THE EFFECT OF THE ELECTRIC FENCE IN REDUCING HUMAN-WILDLIFE CONFLICT IN THE WESTERN PART OF MAKGADIKGADI PAN NATIONAL PARK, BOTSWANA.

NAMETSO FLORAH MONAMETSI

NORWEGIAN UNIVERSITY OF LIFE SCIENCES
DEPARTMENT OF ECOLOGY AND NATURAL RESOURSE MANAGEMENT (INA)
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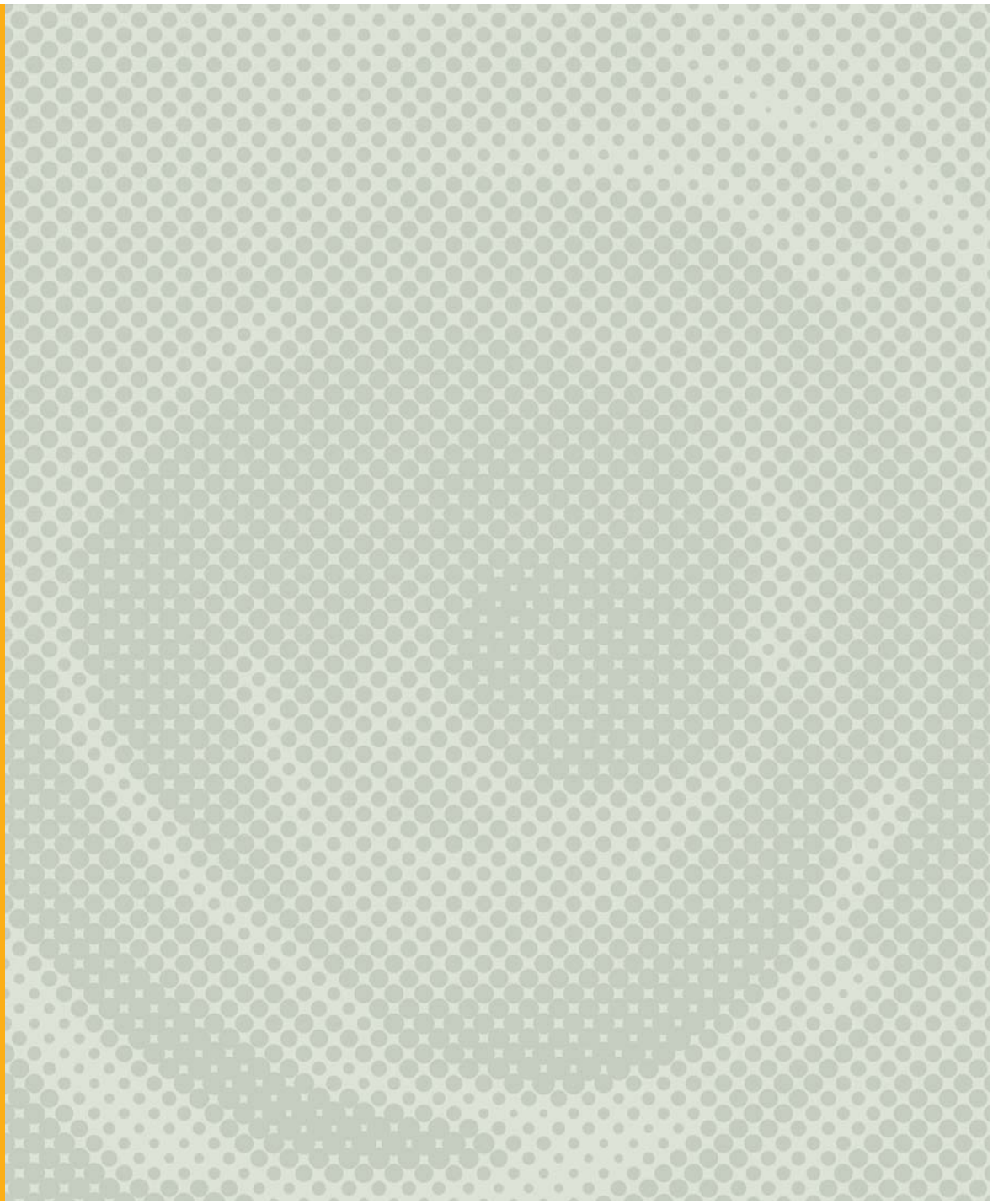

The effect of the electric fence in reducing human-wildlife conflict in the western part of Makgadikgadi Pan National Park, Botswana.

Nametso Florah Monametsi
nametsofm@yahoo.com

A thesis submitted in partial fulfilment of the requirements for the award of Master of Science Degree in Tropical Ecology and Natural Resource Management at the Norwegian University of Life Sciences (UMB)
As, Norway.

Department of Ecology and Natural Resource Management (INA)
Universitetet for miljo-og biovitensap

Supervisor: Stein R. Moe

Preface

Botswana has a history of fences for disease prevention as beef contribute to the gross domestic product of the country. Tourism especially through wildlife, also contributes to the (GDP). Of recent an electric fence was built to reduce the conflict between these two GDP contributors, through human and wildlife, in Makgadikgadi Pan National Park (MPNP). Considering that a lot of money is used in compensation of livestock depredation and crop damage, as well as research into conflict resolution, I found it important to investigate the effect of the fence on human-wildlife conflict. I chose MPNP because it is labelled a human-wildlife conflict hot spot in Botswana and it is one of the places where an electric fence was built.

I would like to express my thanks to the Ministry of Environment, Wildlife and Tourism for granting me a study leave to pursue my Masters degree. I would also like to express my deepest gratitude to the Department of Ecology and Natural Resource Management (INA) at the Norwegian University of Life Sciences (UMB) for accepting as a student and the financial support to my fieldwork. To Lanekassen, I say *tusen takk* for securing the scholarship for my studies. I thank the Department of Wildlife and National Park (DWNP) for the assistance with transport and other logistics of the fieldwork. No words can be used to describe the role played by the contribution of these institutions to the success of my study, to the future of human-wildlife conflict resolution eventually, and management of natural resources as a whole.

I am grateful to my supervisor Dr Stein R. Moe for the guidance throughout the development of this study, the patience with corrections of 'obvious' mistakes and constructive criticisms that helped to the success of this thesis. The comments helped shape the thesis as well as enrich my profession as an Ecologist.

I would like to thank my mother for looking after my son while away on studies. To my late father, I know you are proud of your little girl. To all the colleagues and friends especially Patrick Lubega and Gloria Wapalila, at Pentagon, thank you for making the long dark nights and studies bearable. (*Moja morago ke Kgosi).* My beloved son Kgosi, thank you for the maturity and understanding that mummy needs to study far away. I love you. I thank God for giving me the strength and patience to study hard.

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Abstract

In Botswana wild animals, especially carnivores are a source of conflict with people. Botswana has a history with fencing, for diseases control between wild animals and livestock. There has been a long standing human- wildlife conflict in areas around Makgadikgadi Pan National Park and an electric fence was built to reduce the conflict. Official depredation and crop raid reports were used to assess how the fence had changed human-wildlife conflict. Also one hundred people in villages and cattle posts along the fence in the western part of Makgadikgadi, were interviewed using questionnaires to get their view on the fence. Official records ranked lions the most frequent livestock predator while elephant was ranked the most frequent crop-raider. The presence of the electric fence has significantly reduced the number of depredations and crop raids. High depredations and crop raids were recorded in the wet season. The local people also believed the fence was an effective barrier in the animal movements and supported its erection. However, it should be noted that the fence only reduced the conflict rather than eliminate it. Other management strategies have to be put in place to fight the conflict further. The use of chemical deterrent like chilli, having guarding dogs and kraaling the livestock have been found effective, in other areas. Regular maintenance of the fence also needs to be done to keep it intact and effective.

Keywords: Wildlife electric fence, Makgadikgadi, crop raiding, livestock depredation, human-wildlife conflicts.

Introduction

In many parts of Africa conflicts between wildlife and humans resulting in crop raiding (Thouless & Sakwa, 1995) and livestock depredation are a subject of concern for conservation (Gillingham & Lee, 2003; Perez & Pacheco, 2006). The problem is getting more severe as animals are restricted to isolated areas due to human encroachment (Madhusudan, 2003). Methods of driving animals back into protected areas through translocation, has not worked well as the animals commonly return (per obs). These conflicts make conservation of wildlife difficult and expensive due to large compensations (Madhusudan, 2003). In the past barriers have been used to keep animals away, to prevent spread of diseases, but electric fences are now considered the best solution and are becoming common (Thouless & Sakwa, 1995).

In Botswana wild animals, especially carnivores are a source of conflict with people (Hemson, 2003; Maude, 2005). There has been a long-standing conflict between wildlife and livestock in the Makgadikgadi Pan National Park (MPNP). This problem started in the mid 1980s after the Boteti River that used to separate the Park from the neighbouring villages, dried up. Historically the Boteti River, on the western boundary of the MPNP contained significant amounts of water augmented by the late floods from the Okavango system and acted as boundary between the cattle posts and the National Park (Meynell & Parry, 2002; Hemson, 2003). The drying up of the river led to livestock moving into the Park in search for better pasture as well as wildlife crossing into the villages and cattle posts. Some of the large carnivores, like lions (*Panthera leo*) and brown hyenas (*Hyena brunnea*), prey upon livestock causing economic damage (Hemson, 2003; Maude, 2005), while other animals destroy crops. In defence of their livestock and crops, farmers have killed quite a large number of predators and other wildlife species (Madhusudan, 2003). Problem animal control (PAC) (is any action taken with the intention to reduce damage by animals to people and their livelihoods (Hemson, 2003) has been practiced by the Department of Wildlife and National Parks (DWNP) in Botswana, for conflict resolution (Meynell & Parry, 2002).

Countries that export beef to international markets are required to meet high standards of veterinary health and disease management, commonly large areas are fenced off to separate

wildlife from livestock (Kgathi & Kalikawe, 1993; Mbaiwa & Mbaiwa, 2006). Botswana has such a history with fencing, due impart to its widespread use of veterinary fences to control disease transmission between wildlife and livestock because of beef exports to the European Union (Kgathi & Kalikawe, 1993; Hemson, 2003; Mbaiwa & Mbaiwa, 2006). Before the fence was constructed on the western boundary of MPNP, buffaloes (*Syncerus caffer*) found in the livestock areas were killed to prevent the spread of foot and mouth disease.

The large number of mortality of both livestock and wildlife has been a concern both for the communities neighbouring the park and DWNP, and meetings have been held to discuss ways in which the problem could be solved (Meynell & Parry, 2002). In these meetings communities suggested that the whole Park should be fenced as a measure of controlling wildlife from crossing into their cattle-posts and villages. Thus the Government of Botswana decided to construct a game proof fence around MPNP and part of the adjacent wildlife management areas, to try to solve the conflict.

The study was conducted in the western part of MPNP where the first phase of the electric fence was erected. The objective of the study was to assess the effect of the fence in reducing human-wildlife conflict, by determining the changes in the number of conflict reports after the fence was erected and the perception of local people on the fence. Hopefully the study can provide a basis for negotiations in the eastern part of the Park where the fence is yet to be built as well as for general management strategies. The study addressed the following questions; (1) has the number of conflicts been reduced? (2) Do local people believe that the fence has reduced human-wildlife conflicts? (3) Do local people support the erection of the fence?

Study area

Makgadikgadi Pan National Park is located between 20 and 21^0 South and 20 and 26^0 East in the eastern Kalahari region. The Makgadikgadi complex is a result of a variety of factors with the geology structure as the primary factor. There is a large depression formed by faults which run north-east and south-west, and controls the drainage of the area (Ringrose et al., 1999; Thomas & Shaw, 2002; Ringrose et al., 2005). Previously, the Zambezi, Okavango, Nata and many other smaller rivers drained into the depression forming an ancient-lake Makgadikgadi.

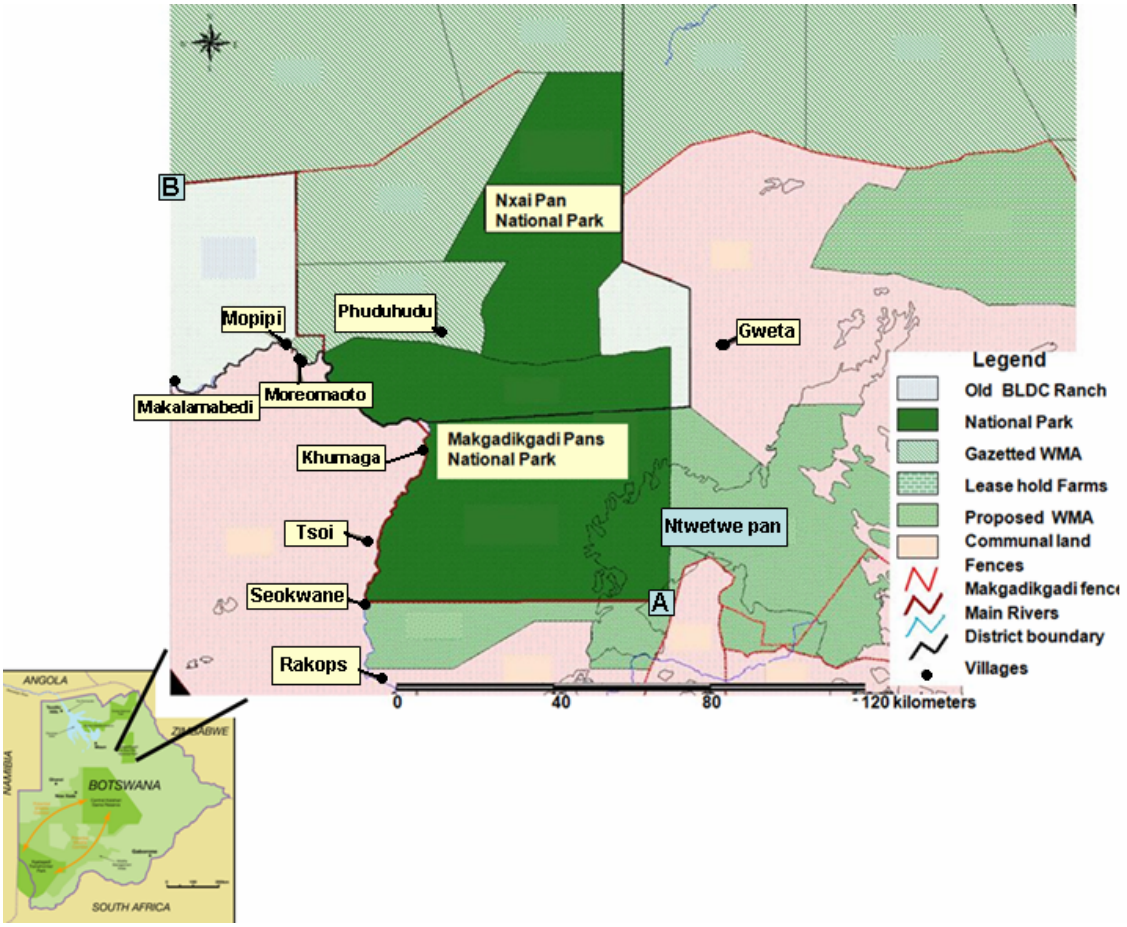

Fig. 1 Map of Makgadikgadi Pan National Park, Wildlife Management Areas and the surrounding villages and cattle posts. The fence is shown by point A to point B on the map. The study area starts from Seokwane to moreomaoto.

The climate of Makgadikgadi area is semi-arid, with cool dry winters and hot summers, and the mean annual rainfall of around 450 mm, most of which falls between October and March. Potential evapo-transpiration (PET) exceeds rainfall in all the months (Ringrose et al., 2002).

The soils of Makgadikgadi are mainly calcretes and silcretes created by fluctuating groundwater during the arid inter-pluvial periods (Ringrose et al., 1999; Thomas & Shaw, 2002). Along the Boteti River, fluvial activity has largely removed the salt content making conditions for plant life slightly better (Ringrose et al., 2002; Thomas & Shaw, 2002). To the west of the river soils are a mixture of calcareous sands and sandy loams. These soils on the riverbank are used for agriculture when flooding permits (Ringrose et al., 2002; Thomas & Shaw, 2002). The vegetation varies from savannah woodland through mixed shrub and open grassland, which, in places, is studded with groves of Makolwane palm trees, a characteristic feature of Makgadikgadi (Ringrose et al., 2002).

The Makgadikgadi Pan system is an intermediate between Chobe River and Okavango Delta biomes in the north and Kalahari biome in the south and therefore has diverse wildlife (Meynell & Parry, 2002). The pans are important for Lesser flamingo (*Phoenicopterus minor*) and Greater flamingo (*Phoenicopterus rubber roseus*), and blue cranes (*Anthropoides paradisea*) are known to nest in the area (McCullock et al., 2003). The grassland is also valuable habitat for migrating raptors, waterfowls and other birds. The wetland supports water-bird population in excess of Ramsar 1% criteria for Lesser flamingo and Greater flamingo, white pelican (*Pelecanus onocrotalus*), pied avocet (*Recurvirostra avosetta*) and other bird species (Meynell & Parry, 2002; McCullock et al., 2003).

The area is important ecologically as it supports significant populations of wildebeest (*Connochaetes taurinus*) and zebra (*Equus quagga*) which are the last truly migratory wildlife in northern Botswana (Brooks, 2005). Large animals occurring in the area include elephant (*Loxodonta Africana*), gemsbok (*Oryx gazella*), giraffe (*Girraffa camelopardelis*), kudu (*Tragelaphus strepsiceros*), hartebeest (*Alcelaphus buselaphus*), ostrich (*Struthio camelus*) and hippo (*Hippopotamus amphibius*) (DWNP, 2006). The carnivores found in the area include lion, leopard, brown hyena, wild dog (*Lycaon pictus*) and jackal (*Canis mesomelas*) (Hemson, 2003;

Maude, 2005; DWNP, 2006). Seasonal migrations of wildebeest and zebra occur annually in the Makgadikgadi (Kgathi & Kalikawe, 1993; Brooks, 2005). During the dry season animals are found in large numbers in the wooded grassland along the Boteti River (Brooks, 2005).

The fence is non-lethal electrified game proof fence of 2.4 m high. It runs on the park side with a parallel standard cattle fence of 1.4 m high. The total perimeter fence of the whole National Park will be 456 kilometres after the eastern part is finished. The length of the fence in the study area is 94 km. The electric power on the fence (6000 to 9000 volts) is provided by photovoltaic cells. The villages that are found along the fence are Khumaga and Moreomaoto; while the cattle posts include Tsoi, and Seokwane.

Methods

I reviewed the records of problem animals reported to the Department of Wildlife and National Parks from 2000 to 2007. The records contained data on livestock depredation, crop damage and destruction of other properties by wild animals before (2000 – 2004) and after (2005 – 2007) the fence was erected.

I also interviewed 100 local people in different villages and cattle posts along the western part of Makgadikgadi fence between August and September, using a questionnaire (Appendix 1). The questionnaires contained both open and closed questions. I selected the local people randomly by going into any household and approached any adult person found in the yard to answer the questionnaire. I asked the respondents to list the predators and rank them in the order of highest livestock predator. I inquired whether the fence prevents wild animals from coming to fields and cattle posts, and if not to suggest how to improve the fence. I also asked the respondents if they supported the erection of the fence. Background information on age, sex, education, employment, livestock ownership and field ownership was also recorded.

I collated and analysed responses using *Minitab statistical software v. 15.0*. Responses to open-ended questions were summarized according to similarities. These include; ranking of problem animals, activities prevented by the fence, and suggestions for fence improvement.

I used multiple binary logistic regression to determine the relationship between the local people's perception on the fence and their sex, employment and educational background. When comparing reports on depredation and crop damage an average for the same months of different years before (2000 – 2004) and after (2005 – 2007) fence erection was used because of seasonal differences in depredation. These data were compared with a paired t-test. I used one-way ANOVA to test variance in depredation between different seasons.

Results

Livestock depredations and crop raids

A total of 2800 cases of livestock kills and crop raids were reported between 2000 and 2007. Lions were the most frequent livestock predator followed by leopard, and wild dogs while elephants caused most of the crop damage (Fig. 2).

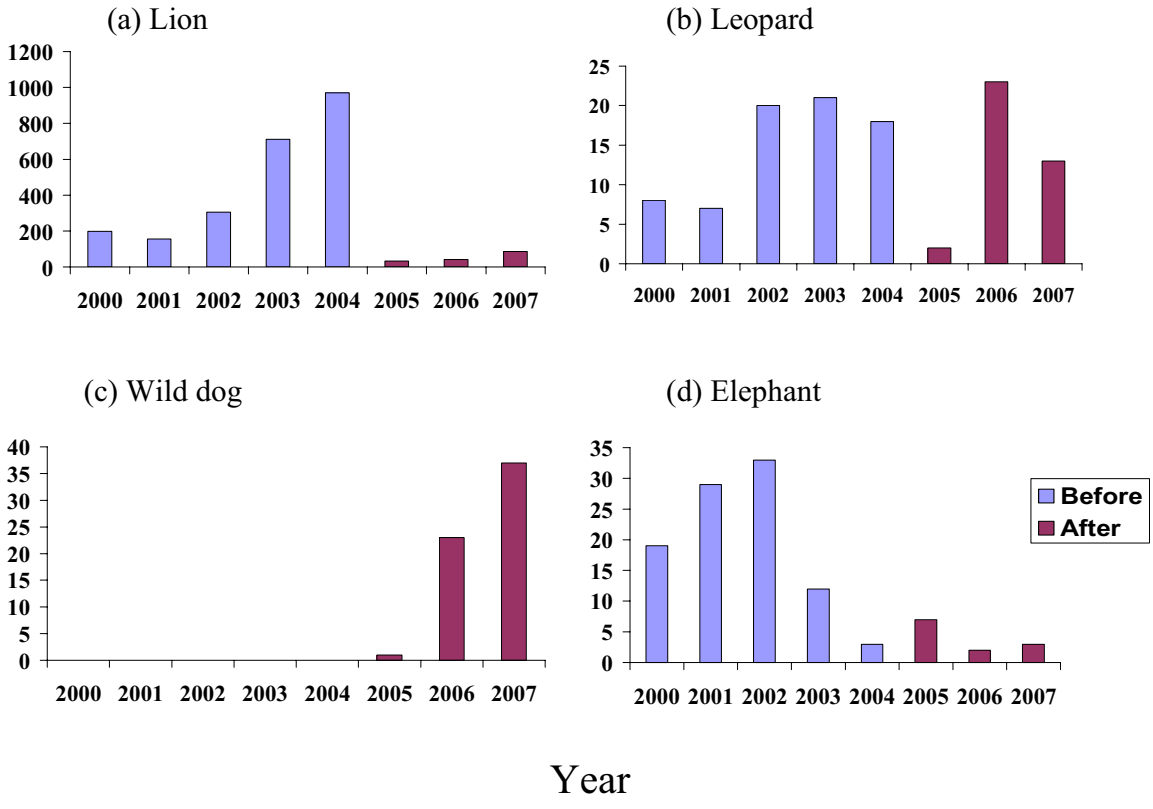

Fig. 2 Number of depredation reports caused by lions (a), leopards (b) and wild dogs (c), as well as crop raids by elephants (d) reported to the Department of Wildlife and National Parks before (2000 – 2004) and after (2005 – 2007) the erection of Makgadikgadi electric fence (other species were only registered in small numbers).

Overall there was a significant reduction in the number of reports of livestock killed and crops raided before (2000 – 2004) and after (2005- 2007) the fence was erected (paired $t = 7.72$, $n_1 + n_2 = 12$, $P<0.001$). Lion depredation on livestock gradually increased until 2004 and it then reduced substantially after the erection of the fence ($t = 7.14$, $df = 11$, $P <0.001$) (Fig. 2a). Although there were only two cases in leopard depredation in the first year after the erection of the fence, the fence caused no long-run reduction (Fig. 2b). There was depredation by wild dogs only after 2005 (Fig. 2c). There was a reduction in elephant crop raids after the erection of the fence ($t = 2.13$, $df = 13$, $P = 0.026$) (Fig. 2d).

There was also a seasonal difference in depredation before the fence (ANOVA $F_{3,8} = 21.32$, $P < 0.001$) and after the fence (ANOVA $F_{3,8} = 4.75$, $P = 0.035$) was erected where wet season depredation was higher than dry season depredation (Tukey's Post hoc test). More damage was reported for on livestock combined compared to crops and farm equipment (Fig. 3). There was a reduction in damage caused before and after the fence was built ($t = 3.18$, $df = 69$, $P = 0.001$).

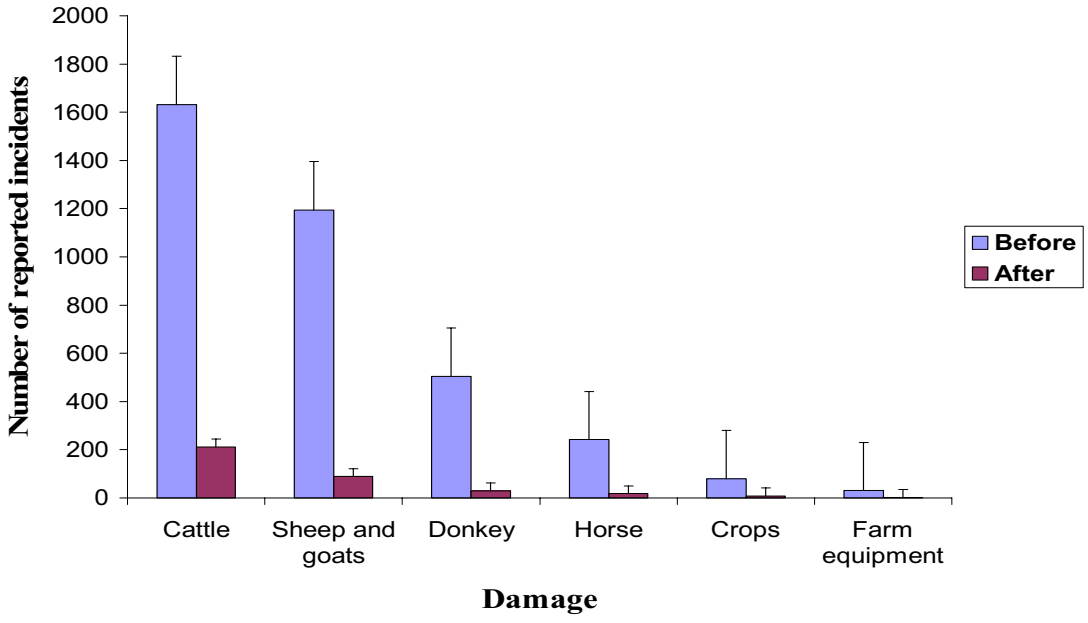

Fig. 3 Number of livestock killed and damage to crops and farm equipment (e.g. fence poles, water pumps) reported to the Department of Wildlife and National Parks before the fence (2000 – 2004) and after the fence (2005 – 2007) was erected.

Local people's perception

Ninety six percent of the local people believed the electric fence prevents wild animals from coming to their fields and cattle-posts. Within those who believed the fence prevents wild animals, only 34% thought it prevented all the animals. The respondents rank lions as the most frequent livestock predator, followed by hyena, leopard, and wild dogs. Elephant was ranked the most frequent crop raider. Ranking was done by cumulative of order of rank given by local people. The people also gave a list of animals not deterred by the fence (Fig. 4).

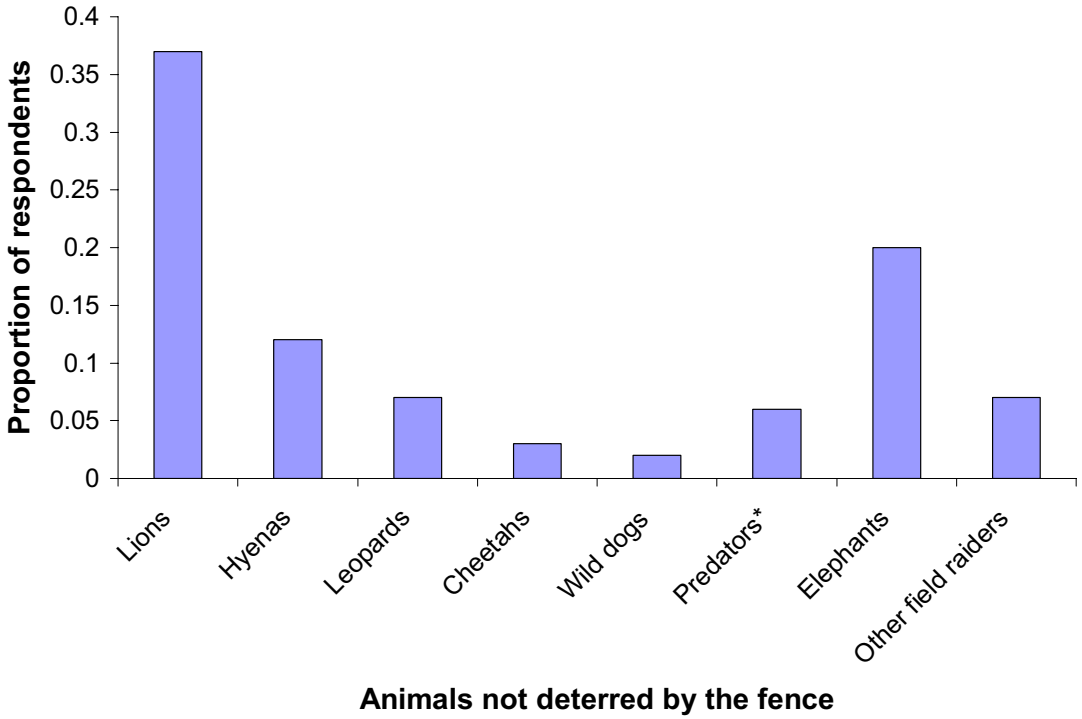

Fig. 4 Rank of animals not deterred by the electric fence listed by local people. * Some people did not specify the predator species.

Seventy percent of the respondents had never had, or anyone in the family had never been in danger of a wild animal. Twenty one percent of the respondents have been or their member of family had been threatened, 8% had been injured and 1% death. Forty six percent of respondents had experienced livestock depredation after the fence was erected. Twenty seven percent of respondents experienced field raids after the fence was built. People believed that the fence had

reduced their problems with wild animals (G = 6.436, df = 2, P = 0.04). People's perceptions were not related to age, sex, tribe, educational background, type of employment, or whether they reside in the cattle post or nearby major village (P>0.05). There was also a reduction of number of livestock raids as reported by local people when comparing before and after the erection of the fence (t= 6.22, df = 116, P<0.001).

The crops that were commonly grown included sorghum, maize, pumpkins and water melon. Fifty percent of the people believed the fence is in the agreed alignment, while 34 % believed the fence did not follow the agreed alignment. The rest of the people did not have any specific opinion on the alignment of the fence. Ninety four percent of the local people supported the erection of the fence. The support was stronger among those who had kraals or farms closest to the Park boundary (G = 22.518, df = 2, P < 0.001). The support was similar among age, sex, tribe, educational background or type of employment. Although there was support for the fence, people acknowledged that it interfered with some activities (Fig. 5).

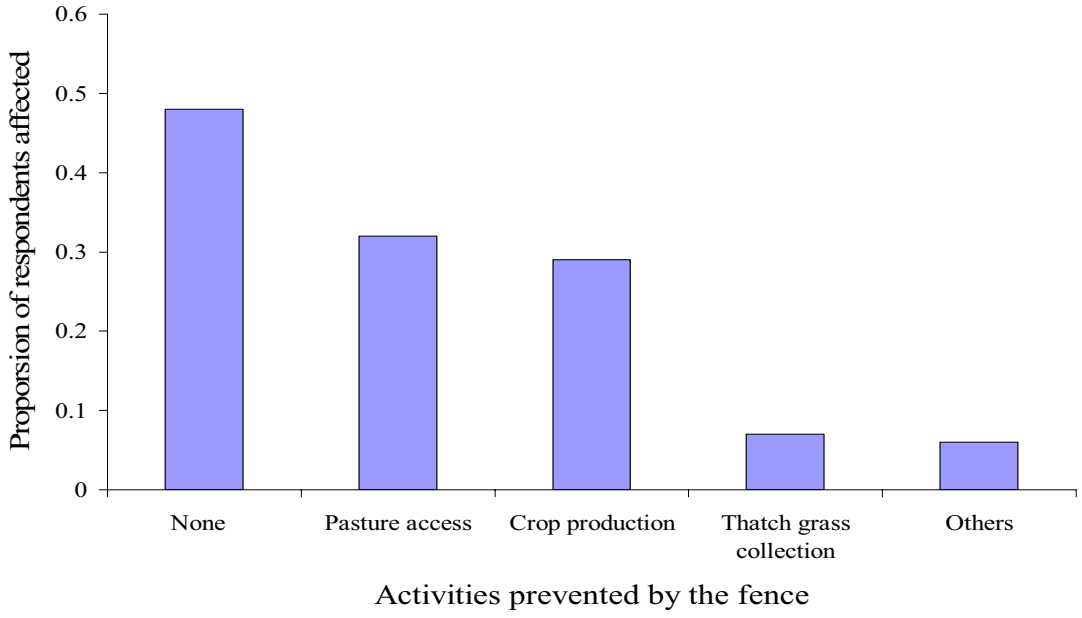

Fig. 5 Activities prevented by fence as listed by local people.

About 14% of the respondents thought the fence was efficient as it is, 37.4% suggested a stronger voltage and 13% thought the fence needs maintenance regularly. Other improvements suggested

were; extending the fence below the ground to prevent digging by predators (19.4%) and that the fence should be moved from the river (11%).

Discussion

Livestock depredations and crop raids

Lions were ranked the most frequent livestock predator. Lions have a high population number compared to other predators in the study area (DWNP, 2006), so it is not surprising that they cause the highest depredation compared to leopards and wild dogs. Leopards are known to hunt at night (Balme & Hunter, 2004; Balme et al., 2007), when most of the livestock are in kraals. There was a substantial reduction in lion depredations and elephant crop raids after the erection of the fence showing that the fence had high impacts on them. This could mean that when building the fence only large mammals were highly considered, as size consideration matters (Thouless & Sakwa, 1995; VerCauteren et al., 2006). There were low numbers of elephant crop raids in 2003 and 2004 just before the fence was build which could partly be explained by low amounts of rains, affecting crop production in those years (Birdlife, 2007). Hoare (1999) also found in his study that crop raids can be reduced when crops do not get to maturity stage.

There seems to be no long term reduction in leopard depredation because leopards are not constrained by fences (Balme & Hunter, 2004). Leopards can climb trees or poles and if these are near the fence they can get across the fences. Some studies have also shown that leopards hunt where prey is easier to catch as opposed to abundance (Balme et al., 2007). This may explain the depredation on livestock that are easily caught even when wild prey is available.

The depredation of wild dogs occurred only after the fence was built. Wild dogs are rare in Botswana and it could be that a family group moved out of the Park just before the fence was erected. Colonization of an area, especially when there is a den is known to result in an increased depredation (Woodroffe et al., 2005). A carnivore would be confined by need to care for young

pups (Creel & Creel, 2002). Compared to the size, wild dogs are known to consume a lot of meat compared to other carnivores (Creel & Creel, 1996; Creel & Creel, 2002), and in cases of low wild prey numbers they may be forced to kill livestock. Wild dogs also lose 50% of their kill to larger carnivores like lions through inter-specific competition (Creel & Creel, 1996) a factor that may contribute to increased livestock depredation.

Several studies show that lack of, or low amounts of wild food may be a strong contributor to high depredation rates and high crop raids ((Chiyo et al., 2005; Woodroffe et al., 2005; Goldstein et al., 2006; Kolowski & Holekamp, 2006). It is difficult to say for certain if it is the case for my studies since depredation also occurred even when wild food was available.

I also found that high depredations on livestock were recorded in the wet season. In the wet season when surface water available, wild prey move away from the Boteti River to Ntwetwe pans (in the south east part of the Park), where there is available forage. Normally the predators would follow the prey but with livestock available as an easy prey they stay behind. Predators are known to select habitats for hunting where they can easily catch prey without a lot of effort (Hayward & Kerley, 2005), which could be the reason for predators to select livestock that have lost anti-predation behaviour (Graham et al., 2005). Patterson (2004) and Woodroffe & Frank, (2005) in their studies on Maasai pastoralists found that most of the depredations occurred in the wet season. Hemson (2003) in his study of Makgadikgadi lions also established that during rain season there were more lion depredations which coincide with the time of numbers of low wild prey.

In my study high numbers of elephant crop raids were recorded in the wet season. Forage quality and growth of crops in fields are determined by rainfall. The crop quality in turn attracts the elephants (Barnes, 2002; Chiyo et al., 2005). Crops mature in the wet season and this is the time when crop raids usually occur (Nyhus et al., 2000). This could mean that crop raiding elephants are attracted by the ripening of crops instead of more scarce wild food of lower quality (Chiyo et al., 2005) as this time coincides with the period when wild food is also abundant. Proximity to the park boundary, field size, types of crops grown and isolation of fields are some of the variables that may increase the risk of crop raid to individual farms (Barnes et al., 2005; Linkie et al.,

2007). The rainy season is characterized by dark nights which are optimal for crop raiding elephants as they prefer to move during dark nights (Barnes et al., 2007). Crops also have low secondary compounds and contain high sodium levels which are an important nutrient for elephants, while wild plants are mainly defended by substances like tannins (Rode et al., 2006; Sitati & Walpole, 2006).

Local people's perception

Ninety six percent of the local people believed the fence reduced wild animal problems and the perception was similar across the age groups, sex, education, tribe and employment. This could mean that the fence brought a positive effect uniformly accepted among the respondents. Sixty five percent believed the fence does not prevent all animals because some people still lost some livestock and experienced crop raids even after the erection of the fence. The people may have had a high expectation that after the fence establishment there will be no loss of livestock and / or crops. It is necessary to make people aware that the fence can only reduce depredation and crop raids, rather than eliminate them (Madhusudan, 2003; Leblond et al., 2007). People also have to be sensitized of the use of other management strategies that include the use of deterrent chemicals and husbandry methods. (Smith et al., 2000a; 2000b) has suggested the use of chemical deterrents, guarding dogs and donkeys as well as kraaling the livestock at night as other methods of fighting depredation and crop raiding.

The crops that were commonly grown included sorghum, maize, pumpkins and water melon. Some studies have shown that these crops are prone to crop raids compared to the others (Hoare, 1999; Gillingham & Lee, 2003; Chiyo et al., 2005). Growing less palatable or less favourable crops may help reduce the conflict. Chilli grease on field fence as a deterrent can be used and it has been shown to be effective in some cases (Osborn & Parker, 2003; Sitati & Walpole, 2006). The chilli can also be grown around the field as a buffer, since it has also been found to have a high market value (Parker & Osborn, 2006). Growing chilli as a cash crop can produce material for wildlife deterrent programs where community-based groups exist, since people have lost some economic opportunities (Osborn & Parker, 2003).

Only 50% of the respondents believed the fence alignment was as agreed. The fence alignment did not follow the original Park boundary but the river course. Some of the land that was originally communal was gained by the Park. Although some of the land that was part of the Park was now communal, the locals did not want to lose land from the communal area to the Park. This could mean that there was low understanding of negotiations that stated that there would be some land lost by both the land use types.

Ninety four percent of the locals supported the erection of the fence. The people closer to the fence were more supportive because being in the heart of the conflict they previously lost more livestock than their counterparts away from the fence and any changes that came with the fence would benefit people living close to the fence. There was support for the erection of the fence even though some people had lost access to pasture and field because when comparing this loss to the loss incurred when there was no fence, the loss was minimal. Some of the land also has been compensated and some allocated land to continue their activities elsewhere.

The local people suggested that a stronger voltage should be used on the fence and regular maintenance be made. Some fences can render ineffective as a result of lack of adequate maintenance (Thouless & Sakwa, 1995). It has also been shown that the quality of maintenance and voltage are important in keeping animals out (Thouless & Sakwa, 1995; Leblond et al., 2007). There was also a suggestion to put the fence below the ground as some animals can dig and pass under the fence. Another study has shown that even a large size white-tailed deer (*Odocoileus virginianus*) can pass through a 25 cm gap (VerCauteren et al., 2006). Lions, wild dog and leopard can dig and pass under the fence.

Although the Makgadikgadi fence has reduced the reports on human-wildlife conflict it has to be noted that fences are known to disrupt migrations. As Brooks (2005) established in his study, this is the case with the Makgadikgadi fence where about one third of the population of zebra that could move to the west of the riverbed before the fence was erected are now prohibited. Herds of wildebeest and zebra that were found along Boteti River from around Makalamabedi to Tsoi are now restricted inside the Park (Kgathi & Kalikawe, 1993; Brooks, 2005). Areas to the west of

Khumaga and Tsoi are important, especially when forage is poor in the park during drought and fire outbreaks (Brooks, 2005).

Animals may also get entangled in fences and die from dehydrations (Kgathi & Kalikawe, 1993; Mbaiwa & Mbaiwa, 2006). Decline in wild animal population numbers in some cases has been attributed to fences (Mbaiwa & Mbaiwa, 2006) but there are complex and interrelated factors that may play a role in population numbers decline (Perkins, 1996). Interference with grazing patterns causes degradations in some areas. Through remote sensing pictures, Ringrose (1997) established widespread degradation in areas separating management areas by fences. This was explained as restriction to migration (Ringrose et al., 1997; Mbaiwa & Mbaiwa, 2006).

However, this does not stop the use of fences as a balance between agriculture development and wildlife management has to be established. An integration of wildlife management and other land uses should be a priority in all policies (Perkins, 1996; Mbaiwa & Mbaiwa, 2006). An Environmental Impact Assessment (EIA) process has to be applied to all fence projects and the mitigation measures implemented to reduce the detrimental effect that fences have.

Conclusion

The presence of the electric fence has significantly reduced the problem with livestock depredation and crop raids. The results show that the electric fence has been an effective barrier for wild animal movements and reduced human-wildlife conflict. The local people have a high appreciation and support on the erection of the fence. The support was there even though they had some constraints on their activities. Although the fence has been an effective barrier to animal movements, some animals managed to go through. Other management strategies need to be in place to increase the value of the fence. Local people, scientists and administrators should work together to come up with practical management strategies and enforce them.

Fences disrupt wildlife migrations and may cause entanglements. Effective EIA can inform decision makers on possible impacts and mitigation measures to reduce the adverse effects. The results of this study give hope for negotiations and issues of concern to the people on the eastern part where the fence is yet to be erected.

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Appendix

Questionnaire

Background of the interviewee

1. Date: / /2007
2. Location _____
3. Name _____
4. Sex: male ( ) female ( )
5. Age _____years
6. Tribe _____
7. Education: none ( ) primary ( ) secondary ( ) tertiary ( )
8. Employment: farmer ( ) self employed ( ) Government ( ) Private sector ( )
9. Residence: farm ( ) cattle-post ( ) nearby village ( ) other
10. Do you own livestock? Yes ( ) No ( )
11. How many animals do you own? _____ cows____ horses___ goats___ donkeys
12. For how long have you owned them? _____years
13. Do you own a field? Yes ( ) No ( )
14. For how old have you owned the field? _____years
15. What is the size of the field? _____
16. What do you grow in the field? _____
17. What is the distance from the cattle post/ field to the fence_____

Wildlife conflict

18. Have you ever had injuries ( ) death to human (relatives) ( ) threat ( ) from wild animals?
19. Have you ever had your field raided? Yes ( ) no ( )
20. How many times in a year did you have your field raided by wild animals before the fence was erected? _____

21. Did you report to Department of Wildlife and National Parks? Yes ( ) No ( )
22. How many times in a year do you have your field raided since the fence was erected? _____
23. Which animals were causing the damage?
24. Did you report to Department of Wildlife and National Parks? Yes ( ) No ( )
25. Have you ever had livestock killed? Yes ( ) No ( ).
26. How many times in a year did you have animals killed, before the fence was erected? _____
27. Did you report to Department of Wildlife and National Parks? Yes ( ) No ( )
28. How many times in a year do you have your animals killed since the fence was erected? _____
29. Did you report to Department of Wildlife and National Parks? Yes ( ) No ( )
30. Which animals were causing the damage?

People's perception about the fence

31. In your opinion is the fence preventing animals to come to your field or cattle post? Yes ( ) No ( )
32. Does it prevent all animals? Yes ( ) No ( )
33. If no which ones are not prevented by the fence?
34. Do you support the erection of the fence? Yes ( ) No ( )
35. If not, why? _____

Improvements on the fence

36. Is there anything wrong with the fence?
37. Does the fence alignment go as it was suggested?
38. If not which activities does it prevent you from doing? Thatch grass collection ( ) Access to pasture ( ) Crop production ( ) None ( ) Other ( )
39. If other, explain _____
40. What would you like changed about the fence?