UPPSALA
UNIVERSITET

The effect of grazing on Aardwolves and how farmers in Namibia perceive the Aardwolf

Jessica Fagerudd

Arbetsgruppen för Tropisk Ekologi
Committee of Tropical Ecology
Uppsala University, Sweden

Minor Field Study 114

September 2005 Uppsala

UPPSALA
UNIVERSITET

The effect of grazing on Aardwolves and how farmers in Namibia perceive the Aardwolf

Jessica Fagerudd

Master Thesis in Zoo ecology, 20 p, Spring 2004
Department of Animal Ecology, Centre for Evolutionary Biology (EBC)
Uppsala University, Uppsala, Sweden
Supervisors: Professor Mats Björklund and Doctor Jennifer Lalley

Abstract

The distribution of the aardwolf (*Proteles cristatus*) is entirely dependent on the presence of termites, on which it feeds almost exclusively. Farmlands that are grazed by livestock are often suitable habitats for termites and hence for the aardwolf. However, many farmlands are nowadays being intensely grazed and this, together with difficult climate conditions, can act as a threat against the biodiversity and the wildlife, including the aardwolf. To test if the grazing of livestock affects this animal, a comparison of the relative population density of aardwolves was made between an ungrazed reserve and a grazed farm in the semi-desert of Namibia. The study was performed between March and May 2004. The results imply that grazing at a medium level favours the aardwolf. It also seems as intense grazing negatively affects termites, and if that is the case, the aardwolf would be negatively affected as well. Another possible threat against the aardwolf is that it sometimes is being killed because of the misbelief that it attacks livestock. To get an idea of this problem a limited number of interviews were done with farmers in the northern part of Namibia. The interviews are supposed to function as a first hint concerning the problem with the unnecessary killings of aardwolves and are only briefly reported in this paper.

Table of contents

1. Introduction

It is a well known fact that long-time overgrazing in combination with difficult climate conditions can lead to ecological disturbances such as desertification, erosion and bush encroachment (Hunter 2002), and thus act as a threat against biodiversity. With about 2.1 million cattle, 2.4 million sheep (Sweet 1998), and being the most arid African country south of the Sahara (Jensen *et al.* 2002), land degradation is of great concern in Namibia (Ministry of Environment and Tourism, Namibia). The fact that 90% of the wildlife in this country is located outside conservation areas and mainly on agricultural land (Bojö 1996), makes the overgrazing problem even more serious. In a previous study Rova (2003) showed that intense grazing on farmlands does act as a threat against certain wildlife species (Bat-Eared Fox *Otocyon megalotis*) that utilize the same habitat as the livestock. With 44 % of the total land being owned by commercial farmers and 41 % being used by communal farmers (Bojö 1996), there might be several species in Namibia that are being out-competed by the grazing of the livestock. One of these species could be the aardwolf.

The aardwolf (*Proteles cristatus*) is listed as "rare" in the The Red Data Book (www.tikkihywoodtrust.com) and our study area is one of the most arid parts of this animal's range in Southern Africa and it is the edge of its range in western Namibia. The aardwolf is one of the most specialized carnivores in Africa, feeding almost exclusively on certain surface-foraging termites (*Trinervitermes*) (Cooper & Skinner 1979; Kruuk & Sands 1972). The distribution of this mammal is therefore entirely dependent on the presence of these termites and on the habitats that these termites prefer; open, dry country with short grass, especially areas that have been heavily grazed by ungulates (Kingdon 1997). Namibia's many farmlands often consist of open dry country with short grass and heavily grazed areas, which is the habitat the termites prefer. Hence, it is possible that farmlands could act as a good habitat for the aardwolf. However, since the termite eating bat-eared fox has been shown to be negatively affected by the grazing of livestock (Rova 2003), it is possible that farmlands can act as a threat against the aardwolf as well. From these contradicting facts, one hypothesis could be that termites and hence the aardwolf are favoured by grazing to a certain extent, but when the grazing lasts over a long period and gets too intense, it leads to ecological disturbances (desertification, erosion and bush encroachment) that make those habitats unsuitable for most wildlife, including both termites and aardwolves.

Concerning the farming activities, it is not only the grazing of livestock that acts as a threat against the wildlife. To defend their cattle, sheep and goats against predators such as hyenas and jackals, farmers use shooting, trapping, poisoning and watchdogs as methods to get rid of these animals. This has, especially in the northern part of the country, become a problem not only regarding the large predators (Lalley, personal communication). Also innocent insectivores, such as the aardwolf, are occasionally mistaken for predators and are therefore also being killed (The Namibian 2003a, b, Bonnier 1984). Since the farmers' watchdogs do not distinguish between aardwolves and jackals, the former are often targeted when packs of watchdogs hunt black-backed jackals (Kingdon 1997). There is also an ignorant belief that aardwolves in fact are involved in livestock losses which often leads to persecution of this mammal (Frandsen 1998).

In this paper I compare the relative abundance of aardwolves at the Kulala Wilderness Reserve (a non-farming area) with the Hammerstein 102 farm (a farming area) in the south west of Namibia, to test if the grazing of livestock affects the aardwolf population. To get an

idea of the problem with innocent insectivorous mammals being killed because of misbelieves, a pilot study was conducted that included 20 interviews in one farming community in the Okakarara region in the northern part of Namibia. The interviews enquired into each farmer's knowledge about aardwolves, bat-eared foxes, jackals and hyenas and what interactions he/she has had with these animals.

This research is a part of the Namibian Small Carnivore Project that was started 2000 by Wilderness Safaris Namibia. The purpose of this project is to increase knowledge on the ecology of arid-adapted small carnivores in Namibia (Lalley 2001). The interviews, that are supposed to function as a pilot study concerning the problem with the unnecessary killings of aardwolves, were done as an additional part of the study and are only briefly reported in this paper.

2. Material and methods

2.1 Study animal

The aardwolf (*Proteles cristatus*) belongs to the family Hyaenidae (Bothma 1998) and is a medium sized (7-10 kg, 40-50 cm height) mammal that lives in open grasslands, semi-desert areas and savannahs in the east-central and southern Africa (Skinner & Smithers 1990). This animal is one of the most specialized carnivores in Africa, feeding almost exclusively on certain species of termites (*Trinervitermes*). This termite species is nocturnal (Richardson 1987a), and hence the aardwolf is primarily nocturnal as well. During night the termites forage on the surface in large parties, often numbering 4000 individuals (Richardson 1987a), making them an easy target for the aardwolf that licks them up from the ground (Richardson 1987b). The aardwolf can eat as many as 300 000 termites in one night during summer (Richardson & Levitan 1994). In the winter, when it sometimes gets too cold for the Trinervitermes to emerge, the aardwolf also forages on the *Hodotermes mossambicus* termite. This species is active during day, allowing the aardwolf to forage in late afternoon during the Southern African winter months. *Hodotermes mossambicus* termites are very irregular in their surface foraging and do so in much smaller parties, usually 10-20 individuals (Richardson 1987a). This termite species is therefore a much less reliable food resource for the aardwolf (Kruuk & Sands 1972). Other insects are eaten as well, but in small quantities (Bothma 1998).

The aardwolf is socially monogamous and occupies a territory together with its mate and their most recent offspring (one to three cubs are produced every summer) (Richardson 1987a). In their territory, which is of the size 1-4 km^2 and contains about 3000 termite mounds (Kruuk & Sands 1972), the aardwolves construct 5-6 dens, usually by enlarging vacant springhare, aardvark or porcupine burrows (see Williams *et al.* 1997). Although it shares the territory with its mate, the aardwolf lives solitary except when mating or accompanying its young cubs (Richardson 1987a). The territory contains several clearly defined latrines that the aardwolves use for defecation. The round-shaped latrines are usually two meters in diameter (personal observation) and consist of soft sand. Defecation is also done randomly outside the latrines (Skinner & Smithers 1990).

2.2 Study area

The study was conducted between the 3rd of March and the 17th of May 2004 at the Kulala Wilderness Reserve and the Hammerstein 102 farm, in the south west of Namibia (Figure 1).

Figure 1. Map of Namibia. The study area is marked with an arrow.

The Kulala Wilderness Reserve is a 20 000 ha private reserve that borders to the east central part of the Namib Naukluft Park in the semi-desert of Namibia. Until 1996 a farmer used this area as a grazing area for cattle and sheep and now the new owner, Wilderness Safaris Namibia, which combines wildlife management and eco-tourism, is trying to rehabilitate and manage the property into a wildlife reserve. On the reserve, there are four camps, each with a main building, staff quarters and eight to twelve guest bungalows/tents. The camps can together accommodate a maximum of 68 guests at the same time. The guests are not allowed to drive on their own on the reserve, with exception when arriving and leaving the camps, and then this is done on the “main roads”. During game drives, guided tours and other driving performed by the staff, off-road driving is strictly forbidden.

The Hammerstein 102 farm is a 14 000 ha property situated approximately 50 km south east of the Kulala Wilderness Reserve. Today the farm mainly functions as a guest farm for tourists, but it also runs farming activities in form of livestock raising. 280 cattle and 1200 goats are grazing on 10 000 ha of the total area. On this grazing area, no main buildings are situated.

For both the Kulala Wilderness Reserve and the Hammerstein farm the dominant vegetation is semi-desert grass savannah. The two areas consist of several different habitat types, such as gravel plains, grass plains, sand plains, mountains and dry ephemeral riverbeds (that occasionally receive water in the rainy season).

The climates of the areas are classified as arid to hyper-arid, with a mean annual rainfall of 50-100 mm. Summer, defined as the rainy season, extends from October to April and is characterized of hot weather, while winters (May – September) consist of warm days and cool nights.

2.3 Field methods

To be able to tell if grazing affects the aardwolf population, estimations of the relative abundance of this animal were done both at the reserve and on the farm. Two different methods were used, namely line transect sampling of aardwolf faeces and signs of food resources during daytime, and line transect distance sampling of aardwolf sightings during night.

2.3.1 Daytime transects

A grid was superimposed on the maps of the reserve and the farm, making the areas divided in 1x1 km squares. The squares that mainly consisted of mountain areas (not suitable habitat for the study animal) were left out and then 30 % of the remaining squares on each map were randomly chosen as transects. This resulted in a total of 82 one km long transects, 57 on the reserve and 25 on the farm. The coordinates for the start points of the transects were calculated from the maps and then a GPS unit (Garmin 12 and Garmin II Plus) was used to detect those spots out in the field.

The transects were carried out by foot and with two persons walking with a distance of 3 m between each other. Every transect was walked once, either in the morning or in the afternoon. When possible the transects were walked in a south-north direction, otherwise in an east-west direction. The width of the transect was 6 m; each observer recorded all observations made within 3 m, 1.5 m to the left and right. The transects were sampled for (a) habitat type, (b) termite and other insect abundance and (c) aardwolf faeces (for description, see below under *Parameters*). The GPS unit was used to mark the observations. On the farm, a (d) "grade of grazing" was also noted (see *Parameters* below).

In this study, where only a relative abundance of the aardwolf is required, every faecal spot and latrine was counted as one animal. The aardwolf densities from the daytime transects are therefore not to be seen as true population densities.

Parameters

(a) Habitat type

To be able to compare the relative abundance of aardwolves on the two study areas and isolate the effects of grazing, any differences in habitat types needed to be assessed. The different habitat types were classified as:

1. Soft ground with grass and bushes
2. Soft ground with grass
3. Stony ground

(b) Termite and other insect abundance

Since termites are the principal food of the aardwolf, termite mounds were counted. Also insects (both holes and sightings of actual insects), that act as secondary food, were counted.

(c) Aardwolf faeces

Aardwolf faeces are easy to identify because of the ammoniacal smell of termites and were counted as an estimation of the relative abundance of this species.

(d) Grade of grazing

To be able to assess if grazing of the livestock affects the termite, insect and/or aardwolf distribution, the grade of grazing on the daytime transects at the farm were noted. This was done by using a three-grade scale;

Grade	Definition
1	Little grazing and trampling. (Less than 40 % of the surrounding area was trampled, grass height over 10 cm.)
2	Moderate grazing and trampling. (40-80 % of the surrounding area was trampled, grass height 5-10 cm.)
3	Intense grazing and trampling. (More than 80 % of the surrounding area was trampled, grass height less than 5 cm.

2.3.2 Night time transects

Since the aardwolf is a nocturnal mammal, the countings of the actual animals were performed during night time from a vehicle. The driven night time transects were performed only on the existing roads, both at the reserve and at the farm, since off-road driving is forbidden at the reserve.

The road-network at the two different areas were divided into several straight transects. The total length of all the transects was 59.2 km at the reserve and 29.3 km at the farm. Since the activity for many animal species may differ depending on the moon status (Biebouw and Blumsein 2003; Kolb 1992; Molsher et al 2000) the night-drives were performed once at full moon, once at half moon and once at new moon, making every transect being driven three times each. The aardwolves were observed from a 4x4 vehicle driving at 20 km/h, with one observer sitting on the roof of the car, using the traditional method of searching for eye reflections with a high-intensity spotlight, and the second observer below in the driver's seat. Previous studies (Bothma 1983) have shown that spotlights do usually not disturb the aardwolf. When an animal was detected, the vehicle was stopped and an 8x42 mm binocular was (when necessary) used to identify the species. Skinner (1990) states that aardwolves, unlike other species, are prone to stand in a beam of light, appearing confused, which enhanced the possibility to identify this species. The positions of the aardwolves were recorded with the GPS unit and date and group sizes were noted.

2.3.3 Interviews

To evaluate the problem with innocent insectivorous mammals being killed because of misbelieves among farmers, interviews were conducted with 20 communal farmers in the Okakarara region in the northern part of Namibia (Figure 2). With the help of an interpreter and by showing pictures of the aardwolf, bat-eared fox, black-backed jackal and the spotted hyena, the farmers were asked if they recognised the animals. They were then asked how often they see the animals, if they know what these animals eat and if they are seen as a problem for the farmers and their livestock. If any of the animals were seen as a problem, the farmers were asked how they act to solve that problem.

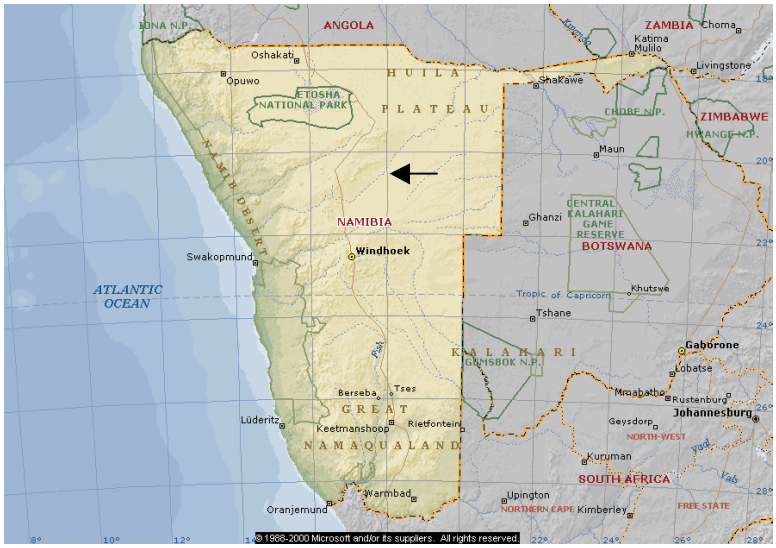

Figure 2. Map of Namibia. The interview area is marked with an arrow.

2.4 Statistical methods

To calculate the relative animal densities, I used the Burnham density method:
$D = (n \times f(0)) / 2L$
where;
D = the estimated density of the species (individuals/km^2)
n = the total number of animals seen
f(0) = the probability density function at zero distance from the strip
L = the total length of the transect (Knott & Venter 1987).

Oziexplorer was used for the work with the GPS-coordinates and to create maps.

3. Results

3.1 Population density estimation

The reserve and the farm areas were compared concerning the different habitat types. No differences were found between the two areas (Mann-Whitney *U*-test; $W = 2341$, $P < 0.26$). Habitat type 1 (soft ground with grass and bushes) was the dominant habitat type for both the reserve and the farm (Figure 3).

The reserve and the farm areas were also compared concerning their termite and insect abundances. There was a difference between the two areas in termite abundance (Mann-Whitney *U*-test; $W = 1380$, $P < 0.001$). At the farm, each transect held on average 87 termite mounds while the corresponding number at the reserve was 41 termite mounds (Figure 4). There was no significant difference between the reserve and the farm in insect abundance (Mann-Whitney *U*-test; $W = 968$, $P < 0.74$).

Most aardwolf observations were recorded at the reserve during full moon, 0.09 individuals/km^2. On the same area, the density during new moon was 0.07 individuals/km^2 and during half moon 0.03 individuals/km^2. At the farm, aardwolves were observed only during the full moon night drive. The density was then calculated to 0.05 individuals/km^2 (Figure 5). The relative aardwolf density based on aardwolf faeces was 0.15 individuals/km^2 at the reserve, and 0.36 individuals/km^2 at the farm (Figure 6).

I found no difference in the numbers of termite mounds in relation to the different grades of grazing (Kruskal Wallis; $H = 5.16$, $P < 0.076$). However, the scatter graph illustrates that there seems to be a large difference between transects of grades 1 and 2 and the intensely grazed transect of grade 3 (Figure 7). The small sample size of transects classified as grade 3 made it difficult for this test to evaluate such differences. On the other hand, there was a significant difference in the amount of insects in relation to the different grades of grazing (Kruskal Wallis; $H = 6.38$, $P < 0.041$), where more grazed transects held fewer insects (Figure 8).

There was no difference in numbers of aardwolf faeces due to the different grades of grazing (Kruskal Wallis; $H = 2.32$, $P < 0.31$) (Figure 9).

3.2 Interviews

Of the 20 interviewed farmers, four of them almost never see the aardwolf. From these farmers no answers about the feeding habits of the aardwolf were given. The answers from these four persons were therefore not used in this study. Ten of the remaining 16 farmers knew that the aardwolf is not a threat against their livestock. Of these ten, three of them reported only insects as the aardwolf's major food resources, another three said fruits, and another three said both fruits and insects. The remaining one thought that the aardwolf eats both insects and carrion. The six other farmers did not have any idea of what the aardwolf eats. As answers on the question about how the farmers act to protect their livestock from predators, different methods were mentioned (some of the farmers used more than one method); watch dogs (nine farmers), shepherds (six farmers), traps (one farmer), poisoning (one farmer), and shooting (one farmer). Two of the farmers did not do anything to protect their livestock.

4. Discussion

4.1 Population density estimation

The main objective of this study was to assess if grazing of livestock has an affect on the aardwolf population.

The relative aardwolf density was higher at the farm than at the reserve in the daytime transects, as interpreted from counts of faeces. In contrast, the results of the night time transects showed that the relative aardwolf density was higher at the reserve than at the farm. Hence, there was a contradiction between the reserve and the farm concerning the relative aardwolf density. There might be several explanations for this. The fact that more aardwolf faeces were found at the farm compared to the reserve was probably because the farm was not intensely grazed to negatively affect the termite and the aardwolf density, but instead possessed a suitable grazing level for termites and hence aardwolves. This makes sense when looking at the average number of termite mounds per transect at the reserve compared to the farm. There was a significant difference between the two areas, with the farm holding on average more than twice as many termite mounds per transect as the reserve (Figure 4). My hypotheses that a medium level of grazing actually favours termites was supported when studying the scatter graph over the different grades of grazing versus the termite density (Figure 7); both transects of grade one (little grazing/trampling) and transects of grade two (moderate grazing/trampling) held large amounts of termites. This was unexpected, since I thought that little grazed/trampled transects would have the most termite mounds, moderately grazed/trampled transects would have less termite mounds and intensely grazed/trampled transects would hold the least number of termite mounds. According to my results, transects that were little (grade one) or moderately (grade two) grazed/trampled were rather similar in termite abundance. Hence, neither transects with grazing grade one nor two seem to be enough disturbed to affect the termite and hence the aardwolf abundance negatively, but rather positively. The fact that termites seem to prefer grazed areas may be due to the diversity of grass species that grazing encourages or the short length of grass. On the other hand, transects that were intensely grazed/trampled (grade three) consisted of observably less termites, which supports my hypotheses that intense grazing would affect termites negatively.

If this is the case, that the farm mainly was not overgrazed, but instead possessed a somewhat optimal grazing pressure for the termites, it makes sense why more aardwolf faeces were found on the farm compared to the reserve. But why did we not see more of the actual animals during our night-drives at the farm? One possible explanation could be that the aardwolves were harder to detect at that farm since that area held more of the larger sized shrubs than the reserve did. The aardwolf is a solitary animal and if it forages in an area with large shrubs, it might be easy to miss. The area at the reserve was more open with fewer large sized shrubs and because of this it was easier to detect the animals there. The fact that most aardwolves were detected during full moon could have two possible explanations. First, it could be because the aardwolf is more active during full moon. Second, the explanation could be that the aardwolf is equally active during half and new moon just as during full moon, but it was much easier for us to detect the animals when it was lighter.

Another explanation to why we saw fewer aardwolves during night time at the farm compared to the reserve could of course also be that there actually were fewer aardwolves at the farm. But if that is the case then the fact that we found more than twice as many aardwolf faeces on

the farm compared to the reserve does not make sense. Hence, this fact makes this last explanation less probable. But this may indicate that there is a significant impact of livestock farming on the sensitivity of the aardwolf population – animals in areas with more activity tend to be more easily frightened. Further studies into the levels of human activity are needed to explain this.

Our results showed a negative correlation between the number of insects and the level of grazing. Since insects (other than termites) are thought to constitute just a minimal part of the diet of the aardwolf, then this finding might not seem to be of great importance for the aardwolf population. On the other hand, if insects are affected by intense grazing, then insect feeding small carnivores such as cape fox may also be affected negatively. This in turn could leave gaps for termite feeding carnivores such as the aardwolf.

Since the statistical tests showed no correlation between grazing and number of termites, it is not surprising that there was no difference in numbers of aardwolves due to the different grades of grazing.

4.2 Interviews

We found out that ten of the 16 farmers knew that the aardwolf was not a threat against their cattle and goats. These ten persons had also a pretty good knowledge about what aardwolves eat. On the other hand, the six other farmers did not have any idea about what this animal eats, and hence could not say if it was a threat against their cattle and goats or not. Of all the farmers, only one reported that he sometimes shoots predators to protect his livestock. However, the fact that nine of the farmers used watchdogs and another two used either traps or poisoning seems to be a greater problem than the selective killing by shooting. Watchdogs, traps or poisoning do not differentiate between jackals and aardwolves.

Hence, according to the pilot study, the problem with farmers unable to distinguish between aardwolves (and other insectivorous animals) and for livestock threatening animals does not seem important. However, since the problem with killing carnivores are quite large in some areas in the country (Lalley, personal communication; The Namibian 2003a, b), we believe that these particular farmers' knowledge and awareness of the carnivores might have something to do with a previous conservation work that had been done recently in this area. That project concerned wilddogs and had in view to inform the farmers about this endangered species situation and how to encounter this animal. It is likely that conservation work on one species might increase the awareness of other species as well. Another factor that most probably has enhanced the awareness of conservation issues among these farmers is the recently formed conservancy in the Okakarara region, where we performed our interviews. These kind of community-based conservancies, which exist in several parts of the country, consist of areas of communal land on which the members of the community have pooled resources for the purpose of conserving and making wildlife sustainable. Conservancy members benefit financially from wildlife and tourism, through a range of activities (Frontline 2002). When talking to the farmers, some of them also told us that the conservancy did not allow killing of predators, so instead of killing the jackals they used shepherds and watchdogs and chased the predators away. The establishment of communal conservancies can hence hopefully greatly benefit conservation of the wildlife.

4.3 Conclusions

Although there was a contradiction between the reserve and the farm concerning the relative aardwolf density, it is reasonable to assume that the relative aardwolf density was higher on the farm. This assumption is based on the hypothesis that the aardwolf faeces found during daytime gives a more reliable measure of the aardwolf density than the counted aardwolves during night time does. Most of the transects on the farm were grazed little or moderate and these grades of grazing seemed to favour termites, and the number of termite mounds per transect was on average twice as many at the farm compared to the reserve. This indicates that grazing at a moderate level favours termites and hence the aardwolf. On the other hand, we saw less termite mounds and no aardwolf faeces on the three transects that were classified as intensely grazed. This indicates that aardwolves are negatively affected by intense grazing.

According to the interviews, the problem with farmers killing aardwolves seems not to be a major problem in the studied area. However, since this was only a pilot study, a more extensive interview study needs to be done to be able to say something more about this problem.

Since its independence in 1990, Namibia has begun to explore the idea of conservation of wildlife and sustainable development. Today Namibia is renowned for its protected areas and wildlife (Bojö 1996). However, the problem with overgrazing is still large and although several steps to address environmental issues in Namibia has been made, a lot still needs to be done to prevent the degradation of land and the decrease of biodiversity. Wildlife is extremely valuable for a country that gets a large part of its income from tourism. Today some farmers are combining farming with tourist activities, for example photo-safaris and game drives, and this is often more profitable than livestock production (Bojö 1996). For most tourists, the aardwolf is an unknown species and farmers could therefore benefit by having this special animal on their property. The fact that termites compete for food with grazing animals, and that termite activity can result in almost complete denudation and lead to accelerated erosion (Lee 1971), are also reasons for why farmers would benefit by having termite eating aardwolves on their properties.

5. Acknowledgements

First, I wish to thank my absolutely superb supervisor in Namibia, Jennifer S Lalley, for making this interesting study possible. Thanks for all your invaluable support and your always good spirits. Without your ideas and your generous help, this project would not have come to be. Second, I want to say thank you to my Swedish supervisor, prof. Mats Björklund, for helping me with both the preparations and this report from the beginning until the end. I would also like to thank the Swedish International Development Cooperation Agency (SIDA) and the Committee of Tropical Ecology at Uppsala University for the financial support. Without that, this study would not have been possible

I would like to express my fullest appreciation to the staff at Wilderness Safaris' office in Windhoek for being so very kind and helpful. A special thanks to David van Smeerdijk for your hospitality and making me feel really welcome when I arrived to Namibia. Jane Meyer, thank you for taking your time to help us with all practical things. Basilia, a big thank you for all your help in the field and for pleasant company.

To all the staff at Soussosvlei Wilderness Camp; I am so grateful for getting the privilege to be around you people. I will never forget your kindness and songs, like "Stop, stop, stop"..! An extra thank to Hermann who helped me with contacts and learned me a lot about Namibia. And Dios, you really brightened up the days with your laughter! Thank you for all your help in the field, I will never forget that. I would also like to thank the staff at the other Wilderness camps, for all your kindness and outstanding service. I am very grateful for getting the chance to stay at those fantastic camps. It was totally unforgettable and amazing!

I would also like to thank Matthew Porteus and Hammerstein Lodge and camp for letting me perform a part of this study on their property. Thank you for your interest and hospitality!

Emma and Nina at Uppsala University, thank you for helping me with the application and for all your tips and recommendations.

Many thanks to my dearest fiancé, my family and my friends for letters, e-mails and phone calls. It meant a lot to me.

Last, but not least, I would like to thank my friend and co-worker in this project, Linda Kurberg. I cannot imagine another person whom I'd rather walk with side by side on all our daytime transects... After about three years talking about going to an exotic country to study wild animals, we finally made it! It became an absolutely fantastic adventure and I would like to thank you for your nice company and all our fun memories.

6. References

Biebouw, K. & Blumstein, D.T. 2003. Tammar wallabies (*Macropus eugenii*) associate safety with higher levels of nocturnal illumination. Ethology Ecology & Evolution 15(2): 159-172.

Bojö, J. 1996. The economics of wildlife: case studies from Ghana, Kenya, Namibia, and Zimbabwe. Environmentally Sustainable Development Division workingpaper No. 19, pp 81-111.

Bothma, J.D.P. 1998. Carnivore Ecology in Arid Lands. Springer-Verlag Berlin, pp 89-148.

Bothma, J.D.P. 1983. Food niche separation between four sympatric Namib Desert carnivores. J. Zool., Lond. 202: 327-340.

Cooper, R.L. & Skinner, J.D. 1979. Importance of termites in the diet of the aardwolf *Proteles cristatus* in South Africa. S. Afr. J. Zool. 14: 5-8.

Directorate of Environmental Affairs. Ministry of Environment and Tourism, Namibia.

Frandsen, R. 1998. Southern Africa's Mammals a field guide. Honeyguide publications, Sandton, pp 56-57.

Frontline 2002, Vol 19**.** Conservation and some claims. World affairs.

Hunter, M.L Jr 2002. Fundamentals of conservation biology, 2:nd ed. Blackwell Sience, Abingdon, England, pp 185-187.

Jensen, S., //Gaseb, A. & /Nawaseb, G. 2002. An Overview of Desertification Issues in the #Khoadi //Hoas Conservancy. Napcod Discussion Document 1/2002.

Jordens djur. 1, Rovdjuren: de viktigaste landlevande rovdjuren. 1984. Bonnier Fakta Bokförlag AB, p 151.

Kingdon, J. 1997. The Kingdon field guide to African mammals. Academic Press, London, pp 264-265.

Knott, A.P. & Venter, J. 1987. An observation on the relative accuracy of two transect census techniques. Lammergeyer 38.

Kolb, H.H. 1992. The effect of moonlight on activity in the wild rabbit (*Oryctolagus cuniculus*). J. Zool., Lond. 228(4): 661-665.

Kruuk, H. & Sands, W.H. 1972. The aardwolf (*Proteles cristatus*, Sparrman 1783) as a predator of termites. E. Afr. Wildl. J. 10: 211-227.

Lalley, J. 2001. Namibian Small Carnivore Project. Project description. Windhoek.

Lee, K.E. & Wood, T.G. 1971. Termite and soils. Academic Press, London, pp 85-170.

Molsher, R.L., Gifford, E.J. & McIlroy, J.C., 2000. Temporal, spatial and individual variation in the diet of red foxes (*Vulpes vulpes*) in central New South Wales. Wildlife Research 27(6): 593-601.

Richardson, P.R.K. 1987a. Food consumption and seasonal variation in the diet of the aardwolf *Proteles cristatus* in southern Africa. Zeitschrift für Saugetierkunde 52: 307-325.

Richardson, P.R.K. 1987b. Aardwolf mating system: Overt cuckoldry in an apparently monogamous species. S. Afr. J. Sci. 83: 405-410.

Richardson, P.R.K & Levitan, C.D.. 1994. Tolerance of aardwolves to defence secretions of *Trinervitermes trinervoides.* J. Mammal 75(1): 84-91.

Rova, E. 2003. Estimating the rehabilitation of former farmlands into wildlife areas using the bat-eared fox as an indicator species. Committee of Tropical Ecology, University of Uppsala, Minor Field Study 94.

Skinner, J.D. & Smithers, H.N. 1990. The Mammals of the Southern African Subregion. University of Pretoria, Pretoria.

Sweet, J. 1998. Livestock – coping with drought: Namibia – a case study. Northern Regions Livestock Development Project. Tsumeb, Namibia.

The Namibian 08-06-2003a. Slaughtered animal was rare aardwolf. Africa News Service.

The Namibian 08-14-2003b. The truth about the harmless aardwolf. Africa News Service.

Tikki Hywood Trust, Harare Zimbabwe. www.tikkihywoodtrust.com, 15-09-2004.

Williams, J.B., Anderson, M.D. & Richardson, P.R.K. 1997. Seasonal differences in field metabolism, water requirements, and foraging behaviour of free-living aardwolves. Ecology 78(8): 2588-2602.

7. Figures

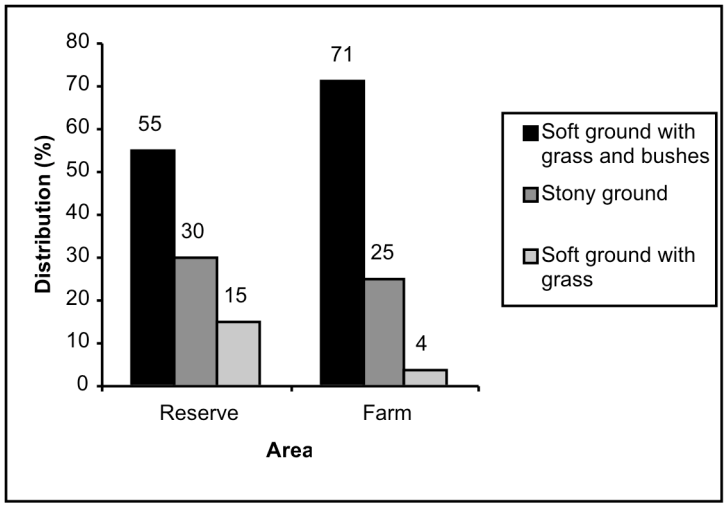

Figure 3. Distribution of the different habitat types at the reserve and the farm.

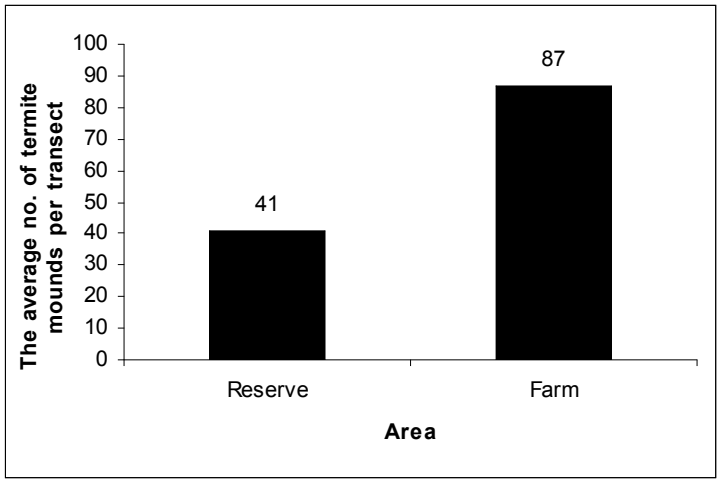

Figure 4. The average number of termite mounds per transect at the reserve and the farm.

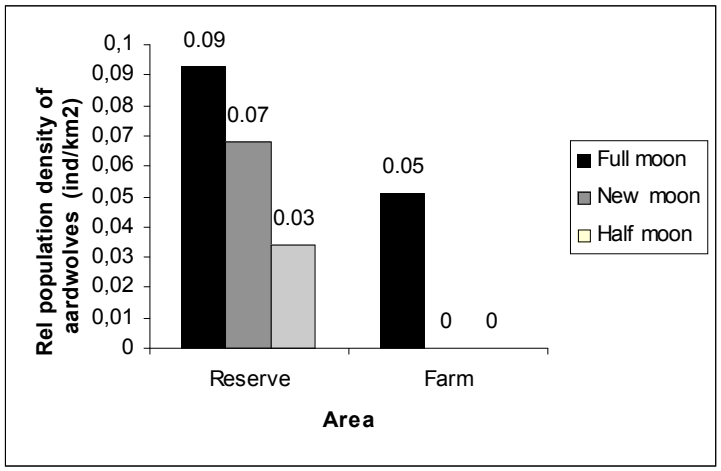

Figure 5. Relative population density of aardwolves (ind/km^2) at the reserve and the farm based on the night time transects.

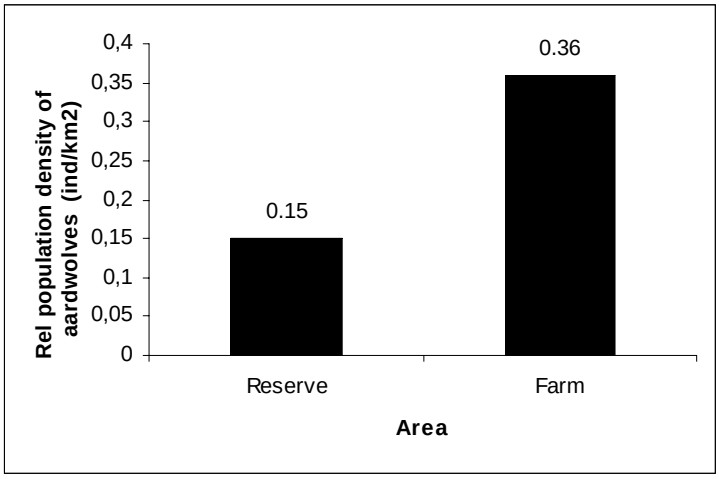

Figure 6. Relative population density of aardwolves (ind/km^2) at the reserve and the farm based on the daytime transects.

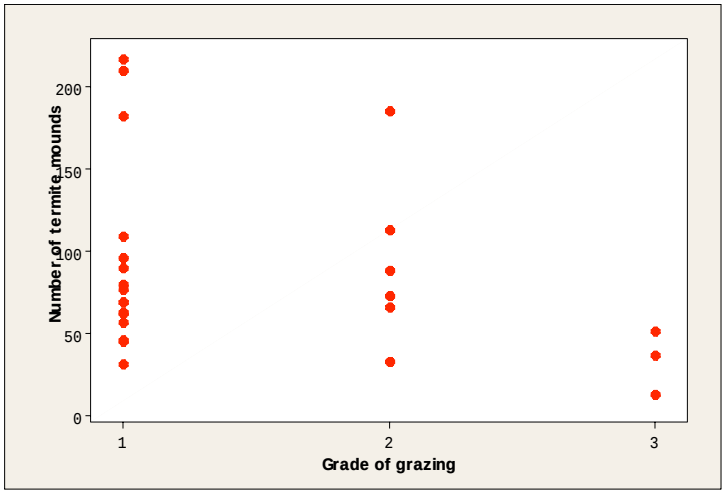

Figure 7. Number of termite mounds in relation to the grade of grazing on respectively daytime transect at the farm.

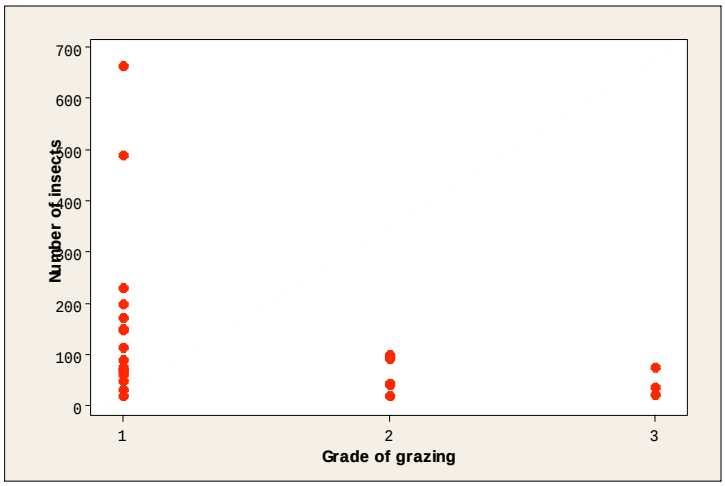

Figure 8. Number of insects in relation to the grade of grazing on respectively daytime transect at the farm.

Figure 9. Number of aardwolf faeces in relation to the grade of grazing on respectively daytime transect at the farm.