it is my own responsibility", and that training is desired to reduce losses. Results indicate that farmers would be receptive to training related to teaching them to solve carnivore problems given that over 90 % of farmers responded positively with reference to this type of training.

4.6.3 Training format and duration

Questions on the importance of different training methods (formats) all yielded statistically significant results. Overall, farmer information days (training is provided by various experts during one day sessions) were seen to be the most important method of receiving training with 95.2 % of respondents in favour of this method ($\chi^2 = 12.29$, $df = 4$, $p = 0.01$), followed by training courses (92.7 %) ($\chi^2 = 14.34$, $df = 4$, $p = 0.01$). About 89 % of respondents felt that study groups were an important method of training ($\chi^2 = 100.56$, $df = 4$, $p = 0.01$) and 81.7 % of respondents felt mentorship was an important method ($\chi^2 = 78.12$, $df = 4$, $p = 0.01$). Receiving training manuals which respondents could read and learn from themselves was also considered important by 79.3 % of respondents ($\chi^2 = 63.49$, $df = 4$, $p = 0.01$).

4.6.4 The associations between constructs relating to training needs

4.6.4.1 All training needs in relation to human-carnivore conflict

The training needs of the respondents in relation to human carnivore conflict were investigated using ordinary least square regression. In order to investigate this association it was hypothesised that the desire for training would increase with increasing carnivore conflict problems. Independent variables of how big a problem farmers said carnivores were (on a scale of 1 - 5, ranging from no problem to a very big problem), own responsibility, all carnivores removed, livestock loss to carnivores, livestock loss to disease, and whether farmers were members of a farmer's association or not were measured. The independent variable of own responsibility was measured combining questions relating to farmers wanting to learn how to solve carnivore problems themselves (Table 4.19).

The dependent variable of all training needs was obtained by combining all topics on training relating to general management such as production systems; training relating to carnivores such as identification, behaviour, management to reduce losses to carnivores; and additional management such as mechanics and financial management. The dependent variable was not normally distributed so the cube root was taken to transform and normalise the variable.

Prior to running the models, the variables were assessed for correlations using Spearman's ρ (Table 4.20). All training topics showed a modest positive correlation to the variable of own responsibility (Spearman's ρ: 0.512, $p = 0.01$) (Table 4.20). Thus, respondents who desired training in all topics were more likely to feel that resolving carnivore conflict was their own responsibility. The length of time respondents were resident on their farm correlated positively and weakly with whether they thought carnivores were a big or small problem (Spearman's ρ: 0.226, $p = 0.045$). The longer respondents were resident on their farm, the more inclined they were to say carnivores were a problem. The length of time respondents were on the farm correlated negatively with the variable own responsibility (Spearman's ρ: -0.317, $p = 0.004$). Thus, the longer respondents were resident on their farms, the less inclined they were to think resolving carnivore problems was their own responsibility. Whether respondents thought carnivores were a big or small problem, correlated negatively to carnivores being identified as the most serious cause of livestock loss. Livestock loss to carnivores was coded in the reverse direction as a ranking variable, so that if this was the most important cause of livestock loss, the rank was equal to one (whereas less important causes were ranked two to six). Therefore, the negative association indicates that respondents who rated carnivores as the most serious cause of livestock loss also likely to feel that carnivores were a bigger problem.

Table 4.20. All training needs in relation to carnivore conflict as per the results of a Spearman's ρ . The dependent variable of all training needs was obtained by combining all topics on training relating to general management such as production systems; training relating to carnivores such as identification, behaviour, management to reduce losses to carnivores; and additional management such as mechanics and financial management

		1		2	3		4	5		6	7	8	9
1	All training needs (Cuberoot)												
2	Home language	0.076 0.500											
3	Time on farm	-0.075 0.511		0.132 0.245									
4	Farm size (thousand hectares)	0.085 0.447		-0.061 0.585	0.075 0.509								
5	Big/small problem	0.076 0.500		-0.098 0.381	0.226 0.045	(*)	0.120 0.282						
6	Own responsibility	0.512 0.000	(**)	0.021 0.853	-0.317 0.004	(**)	0.068 0.545	0.042 0.711					
7	All carnivores removed	-0.084 0.451		-0.069 0.536	0.135 0.004		0.046 0.684	0.116 0.300		0.056 0.619			
8	Livestock lost to carnivores	0.101 0.394		0.104 0.379	0.045 0.706		-0.048 0.682	-0.274 0.018	(*)	-0.065 0.582	-0.135 0.252		
9	Livestock lost to disease	-0.218 0.057		0.082 0.479	-0.016 0.894		0.059 0.611	0.036 0.755		0.010 0.933	0.086 0.456	-0.145 0.225	
10	Farmers Association	0.054 0.635		0.083 0.467	0.027 0.820		0.105 0.359	0.000 1.000		-0.052 0.649	0.004 0.972	-0.003 0.982	-0.049 0.681

Note: * P ≤ 0.05, ** P ≤ 0.01

Two models were run to assess the association between all training needs and human-carnivore conflict. The first model included only the control variables (Model controls, Table 4.21). This model explained 1 % of the variance, and none of the coefficients was statistically significant. The second model (Model all training needs, Table 4.21) included the control variables of home language, time on farm and size of farm, as well as the other independent variables against the dependent variable of all training needs. This model explained 36.5 % of the variance and the regression equation was statistically significant (F = 3.705, p = 0.001).

This model showed that own responsibility (t = 4.080, p = 0.01) was positively and significantly associated with training needs. Thus, respondents who assumed responsibility for addressing the carnivore issue on their farm strongly desired training. All carnivores removed (t = -2.093, p = 0.041) showed a negative significant association to training needs, so that farmers who removed fewer carnivores felt they wanted more training. This could be because they did not know how to remove carnivores or did not desire to remove them. The number of livestock loss to disease (t = -2.687, p = 0.009) was negatively associated to training needs. Livestock loss to disease was coded in the reverse direction as a ranking variable, meaning that if this was the most important cause of livestock loss, the rank was equal to one (whereas less important causes were ranked two to six). Therefore, the negative association indicates that respondents who rated disease as the most important cause of livestock loss felt they wanted more training.

Table 4.21: All training needs in relation to carnivore conflict as per the results of ordinary least square regression analysis. The dependent variable of all training needs was obtained by combining all topics on training relating to general farm management and management to reduce losses to carnivores. Standard error (*S.E.*) and significance (Sig) are indicated

	All training needs			
	Model controls		Model all training needs	
Variables	Beta Coefficient	Sig	Beta Coefficient	Sig
Constant	90.706		17.767	
(S.E.)	*11.819*		*23.343*	
Home Language	1.420		1.794	
	2.326		*1.923*	
Time on Farm	-.431		0.099	
	.638		*0.550*	
Farm size (1000 ha)	-.006		1.221	
	1.328		*1.034*	
Big/small problem			1.979	
			2.435	
Own responsibility			15.599	***
			3.823	
All carnivores removed			-0.595	*
			0.284	
Livestock loss to carnivores			1.499	
			1.375	
Livestock loss to disease			-4.407	**
			1.640	
Farmers association			1.797	
			4.602	
R-square	0.010		0.365	
F (P-value)	0.285 0.863		3.705 0.001	
n	78		67	

two-tailed t-tests: † P ≤ 0.100, * P ≤ 0.050, ** P ≤ 0.01, *** P ≤ 0.001

4.7 Organisational support

Respondents were asked if they knew of any organisations that assisted farmers specifically with carnivore problems. Altogether 45 (57 %) of respondents (n = 79) said they did not know of any organisation that assisted farmers specifically with carnivore problems, while 8 (10.1 %) said the Ministry of Environment and Tourism (MET) provided assistance. A further 21 (26.6 %) identified the Cheetah Conservation Fund, while 5 (6.3 %) respondents identified various other organisations. When asked if any organisation had assisted them with a carnivore problem, 77 (97.5 %) respondents said they had never been assisted.

Farmers' associations, and the Ministry of Agriculture Water and Forestry (MAWF) (Directorates Veterinary and Agriculture extension services) are important support structures (Figure 4.16). However, as veterinary services monitor vaccination protocols on farms,

participation is not voluntary, as is the case for farmer associations in which just over half of the respondents were members.

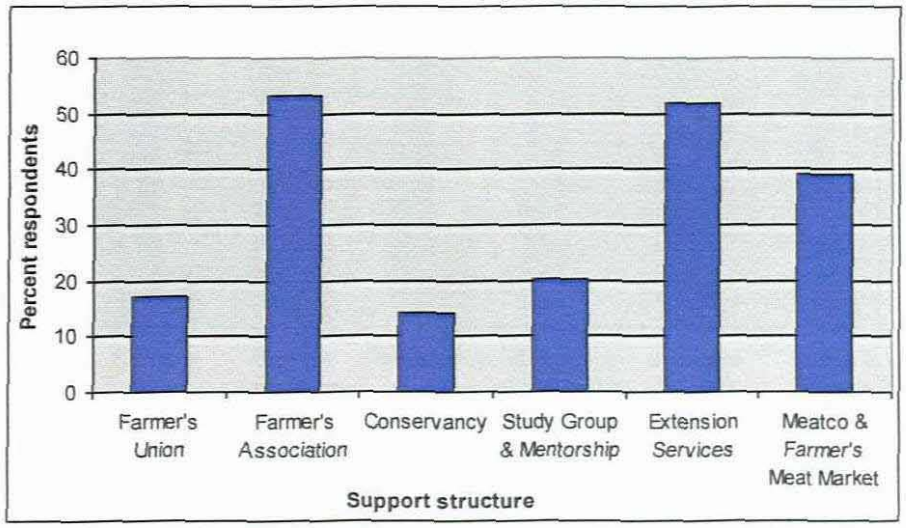

Figure 4.16: Level of participation in organisational support structures by farmers

Investigation into whether the respondents were satisfied or not with the level of service provided by these organisational support structures revealed that overall farmers who did use support structures, appeared to be very satisfied with the level of service provided (Figure 4.17). In the case of the agricultural unions, 62.5 % (n = 10) of respondents (n = 16) were satisfied with the service provided by the National Namibia Farmer's Union (NNFU), compared to 88.89 % (n = 8) of respondents (n = 9) satisfied with the service provided by the Namibian Agricultural Union (NAU). No farmers expressed dissatisfaction with the service provided by the NAU, as opposed to 25 % (n = 4) of respondents (n = 16) who were dissatisfied with the service provided by the NNFU. Altogether 83.87 % (n = 52) of respondents (n = 62) were satisfied with the service provided by the veterinary extension services, while over 70 % of respondents; were satisfied with the service provided by MET extension services (n = 18) and MAWF extension services (n = 39). Relatively few farmers were dissatisfied with the service provided by MET and MAWF extension services. Only 1.61 % (n = 1) of respondents (n = 62) were dissatisfied with the service received by the veterinary extension services.

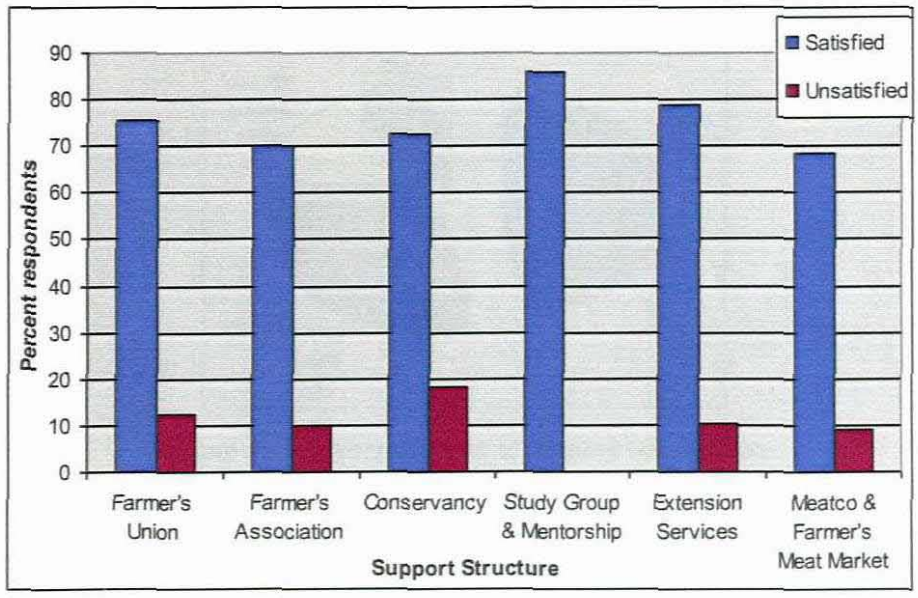

Figure 4.17: The level of satisfaction expressed by respondents with the service provided by organisational support structures (2006)

4.8 Sources of farming information

When respondents were asked if they subscribed to, or regularly bought a selection of magazines, 34 (42 %) respondents said they read *Agriforum* (Namibia's premier agricultural magazine published by the NAU), of which 97 % agreed they were satisfied with the content of the magazine.

Altogether 47 (53.7 %) respondents said they read *Landbou Weekblad* (South African Agricultural magazine sold in Namibia) and all unanimously agreed that they were satisfied with the content. Altogether 35 (43.8 %) respondents said they read *Farmer's Weekly* and of these 97.1 % agreed they were satisfied with the content.

Results depicted in Figure 4.18 show that the radio remains the most important media-related source of farming information, followed by printed media (newspaper, magazines), with television being the least important source of farming information.

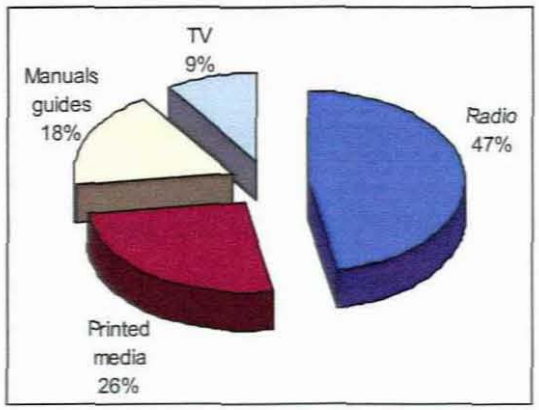

Figure 4.18: Media sources of farming information in order of importance as identified by respondents

Concerning training-related sources of farming information, respondents identified specific training (study groups, training courses, mentorship) as the most important source of farming information, followed by events (shows, information days) and government extension services (Figure 4.19).

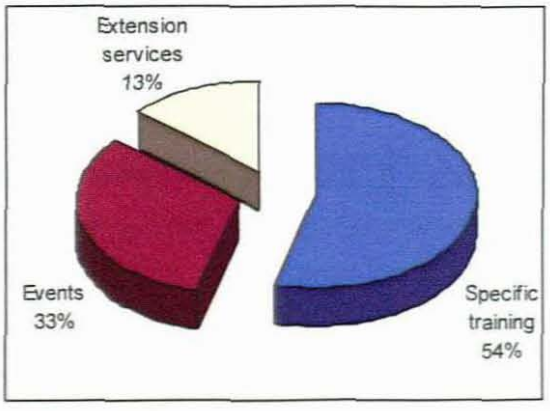

Figure 4.19: Training sources of farming information in order of importance as identified by respondents

4.9 Preferred language of respondents for receiving information

Results show that the majority of respondents would prefer to receive information in English (63 %), followed by Afrikaans (32.1 %). Two respondents wanted to receive information in Owambo and Herero respectively.

CHAPTER FIVE: DISCUSSION

5.1 Attitudes and perceptions of emerging commercial farmers towards carnivores

The attitudes and perceptions expressed by farmers in this study are similar to those found in studies of farming communities elsewhere (Conover, 1994; Dickman, 2005; Fox & Papouchis; Frank *et al.*, 2005). What was encouraging, however, is that despite relatively high levels of conflict, positive attitudes existed and a willingness to learn more about possible solutions was repeatedly expressed.

However, a large percentage of farmers (32.1 %) still believed the only way to solve carnivore conflict was to remove all carnivores off farmland. The challenge lies in changing the mindset of these farmers. Combining general knowledge training with management training is a potentially effective approach as people who are more knowledgeable about carnivores tend to be more tolerant (Caro *et al.*, 2003; Treves & Karanth, 2003). As this study showed, farmers who understood that carnivores had an ecological role to play on their farm were less likely to want all carnivores removed from their farms and more likely to agree that they liked having carnivores on their farms (Table 4.3).

Roughly half of the farmers considered the sight of a carnivore track (56.1 %) or the carnivore itself (54.9 %) a problem, regardless of the occurrence of livestock loss. Just under half the participants (40.3 %) would take action when game was killed by a carnivore on their farm, this although few farmers utilised game. This is cause for concern because there was a strong correlation to action being taken in these cases, demonstrating the strong perception of a problem before one actually occurred in the form of, for example livestock loss (Table 4.4).

5.2 Factors relating to human-carnivore conflict

Various factors influence the level of human-carnivore conflict, of which livestock loss, herd size, trend in carnivore numbers and attitude towards carnivores were investigated in detail.

5.2.1 Extent of carnivore problem and most serious cause of livestock loss

As was found in this study and reflecting a world-wide trend (Conover, 1994; Woodroffe & Ginsberg, 1998; Hemson, 2001; Sillero-Zubiri & Laurenson, 2001), an increase in human-carnivore conflict occurred with an increase in livestock loss. Farmers who identified loss to

carnivores as the most serious cause of livestock loss (Figure 4.2) also tended to say carnivores were a bigger problem.

The larger the farm, the more inclined the owners were to report an increase in carnivore numbers over time. In addition, increased livestock losses were associated with this increase in carnivore numbers. Farmers with larger farms and therefore larger herd sizes experienced proportionately more losses. This result differed from the results of a study on commercial farmers in Namibia where the total number of livestock owned showed no relation to livestock loss (Marker, *et al.*, 1996). Other studies in east Africa found that farmers with larger herds were more able to absorb the economic loss caused by livestock loss to carnivores, and therefore, were less inclined to have a negative attitude towards carnivores (Dickman, 2005; Thirgood *et al.*, 2005). However, in this study there was a strong correlation between larger herd sizes and increasing losses to carnivores, both of which correlated strongly to an increase in negative attitudes. In turn negative attitudes were significantly associated with the length of time the farmers were on the farm (Table 4.14). This is cause for concern, because rather than coming to terms with carnivores and solving problems over time as farmers become established and herds size increases, farmers perceived carnivores as a greater problem.

5.2.2 The impact of livestock losses in relation to herd size

Looking specifically at type of livestock, showed that the impact of carnivores on cattle losses was not significant and in fact conflict was more likely to be tied to attitudes towards and increases in carnivore numbers. This is unexpected given that most AALS farmers are weaner-calf producers (Vigne & Motinga, 2005) and cow-calf operators typically experience more problems than ox-producers, given the vulnerability of calves to predation.

Farmers reported losing on average 4.8 cattle and 5 calves to carnivores during the previous year (2005). In a study of Namibian commercial farmers 85 % reported losing more than one calf and 10 % had losses greater than 10 animals, with an annual mean of 4.3 cattle (no distinction between cattle and calves) lost to cheetah, and 4.4 lost to other predators (Marker *et al.*, 1996). In the same study commercial farmers reported a mean cattle herd size of 800, compared to 150 for emerging commercial farmers in this study. What is important is that although the actual numbers lost are similar, the average herd size differs dramatically between commercial farmers and emerging commercial farmers.

Thus, the proportion of cattle lost by emerging farmers is much higher than the average losses reported by commercial farmers, yet this is not reflected in negative attitudes or levels

of conflict in relation to cattle lost by emerging commercial farmers. This apparent lack of animosity could potentially change as emerging farmers invest more in cattle production and move away from their dependence on small stock as a source of cash income. The great variation in herd size can be related to the farm size of commercial farmers versus that of emerging commercial farmers. In the study of commercial farmers (Marker *et al.*,1996), 61 % farmers reported farm sizes greater than 7 000 hectares, and 13 % reported farm sizes greater than 15 000 hectares. The average farm size of farms in this study was 4 600 hectares, slightly smaller than Vigne and Motinga (2005) reported, mainly because resettled farms (as small as 300 hectares) were included in this study.

In the relationship between small stock loss and conflict, it would appear that although sheep loss to carnivores remained a strong predictor of conflict, herd size and sheep as a source of income were not significant. On the other hand, goat losses to carnivores were a strong predictor of human-carnivore conflict, particularly when farmers regarded goats as an important source of cash income (Table 4.14). These farmers were also more likely to perceive carnivores as a bigger problem. As has been shown in other studies, farmers with smaller herd sizes (large and or small stock herds) tended to regard carnivores as a greater problem (Dickman, 2005). This is understandable in that farmers with smaller herds are less able to absorb the economic impact of livestock loss (Oli *et al.*, 1994; Thirgood *et al.*, 2005). Given that carnivores have a relatively high impact on goat losses as found in this study, a similar trend would be expected with farmers with smaller herds being less able to absorb the impacts of predation.

In comparison of these losses to those experienced by established commercial farmers, emerging farmers lost an average of 9.6 goats and 8.8 sheep to carnivores over the previous year (2005), while established commercial farmers lost an average of 5.2 small stock per year to cheetah and 6.5 to other predators (Marker *et al.* 1996). As is the case for large stock, the mean small stock herd size between commercial farmers and emerging farmers differed considerably. Commercial farmers had a mean small stock herd size of 597 (Marker *et al.*, 1996), compared to 204 for emerging commercial farmers, thus, the emerging farmers were losing proportionately more small stock to carnivores than their commercial counterparts.

Goats are an important source of cash flow to AALS farmers, in addition to which AALS farmers tend to start off mainly with goat production, reflecting the pre-eminence of goats in the communal areas (Vigne & Motinga, 2005). This would account for the high negative attitude towards any goat loss.

These results are significant for carnivore conservation NGOs in that training undertaken by CCF (the only carnivore conservation NGO conducting structured farmer training courses) is focused on cattle production systems. This stems from the fact that commercial farmers regard predation on calves as a greater economic loss than predation on small stock (Marker *et al.*, 1996). However, in the case of emerging commercial farmers, the most significant source of human-carnivore conflict would appear to be related to small stock. This indicates that the training approach should be broadened to include goat production, with particular emphasis on mitigating losses to carnivores. However, continued training on cattle production would help shift the emphasis from the reliance on small stock production as a source of cash income to a more diverse farming approach and faster profit gain from cattle production.

5.2.3 Livestock losses versus carnivore removals

When the relationship between livestock loss and carnivore removals was examined more closely, it became evident that an increase in livestock loss to carnivores correlated to an increase in carnivore removals. In taking these figures into account, one must bare in mind that although farmers attributed certain losses to carnivores, they also lacked general knowledge concerning carnivore identification through killing patterns and tracks (Schumann & Fabiano, 2006).

The discrepancy between actual loss and perceived loss can distort real loss figures. Nonetheless, farmers who perceived more losses to carnivores also removed more carnivores. This perception needs to be changed through training that enables (and encourages) farmers to accurately verify the cause of livestock loss. Despite the high level of uncertainty regarding the actual cause of livestock loss, many farmers reported using a variety of techniques (Figure 4.9) to remove carnivores from their farms. These removal techniques are regarded mostly indiscriminate, resulting in the unnecessary killing of non-target species as well as individuals of the species being targeted (Marker *et al.* 1996). Although Schumann (2006) reported a high rate of non-response in relation to some removal techniques, this problem was not experienced in this study. Just over half of emerging commercial farmers (56 %) are so-called full-time farmers (Vigne & Motinga, 2005), it is thus imperative that training to verify the causes of livestock losses include other farm staff such as farm workers, as they are often responsible for verifying kills.

Certain carnivore species' numbers showed a reported increase, particularly in the case of jackal, cheetah and caracal (Table 4.5). This was mirrored by an increase in reported losses and carnivore removals. One should therefore not conclude too quickly that livestock loss to

carnivores reported by farmers is based merely on their perceptions. If the number of carnivores is indeed increasing, it is likely that farmers are also experiencing higher losses.

Goat losses to carnivores proved an important indicator of conflict, and higher goat losses were associated with higher carnivore removals. The same could not be said for sheep: here a negative correlation was found between sheep loss to carnivores and carnivore removals. This association is counterintuitive and could not be explained despite investigating several possible causes (see Results Section 4.4.9.1).

Overall carnivore removals were relatively low, but closer examination of a subset of the data, looking specifically at the number of respondents removing carnivores (Table 4.5) showed that a few farmers have the potential to remove relatively high numbers of carnivores. This becomes an issue, particularly when considering carnivores with large home range requirements such as cheetah and wild dog because a few landowners can have a high impact on a population of carnivores over a large area. Carnivore removal in response to livestock loss seldom solves the problem in the long term and in fact can often exacerbate conflict (Landa *et al.*, 1999; Beckoff, 2001; Stahl *et al.*, 2001). In contrast, livestock management practices, when applied correctly, have been shown to reduce livestock loss (Ogada *et al.*, 2003). Training in livestock management techniques that can help to reduce livestock loss is thus imperative and needs to be tied to factors to improve productivity. In this way, training addresses two key components to ensure the economic stability of emerging commercial farmers.

5.3 Livestock management and sources of income

Evaluating the production systems farmers were applying provided valuable insights into the level and type of management techniques that were used, and how these related to livestock loss and thus conflict. With the exception of one farmer in the Rehoboth area, all the farmers farmed cattle because the majority of the farmers surveyed were situated in the north-central commercial cattle farming sector of Namibia (Figure 2.1). Also, almost half of the farmers (47.6 %) were Herero speaking, people who have a strong cultural and historical affinity with cattle. In addition, a large percentage of farmers also farmed goats and/or sheep (Figure 4.3).

5.3.1 Cattle management

Livestock management techniques were divided into two broad categories. The first category included techniques that could have an effect on loss to carnivores, such as kraaling calves,

increased patrols and using donkeys during calving seasons. The second category included factors affecting production more directly, such as fertility and disease testing of bulls.

Examining the first category revealed that the majority of farmers were applying measures that could help protect calves from predation (Figure 4.6). With the exception of using donkeys and calving seasons, more than 70 % of farmers used four methods effective in helping to reduce predation: kraaling calves, maternity camps, calving close to home and increased patrols (Figure 4.6). Based on these results one would expect losses to cattle to be relatively low. However, almost half the farmers (51.28 %) reported losing at least 5 calves to carnivores the previous year.

In addition, no statistically significant difference was found between the level of livestock lost by farmers using livestock management practices that could help reduce losses, and those not using these practices. As livestock management techniques have been shown to be effective in reducing losses elsewhere (Marker *et al.*, 1996; Ogada *et al.*, 2003; Breitenmoser *et al.*, 2005), several reasons could account for the lack of variation of losses between the two groups. These include the relatively small sample sizes when examining the spread of the application of techniques within this study group and the actual methodology used by the farmer when applying a particular technique.

As has been shown in previous studies, how a technique is applied is critical to its effectiveness (Ogada *et al.*, 2003; Schumann & Schroeder, 2004; Dickman, 2005; Schumann, 2006). In this study the details of the application of the methods were not examined nor were the circumstances surrounding the losses (e.g. loss in the veld versus loss in the kraal). In the case of kraaling of calves, for example, factors such as the kraal design, proximity to houses, at what point calves are put in the kraal (born in kraal or born in the veld and then brought in) or how long they are kept there before going to veld were not examined. Yet all of these play a role in the number of calves lost when farmers implement the kraaling of calves to prevent loss to carnivores. With regards to the use of donkeys to protect calving herds, many farmers said they had heard about the technique but had no idea how to apply it. As with the kraaling of calves, various factors affect the success of this technique such as the number of donkeys in relation to cattle herd size, camp size, bush density and the sex of the donkey.

Examining management techniques affecting productivity (second category) showed that two important techniques, namely testing bulls for fertility and disease were applied by just over half (56.80 %) the respondents (Figure 4.7). In both cases not having enough information was cited as the most common reason for not applying the technique. Failure to produce on

the part of a bull or the introduction of venereal diseases by an untested bull can have devastating consequences. The results would only be seen nine months later when cows fail to calve, by which time an entire season's production would be lost and would require almost two years to recoup. Given the consequences of not implementing these techniques, it is imperative that every effort is made to encourage emerging commercial farmers to start adopting these practices.

Although the average calving percentage was above the national average of 52 %, it was still relatively low at 59 %. This alone is cause for concern as it represents a huge financial loss since cows are consuming resources, but not producing a marketable calf each year. This indicates an urgent need for improvement in the factors affecting production, and much work remains to be done to encourage farmers to implement certain basic accepted practices, such as ensuring that bulls are fertile and disease-free and that cows conceive and produce a calf annually. As poverty/wealth has been shown to affect the ability of farmers to withstand the economic effects of depredation and their attitudes towards carnivores (Cozza *et al.*, 1996; Sillero-Zubiri & Laurenson, 2001; Dickman, 2005), the economic impact suffered by low productivity of herds must also be considered when addressing the impact of human-carnivore conflict in the case of emerging commercial farmers.

The need for training and information dissemination was highlighted by the fact that not having enough information on many of the farm management techniques was the reason most often cited by farmers for not using them. Over 80 % (86.4 %) of respondents agreed that they could reduce livestock loss by adjusting their livestock management, and almost half the farmers (48 %) agreed that carnivores had an ecological role to play. In addition, farmers demonstrated a great desire to acquire training on how to adjust their livestock management to reduce losses to carnivores and other causes. This shows that there is considerable scope for conservation efforts through training to improve livestock management, and furthermore farmers have indicated that they are willing to take this avenue. In this way carnivore conflict could potentially be mitigated through non-lethal measures in livestock management. Attention must be paid to the details of how the management systems are implemented, as is demonstrated by the use of livestock guarding dogs.

5.3.2 Small stock management

At first glance, small stock management looked positive based on the fact that herders (66.20 %) and dogs (72.4 %) were employed in over 60 % of cases, and small stock was almost always kraaled at night (Figure 4.8). However, when factors causing conflict were

analysed, it appeared that small stock losses, in particular goats, to carnivores were strongly correlated with carnivore removals and were linked to negative attitudes. This is understandable given that the impact of losses to carnivores in relation to herd size was relatively high in this study. In addition AALS farmers rely on goats as a source of cash income while establishing themselves (Vigne & Motinga, 2005).

One of the techniques examined closely to help understand how the implementation of a management technique can affect its success was the use of livestock guarding dogs (LSGDs). The fact that just over 30 % of respondents (31.6 %) reported that their dogs were effective against all predators indicated that although certain practices such as using LSGDs were implemented, they were not working as well as could be. While dog size and behaviour were not investigated in this study, previous studies have shown that often the size of the dog is inadequate and guarding behaviour is not necessarily a selection criterion (Marker *et al.*, 1996). Thus, while some dogs may exhibit protective and guarding behaviour towards their livestock, they may be too small to repel large predators. In other cases, dogs simply fail to exhibit guarding behaviour even though they may be big enough to repel a predator.

The need for training on the correct application of certain livestock management practices such as the use of LSGDs was further supported by the fact that over 50 % of farmers who did not use dogs cited that they did not know how to train them as the main reason for not using this management technique (Figure 4.9).

This conclusion highlights the need for NGOs involved in training to focus more attention on small stock losses and ways to prevent them in order to reduce human-carnivore conflict.

5.3.3 Diversification to provide additional benefits from wildlife

Relatively few emerging commercial farmers derived benefits from tourism (7.27 %), trophy hunting (10.96) or the use of game as a source of income (46.75 % (Figure 4.13). Wildlife was however used for own consumption by the majority of farmers (71.05 %). Farmers expressed a desire to learn how to become involved in commercial utilisation. One of the ways to do so would be through the conservancy structure which provides possibilities for joint ventures with neighbours. However, few of the farmers (14.3 %) were members of conservancies or knew anything about the structure or functioning of conservancies.

5.4 Training needs of emerging commercial farmers in relation to human-carnivore conflict

Farmers who desired training also felt that resolving human-carnivore conflict was their own responsibility. This is not entirely unexpected as farmers making the considerable effort to attend a one week training course where the majority of farmers were surveyed, would be expected to be more inclined to take the initiative in their farming operation.

However, what was cause for concern is that the longer farmers were on the farm, the more inclined they were to say carnivores were a problem and the less they saw solving carnivore problems as their own responsibility. This could be age-related in that older farmers may be more inclined to be less accepting of innovative ideas as has been found in other studies (Hill, 1998; Naughton-Treves *et al.*, 2003). However Vigne and Motinga (2005) did not consider age to be a factor influencing the adoption of innovations amongst AALS farmers. Elsewhere in this study, an increase in farm size, herd size and increase in carnivore numbers were associated with higher losses, more negative attitudes and more conflict (Table 4.14). This may explain why farmers who are on the farm longer, and thus more established with likely larger herds, were more inclined to be negative towards carnivores. Over time, emerging commercial farmers are not coming to terms with carnivores on their land. The increasing numbers of emerging farmers and the potential for a considerable increase in human-carnivore conflict in this farming sector over time is cause for concern: NGOs clearly need to address human-carnivore conflict issues in this target group.

5.4.1 Addressing the farming training needs of emerging commercial farmers to improve production and mitigate human-carnivore conflict

From the above mentioned results, it is clear that farmers highly desired training in all aspects of farming, including production systems, solving carnivore problems and the sustainable use of wildlife that were offered to them during the survey. This was not surprising, given that few emerging commercial farmers have any formal agricultural training (Vigne & Motinga, 2005).

Farmers still tended to regard carnivores as someone else's responsibility in that MET was held largely responsible for solving carnivore problems, and compensation was seen as a viable solution. However, there was also a strong tendency to want training in order to be able to solve problems themselves by not only removing the carnivore, but also to reduce losses to carnivores through livestock management. A strong association was found between farmers wanting training and those who felt that resolving carnivore issues were their own

responsibility. This indicates a change from the traditional mindset of "it is the government's problem," fostered by the fact that historically formerly disadvantaged Namibians in communal farmland had no utilisation rights over wildlife and typically called on government officials to solve problems with wildlife (Esterhuizen, 2004). Thus it is likely that empowering farmers to help themselves on freehold farmland through providing training is a viable option as many farmers (53 %) have already come to the conclusion that the responsibility for solving carnivore issues lies with themselves.

There was a strong demand for training in specific farming topics such as training in livestock production, financial management and marketing, as would be expected. In addition, farmers expressed a strong interest in topics related to learning about predator ecology and behaviour, as well as track and kill identification. Many emerging commercial farmers said they did not know predators could be differentiated by their tracks and killing techniques (Schumann & Fabiano, 2006). A general lack of knowledge regarding carnivore behaviour, ecology and the value of carnivores seems prevalent and was also experienced during training of emerging commercial farmers at CCF on these topics (Schumann & Fabiano, 2006).

While farmers were strongly in favour of farmer information days as a training option, the majority of farmers (54.3 %) were willing to spend up to five days on a training course. This may have been influenced by the fact that many farmers were on a five day course when surveyed, although surveying took place the night of arrival. Many farmers said that although it was difficult being away from the farm or getting leave from work for that period of time, a longer course during which they could get comprehensive training reduced both transport costs and the effort that would be required for numerous shorter training sessions. Being able to leave the farm for extended periods of time or to take leave from employment were also identified by Vigne and Motinga (2005) in a needs assessment of AALS farmers as factors limiting attendance. Farmers travelling to CCF for training courses travelled anything from one to nine hours. Thus, information days have the advantage of being held throughout the farming regions, increasing the chances of reaching farmers by taking the training to them as it were. However, the value of intensive training as provided during longer training courses must not be underestimated.

5.5 Organisational support

Few farmers (43 %) were aware that there were organisations that supported farmers with carnivore problems. Although two large carnivore conservation organisations have been working in Namibia for over 15 years each, a relatively small percentage (26.6 %) identified

CCF and no farmers knew of AfriCat, an organisation similar to CCF. Many participants said they only came to know about CCF through the training courses. Organisations providing assistance with carnivore problems need to consider channels through which they can reach emerging farmers to create an awareness of the kind of assistance they can provide. Virtually no farmers (2.5 %) had been assisted specifically with a carnivore problem, despite the fact that the majority of them said carnivores were a big problem. Few farmers were affiliated to formal support structures. In addition, few farmers reported being involved with a more experienced farmer through mentorship (Figure 4.16).

Almost 80 % of farmers (76.3 %) made use of the government veterinary extension services (Figure 4.16), but the fact that veterinary services are required by law to inspect vaccination procedures on farms would account for this high percentage. Much information is disseminated through farmer's unions, associations and conservancy networks. Farmers not participating in these groups remained relatively isolated within the overall farming community. As those farmers who did participate in formal support structures generally showed a high level of satisfaction with the service received (Figure 4.17), it would be worthwhile encouraging more emerging farmers to join these support structures in order to integrate them into the communication network.

5.6 Sources of farming information

One of the informal but excellent sources of farming information is provided in the form of the *Agriforum* magazine. However, many farmers were not familiar with this magazine, while others said they could not obtain it due to a lack of availability at their local stores. None of the farmers spoken to were aware one could subscribe to the magazine. A higher percentage of farmers read the South African farming magazines as these were readily available in stores. However, the content is not nearly as applicable to practical farming under the extensive arid conditions in Namibia as is the content of the Namibian-specific *Agriforum*. *Agriforum* cost slightly more at N$13.80 (Vol. 18, No. 4), compared to the *Farmer's Weekly* or *Landbou Weekblad* (No. 1400) at about N$11.00 per issue in 2005. Nevertheless, given the value of the Namibian specific information, including husbandry and nutrition information, export issues and breed specific information, one would not expect this price difference to be prohibitive.

Radio still forms the most important source of farming information to many farmers (47 %), while printed media (newspaper, magazines) were not an important source to many (26 %) (Figure 4.18). Very few farmers (9 %) identified television as an important source of farming information, which is not surprising given that radio is more accessible and caters to a wider

audience and is cheaper than television. Radio would thus be a good way to inform farmers of training opportunities such as information days and to disseminate basic information. However, much of the training required by farmers is technical and requires a structured hands-on approach, as is provided by mentorship or training courses.

Over half the farmers (64 %) highly valued specific training as an important source of information, thus highlighting the importance of capacity building through direct contact in the form of training courses, study groups and farmer mentorship. Extension services were identified as being important by relatively few farmers (13 %) (Figure 4.19). Despite this, over 70 % were satisfied with the service they received. There is thus considerable opportunity for MAWF extension services to improve their value to more farmers, particularly as MAWF extension services are relatively widely distributed throughout all the regions and thus accessible to most farmers.

5.7 Preferred language of respondents for receiving information

While some of the older farmers surveyed were unable to speak any English, over 60 % of farmers said they would prefer to receive farming information in English. English has been the official language since independence and is the required primary language taught in Namibian schools; therefore language should be less of a barrier to future generations of farmers who have had schooling.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Other studies have identified the need for agricultural training for emerging commercial farmers (Desert Research Foundation, 2005; Vigne & Motinga, 2005). This study is no different in that respect. However, in addition, this study identified the urgent need for training of emerging commercial farmers to empower them to solve their own predator problems to reduce the economic impact of predation, and reduce the number of predators being killed in response to conflict.

Although the emerging commercial farmers' attitudes are similar to other farmers around the world, in that many still regarded solving carnivore problems as the government's (MET) problem, a strong tendency to want to be empowered to solve the problem themselves was also demonstrated. What is also positive is that at least half the farmers surveyed recognised that carnivores have an ecological role to play on their farms. These farmers were also more inclined to have a positive attitude towards carnivores. There is a distinct lack of general knowledge regarding carnivore behaviour and ecology, but the farmers are very interested in learning more. This paves the way for NGOs and other support structures to provide the right information to these farmers.

Farmers have demonstrated a strong interest in training to solve carnivore problems, but they have also demonstrated that their perceptions regarding carnivores will need to be altered. Often, the mere sighting of carnivore tracks or the carnivore itself still prompts many farmers to take action to remove such animals.

The conflict emerging commercial farmers are experiencing with carnivores are similar to those experienced by their fellow commercial farmers (Marker *et al.*, 1996). However, in many cases they may not be in as sound an economic position to withstand the impacts of predation, given smaller herd sizes, relatively low calving percentages, lack of diversity in farming operations and reliance on small stock as a source of cash income.

This study revealed that the high levels of conflict that were demonstrated were driven mostly by small stock losses, in particular goat losses. What is of great concern is that negative attitudes increased over time. This demonstrates an urgent need to start resolving the conflict issues as the number of emerging farmers on the farmland increases over time, setting the stage for serious conflict in the future. An increase in livestock loss was associated with an increase in conflict. Farmers with larger farms, therefore larger herds,

suffered proportionately more livestock loss and higher levels of conflict. Thus, instead of larger scale farmers being able to absorb a loss, the increased number of livestock loss resulted in increased conflict. The fact that emerging commercial farmers lose proportionately more livestock than their commercial counter-parts may account for the increased conflict. This increase in livestock loss with an increase in herd size is most likely indicative of insufficient management and demonstrates the failure of farmers to adapt to carnivore presence on their farms over time.

The majority of farmers reported applying cattle management techniques that can protect calves from predation. However, the level of livestock loss indicates that how these management techniques are being implemented needs to be looked at. In addition, the low average calving percentage (59 %) also demonstrates that the management techniques that affect productivity need to be improved. Persuading farmers to alter livestock management practices is a challenge, particularly when considering the high number of part-time farmers. These farmers are not on the farm full-time and can thus not supervise livestock management effectively. This makes them less inclined to adopt more sophisticated livestock management systems. Systems such as calving seasons and kraaling require a reliable and well trained staff in the absence of the farmer.

The reasons for not applying measures that can not only reduce losses, but that can increase productivity considerably, are mostly due to a lack of information. This study shows, as has been shown in other needs assessments (DRFN, 2005; Vigne & Motinga, 2005) that there is a distinct need for more farming information.

With regards to small stock, despite the reported use of management techniques that would be expected to reduce losses, small stock losses were still severe enough to be associated with negative attitudes. The incorrect application of livestock guarding dogs is one example of how a technique that is not applied correctly will fail to yield the desired result. In addition, farmers who did not use dogs reported the lack of knowledge on training dogs as the main reason for not using them. What is encouraging is that the majority of farmers recognise that they can reduce losses by management, and at least half the farmers recognise the role carnivores have to play in the farmland ecosystem. This again paves the way for judicious training efforts.

Alternative income from wildlife resources on the farm can help improve the economic stability of the emerging commercial farmer. The effects of, for example, drought and losses to carnivores as experienced by pure livestock farming operations can be buffered. In this way the risks associated with single production systems can be minimised by diversifying

sources of income and applying multiple production systems. However, care must be taken to mitigate the human-carnivore conflict that invariably occurs when game starts to take on value as an asset. The increase in this type of conflict has already been demonstrated by freehold farmers in Namibia (Marker *et al.*, 1996). Thus the process of emerging commercial farmers entering the field of game farming could exacerbate the existing conflict they are experiencing with carnivores in the absence of careful planning and management.

Respondents were very interested in training on how to utilise wildlife sustainably, showing that there was an interest in this aspect of farming, which is positive given the strong historical and cultural affinity with and economic dependency on livestock (Ashley, 1995; Ashley & La Franchi, 1997; Richardson, 1998; Arnold, 2001). Commercial farmers have a vested interest in wildlife conservation and sustainable use because they have been able to derive increasing economic benefits from wildlife for some time (Krugmann, 2001) whereas access to wildlife resources is a new concept to emerging commercial farmers.

An additional benefit of cooperative management is that emerging commercial farmers who are unable as yet to set up their own infrastructure, could tap into the potential revenue earning of wildlife by forming partnerships with commercial ventures within the conservancy framework. Much of the game on the commercial farmlands is free-ranging, crossing farm boundaries at will. In addition, keystone species such as the cheetah have vast home ranges encompassing several farms. Thus, if farmers do not work together on a large scale, it will be difficult to effect conservation at a sustainable level.

All respondents demonstrated a great desire for training in all topics, from farming methodology to carnivores. The farmers in this study indicated that they wanted longer training sessions, but other studies have shown that farmers, particularly part-time farmers would find longer training sessions difficult to attend. Thus, a variety of training formats will need to be made available to target all farmers.

The farmers demonstrated very little awareness of the work done by the carnivore NGOs. Few had heard of the NGOs, and those that had, had mainly done so through the advertising of training courses. Thus, despite a large amount of effort going into disseminating information, the emerging commercial farming sector is not being reached. The fact that their most important source of information is the radio, and this format is seldom used by the carnivore conservation NGOs is probably part of the problem. In addition, traditional ways of reaching groups of farmers through gatherings such as at farmers' association meetings tend not to reach emerging commercial farmers as they are not yet embracing these support structures. Emerging commercial farmers are still very isolated and are not yet integrating

into traditional support structures such as farmers' associations, and more recently, conservancies.

The challenge thus lies in providing a multi-faceted approach to training by all sectors including NGOs and government, one that incorporates basic environmental education to improve general knowledge, as well as agricultural training to strengthen the economic position of farmers and alter management practices to prevent losses and improve productivity.

As has become clear from this study, farmers are lacking key information in various sectors of the farming operation, including human-carnivore conflict. What has also become clear is that information dissemination and training in a variety of formats is urgently needed to convey this information. Timely action is needed by NGOs and support structures to develop the positive attitudes found amongst this sector of the farming community before the human-carnivore conflict escalates to a point where farmers become resentful and unwilling to work with the conservation sector.

6.2 Recommendations

- Negative attitudes need to be addressed by a combined approach of training in livestock husbandry and management, linked to training to improve farmers' general knowledge on the identification of, behaviour and ecology of carnivores. In addition, training in kill identification needs to be done so that perceptions of livestock loss to carnivores can be replaced by accurate verification. This interdisciplinary approach (combining agriculture and conservation training) has already been initiated by the Cheetah Conservation Fund, but it needs to be adopted more widely in the agricultural sector.

- Special attention must be given to training agricultural and veterinary extension officers in this combined approach, so that they in turn can provide informed assistance to farmers in relation to carnivore problems. Quite often these extension officers, including extension officers from MET demonstrate the same lack of information as the farmers do, when it comes to identifying a livestock loss and how to go about preventing future losses. NGOs need to start targeting these support organisations to maximise the dissemination of information to farmers through all possible channels.

- Human-carnivore conflict can be effectively mitigated by addressing the causes of livestock loss. Factors such as disease and theft compound livestock loss and are often erroneously attributed to predation. Training needs to be expanded to comprehensively cover all the causes of loss, such as by looking at livestock husbandry and disease management in addition to livestock management to reduce losses to carnivores. This integrated approach to training has been initiated by CCF. However, this approach needs to be adopted by the agricultural sector at a broader level if all the categories of farmers are to be reached, including the emerging commercial and resettled farmers, communal farmers and established commercial farmers.

- The need to train farm workers, and not just farm owners in environmental education, capacity development and the correct application of management systems was identified in this study. With 46 % of emerging commercial farmers categorised as part-time farmers, multiple people, including farm workers and foremen are often the people responsible for verifying losses. They are also responsible for taking action against predators and implementing management strategies to reduce losses. Thus, training initiatives need to extend beyond the farm owner. However, due to literacy and language issues, particularly amongst farm workers, an innovative approach will be needed. A concerted effort will need to be made to persuade farmers to send their workers on a course. Due to the logistical problems posed by the distances between farms and training venues, all sectors of the agricultural industry will need to be involved to access the workers.

- Training that enables emerging commercial farmers to enter the arena of wildlife use for profit is needed to ensure sustainable practices, preferably within the framework of conservancies, to supplement income derived from farms. Training in both effectively using wildlife and solving carnivore problems will help emerging farmers to farm in an environmentally and economically sound way, whilst maintaining the integrity of the environment. Furthermore, the management of the wildlife resources on commercial farmlands needs to be undertaken on a landscape level to be effective due to the wide-ranging behaviour of much of Namibia's wildlife.

- The CANAM needs to initiate an intensive media campaign to disseminate information on the role and functioning of conservancies to emerging commercial farmers. The radio should be used in order to target the maximum number of emerging farmers. Currently they are not being enticed to join conservancies.

- The NAU, the ECFSP, MET and MAWF (including the veterinary services directorate), all need to start adopting an integrated approach if human-carnivore conflict outside Namibia's protected areas is going to be successfully mitigated to ensure the economic well being of farmers, and the survival of carnivores. NGOs need to start targeting these institutions to ensure their staff is familiar with and sharing integrated livestock and carnivore management information.

- Emerging farmers need to start accessing written sources of farming information. One good source is the *Agriforum* magazine. The ECFSP should consider distributing this magazine free of charge for a period of time to stimulate the awareness and interest of the emerging farmers in this valuable source of farming information. During this period contact information for farmers' associations, the NAU and conservancies could be highlighted to create awareness of the role and functioning of these support organisations.

6.3 Limitations of this study

Due to the length of the questionnaire, time constraints precluded surveying enough farmers at venues such as information days. Questionnaire length was also probably the reason for a poor return rate of postal questionnaires. Survey responses were single-rater therefore common method biases could exist in the data, although factor analysis suggested that this was not the case.

The relatively small sample size of 82 may have been responsible for the failure to obtain a statistically significant result of the effect on losses of various management techniques. Ideally a larger sample size may have yielded better results. In addition no information was collected about the application of management techniques to gauge whether incorrect application was responsible for the lack of variance in losses between farmers applying the techniques and those not doing so. This would require a separate study to assess how well the techniques were being applied, something that was not possible during the course of this study.

Some results such as the duration of training courses desired by farmers may have been biased by the fact that the majority of respondents were attending a one week course when surveyed. Reporting on removal of carnivores may also have been inhibited by the fact that a carnivore conservation NGO was presenting the course, and the course was hosted at the CCF research and environmental education centre. This unfortunately is one of the

limitations of a questionnaire, in that results are solely determined by the level of transparency the respondent is willing to share.

6.4 Suggested future research

Currently training is being carried out at different levels by NGOs, the private sector and government. However, what impact this training is having is not yet being monitored.

Research needs to be conducted to assess whether or not training results in a change in attitude and behaviour on the part of the farmer, irrespective of whether they have attended a one week training course or several farmers' information days. Are they implementing what they have learned and is it working? This is not only true for training in livestock management, but also for training in relation to human-carnivore conflict issues.

In addition, although much work has been done in Namibia focusing on factors affecting human-carnivore (particularly cheetah) conflict, more research is needed on management practices. In particular, it is important not only to quantify which management practices reduce losses to predators, but also how well farmers implement these practices.

One practice in livestock management that has been researched in depth is the use of livestock guarding dogs. This research has highlighted the need to apply a particular technique correctly. However, even here more research is needed. Schumann and Schroeder (2004) found that even where improvements in technique are promoted by NGOs through the provision of a more specialised breed of dog, for example, owners do not necessarily follow guidelines or may, because of cultural or economic factors, still not apply the technique correctly.

The cattle management techniques of kraaling calves, using maternity camps, bringing calving herds closer to home, increasing supervision during calving and the use of donkeys all need to be described in detail. This would include the timing of applications and the designing of structures such as kraals. In addition, their application under field conditions needs to be assessed in relation to factors such as habitat, bush density, prey density, proximity to homesteads or posts and the number of people at homesteads or posts. All of these factors can affect the success or failure of a particular technique and need to be properly understood to be applied successfully.

The use of donkeys is one example of a technique that has the potential to yield good results but that has not been widely adopted by either commercial or emerging farmers. Research

into this technique is needed to provide data that can be used to promote its adoption by farmers, particularly in the case of part-time farmers where inadequate supervision might prohibit the adoption of other practices such as kraaling calves.

Being able to predict expected losses under particular management systems in the presence of specific predator species would provide a powerful tool with which to encourage farmers to adopt specific practices under specific circumstances. This tool can only be developed if enough information is available on which to base predictions.

Furthermore, the economics of applying livestock management techniques purported by farmers and conservationists to reduce loss to predation need to be quantified versus the losses suffered in the absence of their application. The economic consequences have been somewhat neglected by the conservation sector in Namibia, although they are arguably one of the most powerful tools to promote change in behaviour and practices.

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APPENDIX A: Questionnaire

ASSESSMENT OF NAMIBIAN FARMERS NEEDS IN RELATION TO THE ACTIVITIES OF THE CARNIVORE CONSERVATION NON-GOVERNMENT ORGANISATIONS

(Office use only) Enumerator: Ref Number:

District/Region: _____ Date: D ___ M ___ 2006

Farm Name: _____ **Q1a)** Gender: M ___ F___

Farm Number: _____ Size(ha):_____

Select the category that best describes your situation:
b) Affirmative Action Loan Scheme farmer: ___ **c)** Emerging Commercial Farmer: ___
d) Communal Farmer: ___ **e)** Other(Specify): _____

Q2 What is your role on this farm?

a)Owner	
b)Foreman	
c)Other(specify)	

Q3 We would like to know WHAT KIND OF HELP YOU NEED with carnivore problems. Please indicate to what extent you AGREE OR DISAGREE with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) I feel a livestock insurance scheme should be developed for farmers (*owner takes out insurance against losses)*	☺		☹		☹
b) When I have a carnivore problem I want someone to remove it for me	☺		☹		☹
c) I would like to learn how to remove carnivores myself when they cause problems for my livestock	☺		☹		☹
d) I would like training on livestock management techniques to reduce losses to carnivores	☺		☹		☹
e) I would like training on general livestock management to reduce losses to other causes	☺		☹		☹
f) There should be a compensation scheme that pays me for livestock losses to carnivores	☺		☹		☹

Q4 Can you think of ANY OTHER HELP OPTIONS not listed above, that you would want to help solve a carnivore problem on your farm? Please list them.

_____

Q5 WHAT ORGANISATIONS do you know of that HELP FARMERS WITH CARNIVORE PROBLEMS? Please list them.

_____

Q6 Have any of these ORGANISATIONS HELPED YOU with a carnivore problem in the past? Yes__ No__ IF YES, PLEASE ANSWER BELOW.

Q7 Who assisted you? (Organisation)	Q7.1 Type of assistance? (Visit, telephonic, literature, removed carnivore, other)	Q7.2 Satisfied		Q7.3 Why were you satisfied or not satisfied? ☺ ☹
		yes	no	
a) ⇨	a) ⇨			⇨ a)
b) ⇨	b) ⇨			⇨ b)
c) ⇨	c) ⇨			⇨ c)
d) ⇨	d) ⇨			⇨ d)

Q8 Help us understand who you think is RESPONSIBLE for SOLVING CARNIVORE PROBLEMS in Namibia, by indicating to what extent you AGREE OR DISAGREE with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) I am responsible for solving carnivore problems on my farm	☺		😐		☹
b) The **Ministry of Environment and Tourism** (MET)/ government is responsible for solving farmer-carnivore problems	☺		😐		☹
c) The **Ministry of Agriculture** is responsible for solving farmer-carnivore problems	☺		😐		☹
d) Non-Government Organisations are responsible for solving farmer-carnivore problems	☺		😐		☹

Q9 We are thinking about developing training courses for farmers. Would you be interested in participating in farming training? Yes___ No___

Q10 We would like to know which topics you want to receive training on. Please indicate how IMPORTANT the FOLLOWING TOPICS are TO YOU?

Topic	very important	important	neutral	unimportant	very unimportant
a) Livestock production *rangeland, reproduction, licks, health, production systems*	☺		😐		☹
b) Livestock marketing *marketing channels, FAN meat* How to market and sell livestock	☺		😐		☹
c) How carnivores live and behave *ecology and behaviour*	☺		😐		☹
d) Managing staff, *policies, managing disputes, labour act, social security*	☺		😐		☹
e) Financial management *budgeting & cash flow*	☺		😐		☹
f) Sustainable utilisation of wildlife *Harvesting plan, counting and ageing methods, ecology*	☺		😐		☹
g) Livestock management to reduce losses to carnivores	☺		😐		☹
h) Crop production *soil cultivation, fertilization, weed, pest control*	☺		😐		☹
i) Carnivore identification *by sight, tracks, killing methods*	☺		😐		☹
j) Mechanics *wind pumps, welding tractors, engines*	☺		😐		☹

Q11 What OTHER TRAINING TOPICS do you think should be offered?

_____

Q12 How long do you think such a training course should be?

One day ☐
Two days ☐
Three days ☐
Four days ☐
Five days ☐ Evening courses ☐ Other (specify)_____

Q13 How IMPORTANT are the following TYPES OF TRAINING METHODS TO YOU?

Training options	very important	important	neutral	unimportant	very unimportant
a) Training Courses from one to several days long	☺		😐		☹
b) Farmers Study Groups, that are made up of farmers in the area, working together to learn and solve farming problems	☺		😐		☹
c) Mentorship, which means that an experienced farmer works with you to train you	☺		😐		☹
d) Farmer's Information Days where training is provided at different farms by different people	☺		😐		☹
e) Training Manuals you can read and learn from by yourself	☺		😐		☹

Q14 Since OWNING YOUR FARM, would you say that CARNIVORES WERE A:

Very big problem		big problem		small problem		very small problem		no problem	

Q15 Who identifies whether or not you have a carnivore problem on your farm?

a) You	
b) Owner	
c) Your foreman	
d) Your workers	
e) Other (specify)	

Q16 We want to understand HOW you decide WHEN there is A CARNIVORE PROBLEM ON YOUR FARM. Please indicate to what extent you AGREE OR DISAGREE with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) When **several livestock are killed,** I know I have a carnivore problem	☺		😐		☹
b) When **one livestock kill** is found, I know that I have a carnivore problem	☺		😐		☹
c) When my livestock come **home without their calves/kids,** I know I have a carnivore problem	☺		😐		☹
d) When **carnivore tracks** are found, I know that I have a carnivore problem	☺		😐		☹
e) When **carnivores are seen,** I know that I have a carnivore problem	☺		😐		☹
f) When I find **game killed,** I know I have a carnivore problem	☺		😐		☹

Q17 Help us understand at what point you would TAKE ACTION by attempting to REMOVE A CARNIVORE from your farm by indicating to what extent you AGREE OR DISAGREE with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) I attempt to remove a carnivore after **several livestock kills** are found	☺		😐		☹
b) I attempt to remove a carnivore after **one livestock kill** is found	☺		😐		☹
c) I attempt to remove a carnivore when my livestock come **home without their calves/kids**	☺		😐		☹
d) I attempt to remove a carnivore when **carnivore tracks** are found	☺		😐		☹
e) I attempt to remove a carnivore when a **carnivore is seen**	☺		😐		☹
f) I attempt to remove a carnivore when I find **game killed** by carnivores	☺		😐		☹

Q18 Please mark all the TECHNIQUES YOU USE on your farm to REMOVE CARNIVORES?

	yes	no
a) shooting		
b) trap cages (vanghokke)		
c) dogs		
d) poison		
e) gin traps (slagysters)		
f) other (specify)		

Q19 How many of the following carnivores did you REMOVE from your farm during 2005?

Carnivore	0	1 to 5	6 to10	11 to15	16 to 20	More than 20	do not occur on farm
a) jackal							
b) caracal							
c) African wild dog							

Q20 Since you owned the farm or have been living on it (resettled), what has happened to the NUMBERS of the following CARNIVORES on your farm?

Carnivore	increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot	do not occur on farm
a) jackal						
b) caracal						
c) African wild dog						

Q19 How many of the following carnivores did you REMOVE from your farm during 2005?

Carnivore	0	1 to 5	6 to10	11 to15	16 to 20	More than 20	do not occur on farm
d) cheetah							
e) leopard							
f) lion							

Q20 Since you owned the farm or have been living on it (resettled), what has happened to the NUMBERS of the following CARNIVORES?

Carnivore	increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot	do not occur on farm
d) cheetah						
e) leopard						
f) lion						

Q19 How many of the following carnivores did you REMOVE from your farm during 2005?

Carnivore	0	1 to 5	6 to10	11 to15	16 to 20	More than 20	do not occur on farm
g) spotted hyaena							
h) brown hyaena							

Q20 Since you owned the farm or have been living on it (resettled), what has happened to the NUMBERS of the following CARNIVORES?

Carnivore	increased a lot	increased somewhat	stayed the same	decreased somewhat	decreased a lot	do not occur on farm
g)spotted hyaena						
h) brown hyaena						

Q21 Help us to understand what you THINK ABOUT CARNIVORES by indicating to what extent you AGREE OR DISAGREE with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) Carnivores have an **ecological role** to play on my farm	☺		😐		☹
b) I want all carnivores **removed off farmland** and living only in e.g reserves such as Etosha	☺		😐		☹
c) I can reduce livestock losses by **adjusting my livestock management**	☺		😐		☹
d) The only way I can reduce livestock losses is to **remove all carnivores** from my farm	☺		😐		☹
e) I **like having carnivores** living on my farm	☺		😐		☹

Q22 Do you farm with the following:

	yes	no
a) cattle		
b) goats		
c) sheep		
d) game		

Q23 Help us understand the MOST SERIOUS CAUSES OF LIVESTOCK LOSS ON YOUR FARM by ranking (numbering) the options provided in order of importance. The biggest cause of loss = 1,
the second biggest cause of loss = 2, the third biggest cause of loss equals 3 and so on, until you get to 6, which would be the least important cause of livestock loss.

Cause of loss	Rank
a) poisonous plants	
b) birthing problems	
c) carnivores	
d) theft	
e) diseases	
f) unknown causes	

Q24 In order to help us understand the level of livestock lost to ALL causes, please list TOTAL numbers of livestock lost during 2005.

	0	1 to 5	6 to 10	11 to 15	16 to 20	21+
a) cattle						
b) calves						
c) goats						
d) sheep						

Q25 To help us understand the level of livestock lost to CARNIVORES, please indicate how many livestock you lost to carnivores during 2005.

	0	1 to 5	6 to 10	11 to 15	16 to 20	21+
a) cattle						
b) calves						
c) goats						
d) sheep						

Only answer questions 26 to 30 IF YOU FARM *WITH* CATTLE.

Q26 Which of the following cattle management practices do you use on your farm?	**yes**	**no**	**Q26.1 If no, why not?**	**too expensive**	**I don't have enough information**	**not practical**	**other reasons**
a) Calving season *bull taken out to control calving season*			⇨				
b) Calves kept in kraal when very young			⇨				
c) Maternity camp *Cows brought to this camp to calve*			⇨				
d) Cows calving are brought close to home			⇨				
e) Livestock **record keeping**			⇨				
f) Weighing calves and/or weaners			⇨				
g) Increased patrols by workers during calving			⇨				
h) Use donkeys to protect livestock			⇨				

Q27 We would like to know a bit more about your cattle management.	**yes**	**no**	**Q27.1 If no, why not?**	**too expensive**	**I don't have enough information**	**not practical**	**other reasons**
a) Were any of your bulls tested for **fertility** when you bought him/them?			⇨				
b) Were any of your bulls tested for **diseases** when you bought him/them?			⇨				
c) Were any of your bulls **registered** when you bought them?			⇨				
d) Do you carry out **pregnancy tests** on your cows			⇨				

Q28 What is your average annual calving percentage (what percentage of your cows give birth each year)?

1-20 %	21-40 %	41-60 %	61-80 %	81-100 %

Q29 What was the average number of cattle on your farm during 2005?

1 to 50	51 to 100	101 to 150	151 to 200	201 +

Q30 Please provide the following details on the cattle sold by you during 2005.

Type of Livestock sold	0	1 to 25	26 to 50	51 to 75	76 to 100	101 +
a) oxen						
b) weaners						
c) cows						

Only answer questions 31 to 36 IF YOU FARM *WITH* SMALL STOCK.

Q31 Which of the following small stock management practices do you use?	**yes**	**no**	**Q31.1 If no, why not?**	**too expensive**	**I don't have enough information**	**not practical**	**other reasons**
a) I have a **herder** who goes to veld with small stock			⇨				
b) Lambing season *ram taken out to control lambing season*			⇨				
c) Kraal small stock at night			⇨				

Q32 What was the average number of small stock on your farm during 2005?

	1 to 50	51 to 100	101 to 150	151 to 200	201 +
a) goats					
b) sheep					

Q33 Please provide the following details on the small stock sold by you during 2005.

Type of livestock sold	0	1 to 25	26 to 50	51 to 75	76 to 100	101 +
a) goats						
b) sheep						

Q34 Do you use livestock guarding dogs (dogs stay with livestock in the kraal *and* go to veld with them to protect them)? Yes _____ No _____

Q35 If you DO USE livestock guarding dogs, please help us understand how effective they are, by indicating to what extent you agree or disagree with the following statements.

Statements	strongly agree	agree	neutral	disagree	strongly disagree
a) My livestock guarding dogs **cannot prevent losses** to big or small predators	☺		☹		☹
b) My livestock guarding dogs are only able to protect my livestock against **small predators** such as jackal and caracal	☺		☹		☹
c) My livestock guarding dogs are **very effective** in protecting my livestock against **all predators**	☺		☹		☹
d) My dogs **prevent theft** of my livestock	☺		☹		☹

ONLY ANSWER question 36 if YOU DO *NOT* use livestock guarding dogs.

Q36 Please help us understand the reasons why you DO NOT USE LIVESTOCK GUARDING DOGS with your small stock, by ranking (numbering) IN ORDER OF IMPORTANCE the reasons provided below.
The most important reason = 1; the second most important reason = 2; the third most important reason = 3; until you get to 5, which would be the least important reason.

Why I *do not* use livestock guarding dogs to protect my small stock	Rank
a) Cost too much to maintain	
b) Guarding dogs cannot prevent losses against predators	
c) Dogs injure/kill small stock	
d) Dogs chase game	
e) I do not know how to train them	

Please answer the following questions on ORGANISATIONAL SUPPORT STRUCTURES available to farmers, by indicating if you belong to a particular support structure, AND your level of satisfaction with the service you receive.

Q37 Do you belong to/participate in/use?	yes	no	Q37.1 If "yes", please indicate to what extent you agree or disagree with the following statement: "I AM VERY SATISFIED WITH THE SERVICE PROVIDED" strongly agree	agree	neutral	disagree	strongly disagree
a) National Namibia Farmer's Union (NNFU)			☺		😐		☹
b) Namibian Agriculture Union (NAU)			☺		😐		☹
c) Farmers Association			☺		😐		☹
d) Study Group			☺		😐		☹
e) Mentorship			☺		😐		☹
f) Conservancy			☺		😐		☹
g) MET extension services			☺		😐		☹
h) Agriculture extension services			☺		😐		☹
i) Veterinary extension services			☺		😐		☹
j) Meatco			☺		😐		☹
k) Farmer's Meat Market							

SOURCE OF FARMING INFORMATION

Q38 Do you Subscribe to or regularly buy?	yes	no	Q38.1 If "yes", please indicate to what extent you agree or disagree with the following statement: "I AM SATISFIED WITH THE CONTENT OF THE MAGAZINE" strongly agree	agree	neutral	disagree	strongly disagree
a) *Agriforum*			☺		😐		☹
b) *Landbou Weekblad*			☺		😐		☹
c) *Farmer's Weekly*			☺		😐		☹
d) Other			☺		😐		☹

Q39 What are the most important sources of farming information to you? Please rank (number) in order of importance where 1 is the most important and 4 is the least important to you.

Source of information	Rank
a) Radio	
b) TV	
c) Newspapers, magazines	
d) Training manuals, guides	

Source of information where 1 = most important and 3 = least important	Rank
a) Events (*shows, information days*)	
b) Specific training (*study groups, training courses, mentorship*)	
c) Organisation's extension services (*Non-Government organisations, Ministry of Environment and Tourism, Ministry of Agriculture, Veterinary Services*)	

Q40 What is your home language (mostly spoken while growing up)?

_____

Q41 Which language would you prefer to get information in?

_____

ABOUT THE FARM

Q42 When did you assume ownership of your farm (when resettled)? Year_____

Q43 How many people on average live on the farm throughout the year? (include workers, families, charcoal burners etc.) _____

Q44 How important are the following SOURCES OF INCOME to you either as a DIRECT CASH INCOME and/or in support of your LIVELIHOOD (own use, not for sale)?

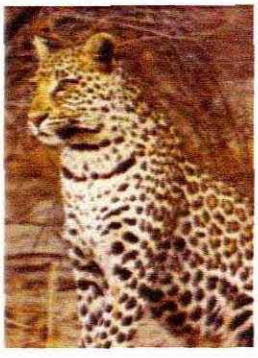
Sources of income		very important	important	neutral	unimportant	very unimportant
a) Cattle	cash income	☺		😐		☹
	own use	☺		😐		☹
b) Goats	cash income	☺		😐		☹
	own use	☺		😐		☹
c) Sheep	cash income	☺		😐		☹
	own use	☺		😐		☹
d) Crops	cash income	☺		😐		☹
	own use	☺		😐		☹
e) Vegetable garden	cash income	☺		😐		☹
	own use	☺		😐		☹
f) Game meat	cash income	☺		😐		☹
	own use	☺		😐		☹
g) Tourism	cash income	☺		😐		☹
h) Trophy hunting	cash income	☺		😐		☹
i) Live sale of game	cash income	☺		😐		☹
j) Sale of charcoal	cash income	☺		😐		☹
k) Employment off the farm	cash income	☺		😐		☹

GAME UTILISATION

Q45 Please indicate the average number of game utilised on your farm during 2005					
Game species utilised on your farm	**0**	**1 to 10**	**11 to 20**	**21 to 30**	**31+**
a) Kudu					
b) Gemsbok					
c) Hartebeest					
d) Eland					
e) Warthog					
f) Steenbok					
g) Duiker					
h) Other					

Q46 Pictures of animals are provided, PLEASE NAME THEM preferably in English or Afrikaans, but use your own language if you only know its name in your language. If you do not know what the animal is, just write "don't know".

a. _____



b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____