

CONFLICTS BETWEEN HUMANS AND WOLF:
A STUDY IN BOZDAĞ, KONYA PROVINCE, TURKEY

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ABSTRACT

CONFLICTS BETWEEN HUMANS AND WOLF: A STUDY IN BOZDAĞ, KONYA PROVINCE, TURKEY

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Canis lupus is one of the most important but least studied species of Turkish fauna, however, livestock depredation and recently increased number of publications on attacks on humans intensifies human-wildlife conflict. In this study, wolf depredation is studied in Bozdağ in the province of Konya where conflicts between wolves and livestock holders are well known.

The study site holds >50,000 sheep and covers 9 villages and a small town. A total of 13 shepherds are interviewed in 2004 and 2005 to reveal husbandry methods and vulnerability of livestock to wolf attacks in Bozdağ. Each flock is attended by a shepherd and several livestock guarding dogs (LGDs), and experiences 1.96 wolf attacks per year, on average, independent of flock size. The flocks attended by less LGDs experience less attacks and therefore, the quality of the LGDs –not their numbers- are more important. Confining sheep in corrals that are attended by a shepherd and good quality LGDs appears to be the most effective husbandry method to decrease depredation. Human attitude towards wolf is also assessed and

the perception of wolf is generally negative; 8 out of 11 shepherds are in favour of the eradication of this carnivore.

Publicized wolf attacks on humans are compiled from 21 news sources on the internet and records of wolf rabies are sought from various sources. There were five publicized cases of attacks on humans, no verified records of human death between 2000 and 2005. Rabies stands out as the primary reason of wolf attacks, but it requires further research because proper records are missing.

Keywords: *Canis lupus*, wolf, depredation, livestock, human-wildlife conflict

ÖZ

KONYA – BOZDAĞ'DA İNSAN – KURT ÇATIŞMASI

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Canis lupus Türkiye faunasındaki en önemli ama en az çalışılmış türlerden biridir, fakat evcil hayvanlara saldırılar ve haberlere yansıyan insana saldırı olaylarındaki son zamanlardaki artış insan-yabanhayat çatışmasını arttırmaktadır. Bu çalışmada, kurtlar ve hayvan sahipleri arasında çatışma olduğu bilinen Konya ili Bozdağ yöresinde koyunlar üzerindeki kurt baskısı araştırılmıştır.

Çalışma alanına 9 köy ve bir kasaba girmektedir ve alanda 50,000'in üzerinde koyun bulunmaktadır. 2004 ve 2005 yıllarında toplam 13 çoban ile görüşülmüş ve Bozdağ'daki hayvancılık uygulamaları ile koyunların kurt saldırılarına hassasiyetleri tespit edilmeye çalışılmıştır. Her sürünün başında bir çoban ve birkaç çoban köpeği bulunmaktadır ve sürü büyüklüğünden bağımsız olarak herbiri yılda ortalama 1.96 kurt saldırısına uğramaktadır. Daha az sayıda çoban köpeği tarafından korunan sürülerin daha az saldırıya uğraması köpeklerin sayılarından çok kalitelerinin önemli olduğunu göstermektedir. Sürünün bir çoban ve kaliteli köpekler eşliğinde ağıl içinde barındırılması koyun kaybını azaltmada en etkili hayvancılık uygulaması olarak ortaya çıkmaktadır. Bölgede insanların kurda

yaklaşımı da incelenmiştir ve genellikle olumsuz olduğu görülmüştür; 11 çobandan 8'i bu yırtıcının öldürülmesi taraftarıdır.

Basına yansıyan kurt saldırısı olayları internet üzerinde 21 haber kaynağı taranarak toplanmış ve çeşitli kaynaklardan kuduz kurt kayıtları istenmiştir. 2000-2005 yıllarında kurtların insana saldırdığı beş olay bulunmuştur ancak kurtların neden olduğu ölümlü ve doğrulanmış hiçbir kayda rastlanmamıştır. Kuduz hastalığı kurt saldırılarının en önemli nedeni olarak görünmektedir ancak kayıtların yetersizliği nedeniyle bu konuda daha çok çalışma gerekmektedir.

Anahtar Kelimeler: *Canis lupus*, avlanma, hayvancılık, insan-yaban hayat çatışması

To Mom and Dad

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CHAPTER 1

INTRODUCTION

The wolf is a mammal that has attracted significant interest of humans, gained respect, fear and hatred all at the same time in many cultures worldwide and both in history and at present. These mixed feelings towards the wolf are apparent in various myths, epics, fables and tales, in which wolves are depicted as either evil or heroic. The reason behind this highly emotional approach to this canid is probably its long history of coexistence with man and the resulting competition for the same prey, the ungulates. This competition has placed the wolf to the core of the human-wildlife conflict, which is identified as a big obstacle to conservation of all carnivores.

In order to understand its complex relationship with humans, one has to know the behaviour of wolf. Therefore, firstly, background information on the species *Canis lupus* gathered by a literature survey will be given in this chapter. In addition, reasons of conflicts between humans and wolf will be presented and the objectives of this study will be stated.

1.1 Life History of Gray Wolf

Gray wolf, *Canis lupus* L., 1758 is a well-known mammal classified in the Family Canidae under Order Carnivora. Being one of the most adaptable mammals, the wolf is distributed in many parts of the world, from Alaska to Saudi Arabia (Mech

& Boitani, 2003) inhabiting very diverse habitats including tundra, taiga, forests, plains and deserts (Busch, 1995).

Wolf is also the most widespread large predator in Turkey. Despite this fact, there are no studies on this canid but the population in the country is variously estimated to be 1000 (Mech & Boitani, 2003), between 5000 and 10000 (Bilgin & Can, 2001) or between 5000 and 7000 (Can, 2004).

Wolf is a very flexible mammal with a highly variable diet, a broad geographical range and high adaptability, very much like humans. Therefore, there is high variation in many aspects of its biology. An example of high individual variation is apparent in their fur colour, varying from different shades of gray and brown to black, as well as the white Arctic wolves (Fig. 1-1).



Figure 1-1. Two grey wolves in Bozdağ Turkish Mouflon Breeding Station. Photograph taken by a camera trap (December 2004).

Wolves have very sharp vision and delicate hearing but their most acute sense is smell. A wolf locates the prey primarily with its scent. Second best sense, hearing is

especially important in vocal expressions as a means of communication. Howls are the most studied form of vocalizations of wolves. Wolves howl for many reasons including to announce whereabouts or as an alarm, to attract mates or to stimulate pack members prior to a hunt (Busch, 1995). Howls can be heard several kilometres away depending on the weather conditions (Mech & Boitani, 2003).

1.1.1 Social structure

Wolf is a social animal that lives in packs comprising a reproductively active pair (i.e. alpha male and alpha female) and their offspring of successive years (i.e. litter of that year and usually the year before) (Mech & Boitani, 2003). There is a strict age-graded dominance hierarchy in a pack where the alpha male and the alpha female are dominant over the other members, and litter of the previous year are dominant over that year's pups (Mech & Boitani, 2003).

There has been a theoretical debate on the factors affecting the number of wolves in a pack. The most generally accepted theory states that pack size is variable in relation to the size of primary prey in the wolf inhabited area and it can be as low as 2 or as high as 42 (Mech & Boitani, 2003). Nevertheless, availability of primary prey is identified to play a role on wolf's pack size.

Higher pack sizes in regions with large prey are consistent with the view that hunting is often a cooperative act. Nevertheless, there are also solitary wolves that manage to survive and kill even the largest prey without any outside help. The most reasonable explanation to the relationship between prey size and pack size is that wolf pups do not disperse as long as food supply can support the whole pack (Mech & Boitani, 2003). In other words, when the amount of prey consumed per wolf becomes lower, the wolves other than the alpha pair leave the pack to form a new pack in a new territory.

1.1.2 Territoriality

Wolves are highly territorial mammals with each pack defending its territory. Territoriality brings about economical defence of resources and it also bears an adaptive value by decreasing the probability of confrontation with a competitor and as a result lowering the energy consumed to defend the hunted prey and pups against outsiders (Wilson, 1975).

Territory size is also highly variable among wolf packs in different regions of the world. The smallest recorded territory is 33 km² belonging to a pack of six in north-eastern Minnesota (USA) and the two largest are 4,335 km² of a pack of ten in Denali National Park (Alaska) and 6,272 km² of again a pack of ten in Alaska (Mech & Boitani, 2003). Since there are no studies on the territory size of wolves in Turkey, the only available information is their density in Bolu region that is 2.2 – 2.8 individuals per 100 km² (Can, 2000).

Most of the individuals dispersing from their natal packs seek for a mate and a territory to form a new pack. When a pair newly occupies a territory, they must secure enough prey and resources for their future offspring; otherwise the territory needs to be enlarged later.

Territorial defence is attained by means of scent marking, howling and direct attacks. Wolves mark their home range by urination, defecation and ground scratching. Markings are denser along the boundaries than in the core region of the home range. In addition, marks are more likely to be found along and at the junctions of regular travel ways. Scent marks can advertise the presence of the pack in an area for 2 or 3 weeks and hence deter potential intruders (Mech & Boitani, 2003). Another way of claiming the territory is howling and it is effective in longer distances than scent marking. The studies show that wolves can hear howling from

up to 16 km. Scent marking and howling are used for indirect defence of the territory aiming to minimize the chances of an encounter with a stranger. However, when the pack meets another pack or a lone wolf, the only means of defence of the territory is direct attack that is usually fatal (Busch, 1995).

1.1.3 Interactions with Competitors

Inhabiting diverse habitats and being widely distributed, wolves often coexist with other carnivores, such as coyotes and foxes. Encounters between coyotes and wolves are often aggressive in order to defend their dens, hunted prey and territory; however, coyotes continue to scavenge the kills of wolves by following them (Busch, 1995). Interactions between foxes and wolves are more complex. Wolves may use fox dens after forcing them out and foxes usually scavenge wolf kills. Wolves may also kill and eat foxes (Busch, 1995).

Another competitor of wolf is wandering or free-ranging dogs but encounters of wolves and dogs can have various outcomes. First of all, being competitors, wolf and dog encounters are aggressive and although feral dogs are not natural prey, dog hunting is not uncommon among European populations of wolf (Mech & Boitani, 2003). Secondly, although it can be rare (Randi & Lucchini, 2002), dogs and wolves can crossbreed and produce fertile offspring (Mech & Boitani, 2003) and wolf-dog hybrids are intentionally produced by some North American cultures because of their improved vigor (Schwartz, 1997).

Another critical aspect of interactions with competitors is transmission of diseases, most important of which is rabies due to its effects on humans. Foxes are the reservoir of rabies in Europe (Sillero-Zubiri & Laurenson, 2002) whereas dogs are responsible of the 98% of transmission of rabies to humans (Sillero-Zubiri & Laurenson, 2002). These animals can threaten other endangered canids by “spill

overs" (Woodroffe, 1999). Wolves are also susceptible to this fatal disease and they usually acquire rabies virus from contacts with wandering dogs (Busch, 1995). The effects of rabies are discussed in section 1.3.2.

1.2 Diet and Predatory Behaviour of Wolf

What wolves eat has always attracted significant interest and there are many studies in almost all habitats of wolves in the world. In order to determine wolf's diet, these studies used direct recording of kills, stomach contents and scats (Mech & Boitani, 2003). Among these methods, scat analysis is the most widely used one because of its advantages like it not being an intrusive method (i.e. wolves are not disturbed), and because of the availability of large samples at all seasons. The method includes collection of scats in the area along transects and bringing them to laboratory for macroanalysis of the contents. The contents are identified by comparing them to a reference collection. Nevertheless, studying scats have certain weaknesses; distinguishing wolf scats from that of dogs or coyotes is highly improbable, the contents of the scats can vary with the digestibility, size or frequency of the meals and identification of the contents may also be problematic (Mech & Boitani, 2003).

The wolf is on top of the food chain in its habitat and it preys upon a variety of animals, but as the studies point out, diet breadth generally depends on the availability of large prey. If populations of large prey, such as red deer are either lacking or insufficient, wolves feed on a higher variety of food items (Meriggi & Lovari, 1996; Meriggi et al, 1996; Mech & Boitani, 2003). Although they have a highly variable diet, ungulates constitute the largest prey group of wolves, in Europe as in other parts of the world (Meriggi & Lovari, 1996; Poulle et al., 1997; Kübarsepp & Valdman, 2003).

Wolves in Eurasia mainly prey on red deer, roe deer (Głowaciński & Profus, 1996) moose and wild boar (Mech & Boitani, 2003) but in northern parts, diet variability increases with inclusion of small and medium-size mammals like hare, beaver, badger, small rodents and also birds, insects and even fish. Studies of Meriggi (1991) and Gade-Jorgensen and Stagegaard (2000) show that fruit is an additional food to the wolf, possibly as a source of vitamins. On the other hand, in human populated areas of Italy where natural prey is extirpated, wolves are reported to survive on garbage (Boitani, 1992; Okarma, 1995; Meriggi & Lovari, 1996). A small group of wolves seem to have survived until mid 1990s at METU campus grounds, possibly relying on garbage as the main food source (C. Bilgin, *pers. comm.*). Domestic ungulates occupy a substantial part in the diet of wolf in other degraded habitats where native wild prey is rare. Nevertheless, when native ungulate populations are restored, livestock depredation by wolf may decrease unless domestic livestock is abundant and easily accessible (due to ineffective preventive measures) (Patalano & Lovari, 1993; Meriggi et al, 1996; Poulle et al., 1997; Mech & Boitani, 2003). Additionally, wolves may occasionally eat grass as a purgative to facilitate digestion or to avoid vomiting (Mech & Boitani, 2003; Busch, 1995).

Moreover, wolves are usually adapted to the seasonal variations of populations of prey in their habitat. Generally, during grazing period, livestock depredation increases, but in the winter, wolves mostly subsist on wild prey (Mech & Boitani, 2003). In places where availability of prey populations fluctuates throughout the year, the wolf depredation pattern can be difficult to understand (Mech & Boitani, 2003).

Wolf can locate prey by travelling long distances and with the use of their acute sense of smell and good eyesight and sometimes by chance (Mech & Boitani, 2003) or by tracking (Busch, 1995). Although it is known as a fierce predator, the success of wolf resides in its ability to reasonably estimate the vulnerability of individual

prey. According to the situation, wolf can either give up the hunt or press the attack. Especially when the prey is large and dangerous, the probability that it will give up is higher. The successful estimation of prey vulnerability is achieved with experience. By quick learning and perception of complexities, the wolves not only understand which classes of prey are more vulnerable but also learn where to find them (Mech & Boitani, 2003).

Wolves generally hunt in packs but this is not usually a group chase. Although there is no unanimity on this, they are thought to cooperate strategically (Boitani, 2000) in which, for example, parent wolves hide themselves to ambush prey while yearlings chase them towards (Mech & Boitani, 2003).

1.3 Human Attitude and Conflicts with Wolves

There has been a special relationship between humans and wolves. Having similar social systems, prey preferences, using strategic hunting techniques, high adaptability to diverse geographical conditions have resulted in competition between wolves and humans (Boitani, 2000). Human perception of wolf is highly variable ranging from admiration to hatred and this is evident in epics, fables and tales in the literature of many cultures. In Turkey, the wolf is generally called as “canavar” (*the beast*) but it also had been described as the saviour in the Oğuz Kağan epic by leading the Turkish tribe and therefore, Turkish people have mixed feelings towards this canid.

Mainly, depredation on domestic livestock and large home ranges of wolves trigger a negative public attitude towards wolves, which then creates a conflict between the livestock holders, wildlife authorities and carnivores (Mishra, 1997, Treves, 2003). Attacks on humans are another factor in the negative perception of wolf (Sillero-Zubiri & Laurenson, 2002). Moreover, urban sympathy to wolves and

government's ignorance of rural complaints has made the wolf a symbol of urban dominance in many parts of the world (Ericsson & Heberlein, 2003).

Most negative feelings towards wolf generally results from the fear of carnivores that evolutionarily has an adaptive value and that is engraved in people's minds for centuries. However, studies show that this fear is reduced in people with higher education or in people that have knowledge of the carnivore and its behaviour, even if the negative attitude may persist (Naughton-Treves et al., 2003; Røskaft et al., 2003). Attitudes towards carnivores are assessed by applying questionnaire surveys (Naughton-Treves et al., 2003; Røskaft et al., 2003,) or with direct interviews (White et al., 2005). The results of this questionnaires are later used in decision-making processes in wildlife management, for example in the UK and USA (White et al., 2005).

There are three main reasons of increasing conflicts between humans and wildlife; (1) large ranges of carnivores, (2) habitat degradation, and (3) predation on livestock (Busch, 1995, Mech & Boitani, 2003). As human populations expand, these conflicts increase (Treves, 2003) and it may lead to persecution of wolf. Therefore, the conservation of this carnivore necessitates mitigation of the human wolf conflict by providing intact habitats to wildlife, decreasing the livestock depredation and taking preventive measures against wolf attacks on humans.

1.3.1 Livestock Depredation

Livestock depredation is located in the core of the human-carnivore conflict. In areas where domestic livestock is abundant and easily accessible and where wild prey is either scarce or extirpated, carnivores like wolves often prey on livestock (Patalano & Lovari, 1993; Meriggi et al, 1996; Poulle et al., 1997) and this creates a conflict with livestock holders. First of all, livestock husbandry methods are rarely

preventative and therefore, the domestic ungulates are susceptible to depredation. Secondly, domestic livestock can affect the abundance of wild ungulates, which are prey to carnivores, as a result of competition for resources (Sillero-Zubiri & Laurenson, 2002).

People who have experienced depredation have a more negative perception of wolf and tend to persecute the wolf more than the ones that have not lost any domestic animals to wolves (Ericsson & Heberlein, 2003). Therefore, preventing livestock loss to wolves brings about a decrease in negative attitude, hence the conservation of wolf.

There are no studies on the extent of wolf depredation in Turkey and livestock holders do not file complaints of their losses. Nevertheless, it cannot be assumed that wolf depredation on domestic livestock is negligible in Turkey since distribution of this carnivore covers almost whole of the country except for the Mediterranean and Aegean coastal regions (Can, 2001).

1.3.2 Wolf Attacks on Humans and Rabies

Wolves often coexist with humans but despite their bad reputation, attacks on humans are very rare. Many wolf researchers state that wolves are wary and fearful of humans (Busch, 1995, Mech & Boitani, 2003) and avoid humans even while their pups are being taken away from their den. In the review of historic records of wolf attacks in Europe and central Asia by Clarke (1971), it is concluded that nearly all the attacks were carried out by wolf-dog hybrids or rabid wolves. Nevertheless, because of anthropogenic habitat destruction and the resulting decrease in the number of natural prey, the risk of the attacks on humans by wolf cannot be overlooked.

Linnell et. al. (2002) classifies wolf attacks on humans in three groups; rabid attacks, predatory attacks and defensive attacks. The attacks of the first group correspond to the majority of wolf attacks and concern a rabid and usually lone wolf, which approaches, bites and runs. A rabid wolf never eats the victim. On the other hand, after a predatory attack, the wolf either consumes the victim where it attacks or drags it somewhere else to eat. Predatory attacks may repeatedly occur at the same location or in the vicinity for a few years. Defensive attacks are triggered by threatening or provoking acts of humans and they occur only once. The wolf can feel threatened when cornered and/or attacked by either shooting a gun or throwing stones or even because of an unintentional sudden gesture of a person unaware of the wolf nearby. In these circumstances, the defensive attack takes place as a bite and run fashion.

There are a few reasons recognized to play a role in wolf attacks on humans. These can be summarized as; degradation of the habitat of wolves, habituation to humans and provocation by humans and rabies. Most attacks of non-rabid wolves are thought to be performed by wolves that have lost the fear of humans and that have become habituated to humans (Carnes, 2002; Linnell et al., 2002). Normally, wolves are wary of humans and thus avoid them but when they manage to approach humans in search of food and loses the fear, they might increase their chances of encounter (Sillero-Zubiri & Switzer, 2004). Food resources like livestock or garbage dump areas around the human settlements may cause habituation and consequently, the probability of the attack on humans are increased when the wolf gets used to being close to humans (Linnell et al., 2002).

Rabies is a viral disease of mammalian central nervous system, which is usually transmitted to other mammals through a bite of the rabid animal. Being a mammal, humans are susceptible to this neural disease and can receive the rabies virus as a result of contact between human blood and saliva of the infected animal. The bitten

person dies unless appropriate medical care is given within a certain time frame upon exposure to the virus. Wolves are not a reservoir of rabies disease in many parts of Europe (Linnell et al., 2002) but they are affected from this disease directly by suffering from rabies and indirectly by rabid attacks on humans, which then worsens the already negative reputation the wolf has.

Table 1-1. Laboratory confirmed cases of rabies in Turkey (data from WHO, 2005).

Year	Laboratory confirmed cases in domestic animals					Laboratory confirmed cases in wild animals	
	Dog	Cat	Ruminant	Equine	Other	Fox	Other*
1987	4678	470			2485**		97***
1995	143	4	20	-	-	-	1
1998	104	1	21	2	0	0	0
1999	173	5	25	2	-	-	1

* Other wild animals include -but not limited to- skunk, racoon, mongoose and bat.

** Figure representing rabies cases in farm animals (other than cats and dogs).

*** Figure representing all wildlife rabies cases (including foxes).

There are 21 verified records of wolf attacks throughout the 21st century in North America, but none of them were fatal. Nevertheless, wolf attacks are more common in Europe. The report by Linnell et al. (2002) states that 38 rabid wolf attacks on humans, (5 of them fatal) and 21 non-rabid attacks (4 of them fatal) between 1950 and 2000 in Europe. The only record of a laboratory diagnosed case of rabies in wolves dates 1999 from Turkey in this report. The website of World Health Organization (WHO, 2005) contains more information on rabies cases in Turkey (Table 1-1), however, wolf is not listed separately in the reports.

1.3.3 Conservation of Wolf

Canis lupus is a “strictly protected fauna species” as listed in the Appendix II of the 1979 Convention on the Conservation of European Wildlife and Natural Habitats

(The Bern Convention) (Council of Europe, 1979). However, Turkey has placed a drawback to this species and therefore, wolf is not “strictly” protected in this country. Nevertheless, wolf hunting has been banned in Turkey -for the first time- since 2004.

Being widespread and abundant, *Canis lupus* is listed in the *Least Concern* (LC) category in the Red List of Threatened Species (IUCN, 2004). Trend is thought to be positive for wolves in Turkey because they are protected –at least- inside the nature reserves and national parks that constitute 16% of land of Turkey (Busch, 1995). Actually, Turkey is identified as one of the three countries that maintain the wolf population in the region along with Israel and Saudi Arabia. (Boitani, 2000; Mech & Boitani, 2003).

Ecologically effective densities of wolves depend on, coexistence of predator species, weather conditions and interactions between forage quality and quantity, productivity and the number and abundance of prey species (Soulé, 2003). However, with the ongoing degradation of habitats, wild prey populations have been declining and increasing livestock depredation is causing increased persecution of wolf. For example, in India, at places where livestock is known to be depredated by snow leopard, the wolf is persecuted, whereas there seems to be only occasional persecutions of snow leopard (Mishra, 1997). However, wolf is not only persecuted because of livestock depredation and attacks on humans, but also for their pelts which are sold in Turkey, as well.

1.4 Objectives of the Study

The purpose of the present study is to reveal the factors that play important roles on the conflict between humans and wolf. Two of these factors are wolf depredation on livestock and wolf attacks to humans. Another important aspect of

the conflict that needs to be investigated is human attitude towards wolf. Consequently, the present study aims;

- to investigate wolf depredation in Bozdağ in the last 2 years,
- to assess the vulnerability of livestock to wolf attacks and the factors affecting this vulnerability,
- to document and analyze the wolf attacks on humans in Turkey,
- to reveal local human attitudes towards wolves,
- to propose ways to mitigate human-wolf conflict in Central Anatolia.

CHAPTER 2

MATERIALS AND METHODS

2.1 Study Site

The study site, Bozdağ is a Wildlife Protection Area within the city province of Konya. The coordinates are roughly 38° N and 33° E (Fig. 2-1). The altitude varies between 1000–1746m above sea level. Dominated by xerophytic, thorny and cushion like plant species, the area is a steppe ecosystem, which is heavily grazed by domestic livestock outside the fences of the Bozdağ Turkish Mouflon Breeding Station that is 5000 hectares. Bozdağ is under the influence of the continental climate; hot summers and cold winters with precipitation usually in the form of snow (Arihan & Bilgin 2000).

The mammalian species recorded in the region are fox (*Vulpes vulpes*), badger (*Meles meles*), stone marten (*Martes foina*), caracal (*Caracal caracal*) and hare (*Lepus europaeus*) besides wolf (*Canis lupus*) and Turkish mouflon (*Ovis gmelinii anatolica*) (Arihan, 2000).

Bozdağ region is especially important because of serving as a habitat for the last remaining population of the Turkish mouflon or “ceran” as called by the locals. Wolf is the main predator of this endemic subspecies. The mouflon is under protection since 1937 but it was not until the installation of an electric fence along the boundary of the breeding station in 1996 that the population recovered

significantly as wolves were excluded. The study by Arihan (in Arihan & Bilgin 2000) states that there are about a thousand individuals and over a hundred individuals, inside and outside the fence, respectively. Local people have mixed feelings about this ungulate. On the one hand, they are against its existence because mouflon competes with their domestic animals for grazing, but on the other hand, there is a local belief that killing a mouflon would bring bad luck. Fortunately, they usually prefer to ignore the species.

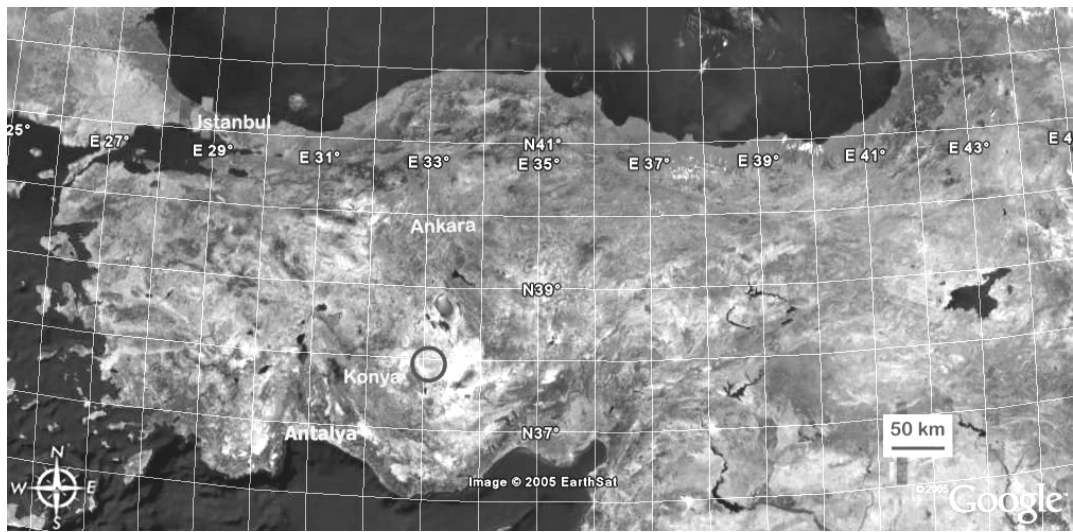


Figure 2-1. Location of the study site on the map of Turkey.
(The map is obtained from Google Earth)

There are nine villages encompassing the Turkish Mouflon Breeding Station and these are, Kızılcakuyu, Karadona, Yağlıbayat, Ağsaklı, Beşağıl, Göçü, Karakaya, Divanlar, and Akbaş. There is also a small town called Yarma to the southwest of the station (Fig 2-2). In addition to farming practices, local villagers are engaged in livestock husbandry and more than 50,000 sheep (*Ovis aries*) heavily graze in the Bozdağ region (Table 2-1). They not only compete for food with the mouflon, but also carry many internal and external parasites that affect both species. Moreover, because of their overgrazing, the soil becomes susceptible to erosion, which effects

the remaining vegetation of the region, as well. The sheep graze in spring, summer and autumn in flocks attended by shepherds and livestock guarding dogs (LGDs). In the winter, they are confined in semi-closed corrals at nights. Throughout the grazing season, they seem to fall prey to the wolves. However, since they are kept in corrals in winter, predation pressure on the small mouflon population -outside the breeding station- intensifies.

According to the records of the Konya Province Directorate of Agriculture, the number of cattle, sheep, goats and dogs in the villages in the study site are listed in Table 2-1.

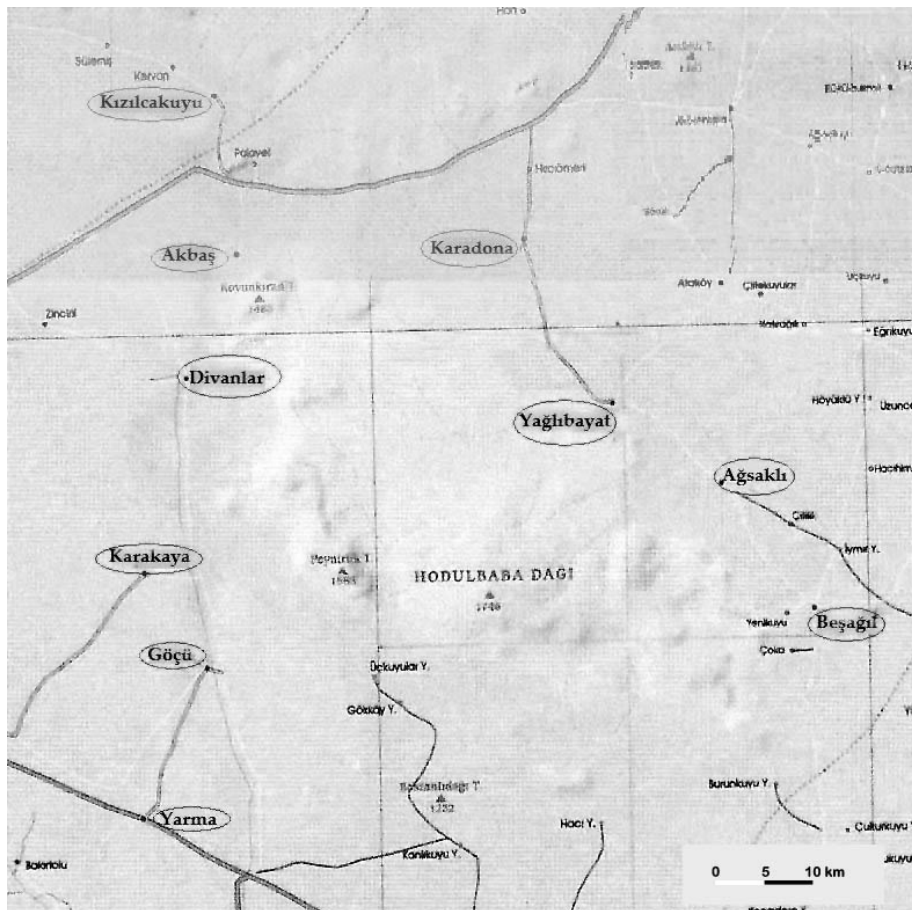


Figure 2-2. The map of the Bozdağ region. Circles indicate the villages and the small town, Yarma, within the study site.

Table 2-1. The Livestock and LGD numbers of the villages in the study site (data provided from Konya Province Directorate of Agriculture).

Name of the Village	Number of			
	Cattle	Sheep	Goats	Dogs
Akbaş	-	540	12	5
Ağsaklı	360	3400	25	10
Beşağıl	350	6500	45	15
Göçü	725	18000	270	50
Kızılcaкую	95	3500	65	5
Yağlibayat	400	7500	170	15
Karadona	350	3300	62	10
Karakaya	850	8850	150	10
Divanlar	135	5500	120	20
TOTAL	3265	56550	907	135

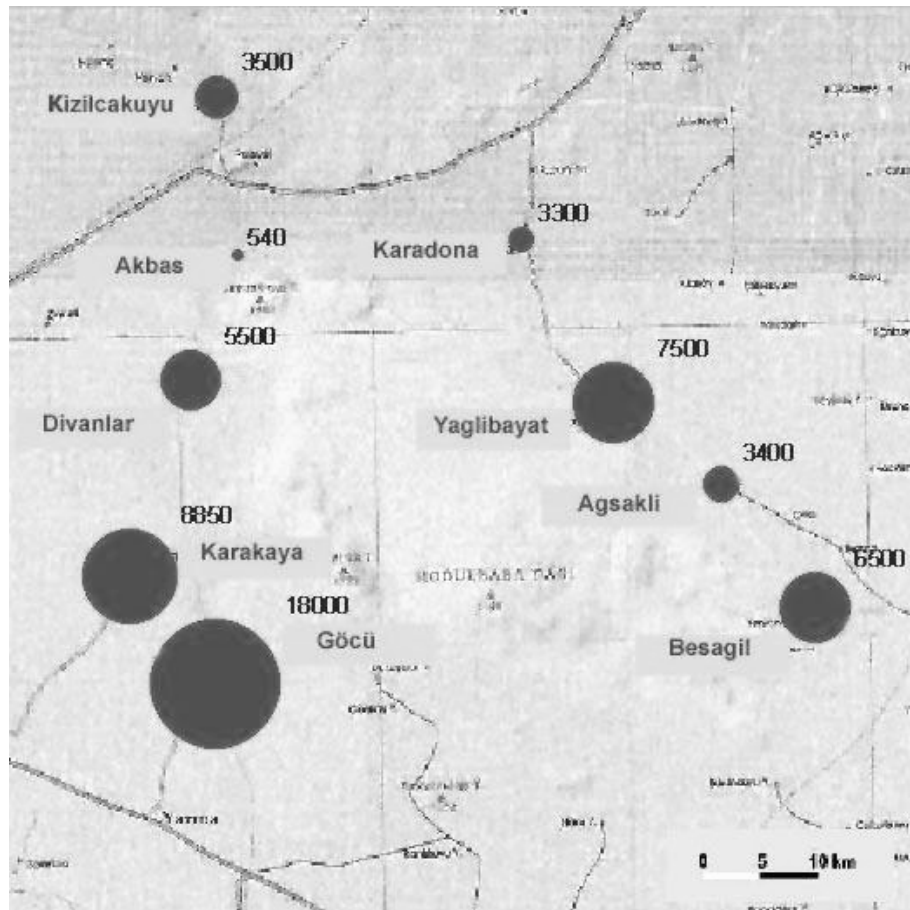


Figure 2-3. Map of the study site showing the number of sheep at each village.

2.2 Interviews

Thirteen shepherds from nine villages (Kızılcaкую, Karadona, Yağlibayat, Ağsaklı, Beşagıl, Göcü, Karakaya, Divanlar, and Akbaş) and a small town, Yarma, around the Turkish Mouflon Breeding Station (Fig 2-2) were interviewed to investigate animal husbandry practices and depredation events and to assess attitude towards wolf. Interviews were executed in two sessions and the first session on September 30-31, 2004, which was the pilot study, included 3 interviews and one of them is repeated in the second session. In the pilot study, the questions of the interview are tested to avoid misunderstandings and new questions that aroused during the conversation with the locals were included for the next session. In the second session, 12 shepherds were interviewed on dates 30th and 31st of July 2005.

During the interviews, the questions were asked in a mixed order to make it a relaxing conversation for the interviewee and to increase the dependability of the answers. Moreover, instead of filling up a questionnaire, the interviews were recorded by either an analogous tape recorder (only in the pilot study) or a digital sound recorder to decrease time spent between the questions and to assess what the interviewee actually means. The recordings were then transferred to text for the analyses. The questions asked in the interviews could be grouped in 5 major parts;

- 1) Information on the interviewee,
- 2) Information on the livestock and husbandry practices,
- 3) Information on livestock guarding dogs,
- 4) Information on wolf attacks,
- 5) Attitude towards wolf.

Questions aiming to collect information on the interviewee included where the interviewee is from, whether he likes to be a shepherd and whether he received

training for being a shepherd. In addition, the interviewee's knowledge of and past experiences with wolves were assessed.

Questions investigating livestock husbandry practices were used to record the flock size, whether they are protected in corrals during the night and whether livestock guarding dogs are used. If livestock guarding dogs (LGDs) are used, questions regarding their number, breed and behaviour were asked. The question on LGD's behaviour included their reaction in confrontation with wolves, and their interactions with strangers and sheep of other flocks.

Information on wolf attacks were gathered with the use of questions on the frequency of depredation and questions asking for a detailed description of the last depredation event including information on what time of the day it occurred, whether a wolf was seen during the occasion and what was done to the injured and dead sheep. In addition, interviewees were asked to state the time of the year when wolf attacks occur often.

Questions on attitude towards wolf were intentionally asked in a certain sequence to reveal the real attitude of the interviewee by avoiding him to conceal his real perception of wolf. Firstly, the interviewees were asked about their opinion on the existence of wolves in the area and then according to their answer, a new question was directed at them. The interviewees that were positive about this carnivore were asked to comment on the number of wolves in the region and the others that did not like wolves were asked if they would like all wolves be killed. Therefore, shepherds were made reconsider their answers to the first question and their answers to the second questions revealed their real attitude.

2.3 Attacks on Humans and Rabies

Wolf attacks on humans are analyzed with the use of news stories collected from news sources on the internet. Moreover, records of wolf attacks on humans and records of rabid wolves are requested from the Ministry of Health, Ministry of Environment and Forest and Etlik Central Veterinary Institute, Ankara.

CHAPTER 3

RESULTS AND DISCUSSION

3.1 Livestock Husbandry in Bozdağ

The main livelihood in the Bozdağ region is cereal agriculture, followed by sheep husbandry. The main agricultural crops are wheat and barley. The study site covering nine villages and encompassing the Turkish Mouflon Breeding Station in Bozdağ holds over 50,000 sheep (Table 2-1). Most common livestock breed is fat-tailed sheep of the White Karaman breed, whereas there were some mixed flocks with Chios and at least one flock with Awassi (*İvesi*). Additionally, most of the flocks had a few goats to guide the flock.



Figure 3-1. Years of experience of the 13 interviewed shepherds.

The smallest flock size was 300, whereas there was an extraordinarily big flock of 1200 sheep under the responsibility of one shepherd -in Göçü-, but the median flock size was 500. The years of experience of the shepherds (15 ± 8.53) varied with the age of the shepherd (Fig 3-1); most were professional shepherds recruited from Aksaray. Four of the interviewees were shepherding flocks comprising sheep of their own and a few other families. Each flock in the study site was attended by a shepherd and a number of livestock guarding dogs (LGDs). Moreover, all of the interviewed shepherds had donkeys (N=12).



Figure 3-2. Mixed breed shepherd dogs (Kızılcakuyu, 30.08.2005).

There was a high variation in the number of LGDs accompanying the flocks but the average was $6 (\pm 1.66, \text{range } 3\text{-}16)$ including the puppies. However, the number of dogs and flock size did not show any relationship (Fig 3-2). Number of dogs per 100 sheep varied between 0.46 and 3.33 (1.53 ± 1.10) and all were mixed breed dogs (Fig 3-3), except for Kangal dogs in two flocks.

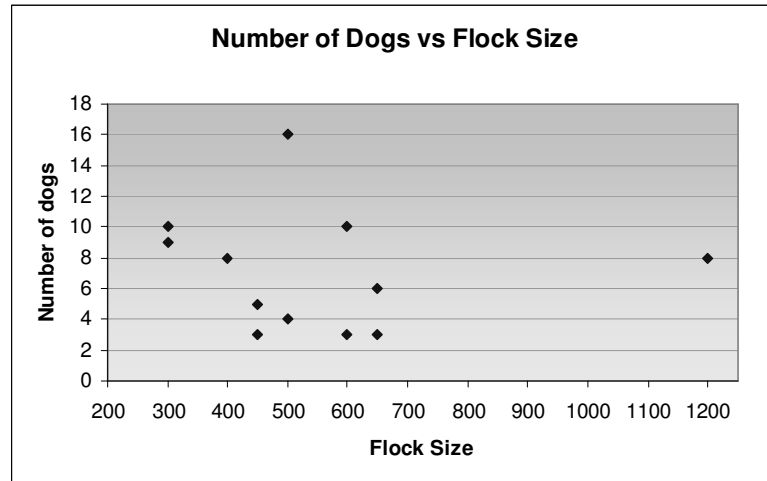


Figure 3-3. Number of livestock guarding dogs (LGDs) versus flock size.

After a depredation event, shepherds left the dead and seriously injured sheep to dogs to eat after taking some part of the pelt as a proof of the loss. However, sheep that had minor injuries are consumed by the owner of the sheep and/or the shepherds after being killed according to Islamic methods. Nevertheless, shepherds from some villagers transport the dead and seriously injured sheep to the village unless they are too many. The dogs in those villages then consume them at the village. Dead sheep left in the pasture are stated to be consumed primarily by dogs and then by other scavengers, but never by the wolf. This needs to be investigated further but if wolves do not consume carrion, it might be due to a local adaptation against poisonous baits, which was used in the past to control the wolf population in the area.

The annual calendar for sheep husbandry changes slightly from one shepherd to another, but can be generalized as follows: During spring, summer and autumn, most of the flocks spend the day inside the village (close to the water source and in shade) (Fig 3-4) and are taken to the steppe or mountain pastures for the night. In August and September, cereal stubble is grazed and the sheep do not go much farther than the village grounds. Throughout the warmer months, although there

are corrals inside the villages, the flocks are not kept inside any type of construction at night. This husbandry practice changes when “the first snow flake touches the ground” (i.e. usually late November), as one shepherd from Kızılcakuyu expressed (İsmet Yalçın, Kızılcakuyu, *pers. comm.*). In winter, flocks do not graze away from the village, unless the owner of the livestock has built corrals on the pastures. All the flocks spend the night inside the corrals either in the village or on the pasture. Only two flocks from Karakaya and one flock from Göçü spent the winter on the mountain pasture.

Only one livestock guarding dog (LGD) per flock is allowed in the mountain pastures from April until August as a precaution against dog attacks on the vulnerable population of mouflon, outside the fences. As LGDs are considered as a threat to mouflons, they may also pose a threat to domestic sheep, as well.



Figure 3-4. Sheep spending the day in the village where there is water and some shade (Göçü, 31.08.2005).

Moreover, since LGDs eat sheep killed by wolves, it might be expected that they would see sheep as prey at other times, and therefore, dog predation on sheep is probable. The behaviour of the LGDs needs further investigation for sound precautions to be taken against livestock losses that are solely attributed to wolves.

3.2 Wolf Depredation in Bozdağ

The wolf is recognized as the main predator of domestic sheep by the shepherds. Among the 12 shepherds that were interviewed in 2005, 8 claimed to have experienced a wolf attack this year and 10 claimed to have been attacked last year. The number of wolf attacks experienced by each flock is given in Table 3-1 along with the flock sizes and the number of livestock guarding dogs (LGDs) in each flock. Two interviewees were reluctant to give the exact number of attacks that occurred because of the notion that attacks were too many and because wolf attacks are not recorded anywhere in the study site. Those “many attacks” were assumed to be 5 since the highest reported number of wolf attacks were 4. The average number of wolf attacks experienced by a flock in two years time was 3.92 (\pm 3.23), therefore number of wolf attacks per flock per year was 1.96.

Table 3-1. Flock size, number of livestock guarding dogs (LGDs) and number of wolf attacks as stated by the interviewees.

Interviewee ID No.	Village	Flock Size	Number of LGDs	Number of attacks	
				in 2005	in 2004
1	Kızılcakuyu	400	8	1	0
2	Karadona	650	3	1	2
3	Karadona	500	4	0	0
4	Yağlıbayat	450	5	0	1
5	Ağsaklı	300	9	3	5*
6	Beştaşıl	450	3	0	1
7	Beştaşıl	600	3	0	1
8	Göçü	1200	8	3	3
9	Göçü	650	6	5*	4
10	Karakaya	300	10	2	2
11	Karakaya	500	16	4	4
12	Divanlar	600	10	4	1

* Figures attributed to “many attacks” that the interviewees stated.

The interviewees were also asked to state the seasons when the wolf attacks most generally occur and the answers are illustrated on Figure 3-5. Winter is not stated as a season when depredation events are common by any of the interviewees, although rare occasions are reported. The sheep are kept inside the corrals during winter and during this season, corrals with 1.5 - 2.5m high walls might be effective in decreasing the frequency of wolf attacks.

The last wolf attack to nine of the flocks occurred at night and one flock experienced the last attack at dawn. Consequently, these results support the general idea that wolves usually attack between the late hours of the day and early hours of the morning when the available light is limited.

ID No.	Village	Months of the year											
		J	F	M	A	M	J	J	A	S	O	N	D
1	Kızılıcakuyu							■					
2	Karadona			▨	▨	▨	■			▨	▨	▨	
3	Karadona			▨	▨	▨				▨	▨	▨	
4	Yağlıbayat			▨	▨	▨	▨	▨	▨	▨	▨	▨	
5	Ağsaklı						▨	■	▨				
6	Beşağıl			▨	▨	▨				▨	▨	▨	
7	Beşağıl					▨					▨	▨	
8	Göçü						▨	▨	▨				
9	Göçü						▨	■	▨				
10	Karakaya					■				▨	▨	▨	
11	Karakaya			▨	▨	▨		■					
12	Divanlar							■					

▨ → Months in which wolf attacks are said to generally occur

■ → Last attack (2005)

▨ → Last attack in 2004 (in case no attack has occurred in 2005)

Figure 3-5. The calendar of wolf attacks according to the statements of the interviewees.

It should also be noted that none of the interviewees saw the wolf or wolves during the last attack they experienced. Therefore, it is not certain that all these attacks are due to wolves. Moreover, in the village Karadona, there was a rumour about the release of wolf-dog hybrids at Karapınar, which is to the southeast of the study area, by the Municipality of Aksaray after an unsuccessful attempt of training them as LGDs, however, this rumour could not be verified through the veterinary surgeon of the municipality.

Hybrids are known for their aggressiveness, unpredictability (Busch, 1995) and thus the danger they pose (Mech & Boitani, 2003). Most of the attacks attributed to wolves are found to be carried out by hybrids in Spain and similarly, wolves are blamed for even the depredation events thought to be due to wandering dogs (Mech & Boitani, 2003) in other parts of the world. IUCN/SSC Wolf Specialist group recognizes wolf-dog hybrids a threat to conservation of wolf (IUCN Resolution on Wolf-Dog Hybrids, 1990, cited in Busch, 1995). Consequently, there needs to be further studies on wolf-dog hybrids in Turkey and a national protocol needs to be developed to control or to ban breeding hybrids.

3.2.1 Effects of Flock Size

Flock size might be a parameter in determining the level of depredation. Small flocks may be easier to shepherd and be protected by a few dogs. On the other hand, larger number of sheep may warn the shepherd earlier in the face of danger. However, there was no correlation between flock size and wolf attacks in the last two years (Fig 3-6). This suggests that the shepherd and LGDs can be more effective in reducing the sheep losses to wolves.

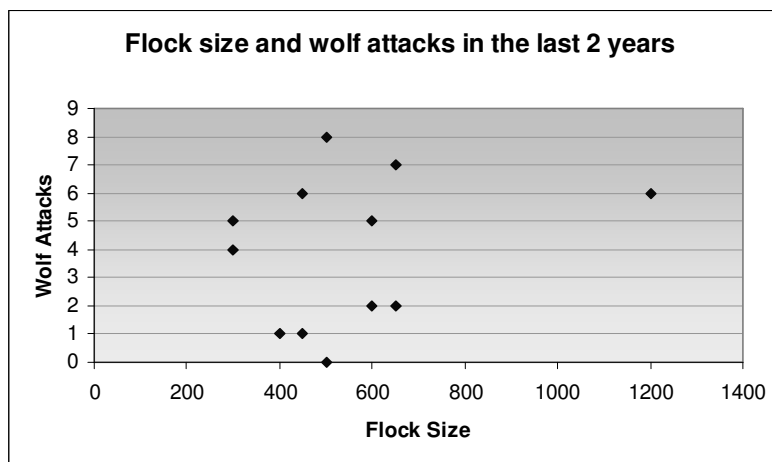


Figure 3-6. Number of wolf attacks in relation to flock size.

3.2.2 Effects of Livestock Guarding Dogs

Livestock guarding dogs are usually considered to be the most effective deterrent against predators (Mech & Boitani, 2003). However, at the study area there was no relation between the number of LGDs in a flock and the number of wolf attacks (Fig 3-7). Similarly, number of LGDs per 100 sheep did not have any significant relationship to the number of depredation events (Fig 3-8).

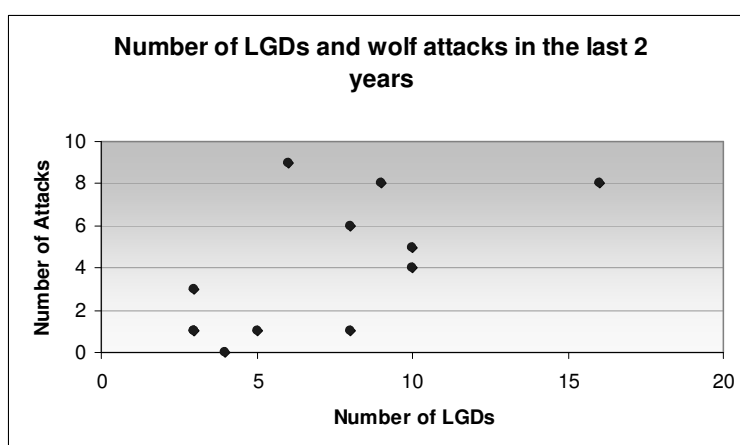


Figure 3-7. Number of wolf attacks in relation to number of livestock guarding dogs (LGDs) attending the flocks.

These results corroborate the findings of Espuno et. al. (2005) that when sheep are freely ranging, shepherd dogs did not have much effect in deterring wolf attacks unless the sheep are confined at night. The flocks in our study site spent the night in the corrals only in the winter and the interviewees did not report winter as a time when wolf attacks are particularly frequent.

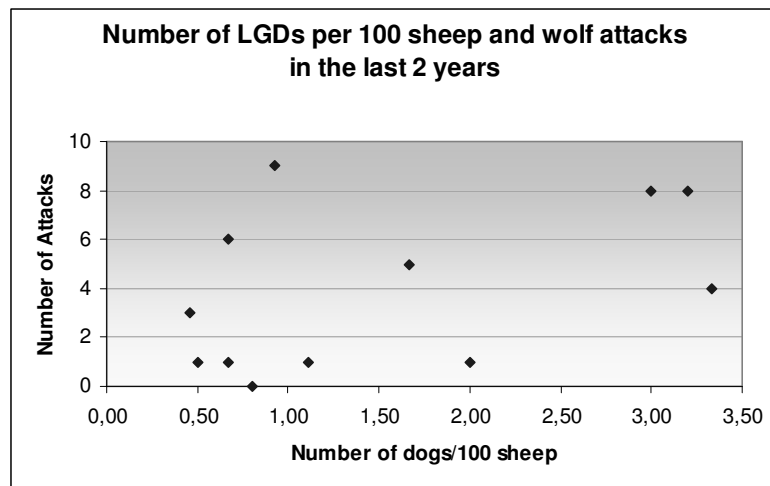


Figure 3-8. Wolf attacks in the last 2 years in relation to number of dogs per 100 sheep.

To assess the quality of LGDs, questions on the reaction of dogs to wolves, to strangers (i.e. people other than their owner families and shepherds) and to sheep of other flocks were directed to the interviewees. Dogs were stated to chase away wolves in any encounter except for the dogs of two flocks and in another flock, only a dog of the Kangal breed is stated to pursue wolves. Flocks that had dogs that chase away wolves experienced, on average, less wolf attacks in the last two years (Fig 3-9).

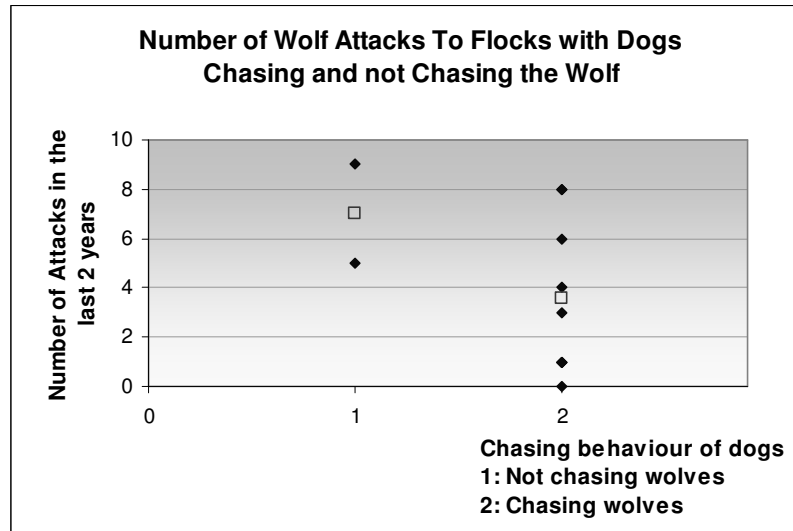


Figure 3-9. Number of wolf attacks to flocks attended by dogs that chase and that do not chase wolves away. Squares indicate the averages.

To test the effects of behaviour of dogs, a simple “aggressiveness value” was calculated for dogs attending each flock according to the following rules:

- Dogs that chase both strangers and sheep of other flocks get 3 points,
- Dogs that chase either strangers or sheep of other flocks get 2 points,
- Dogs that do not chase strangers or sheep of other flocks get 1 point.

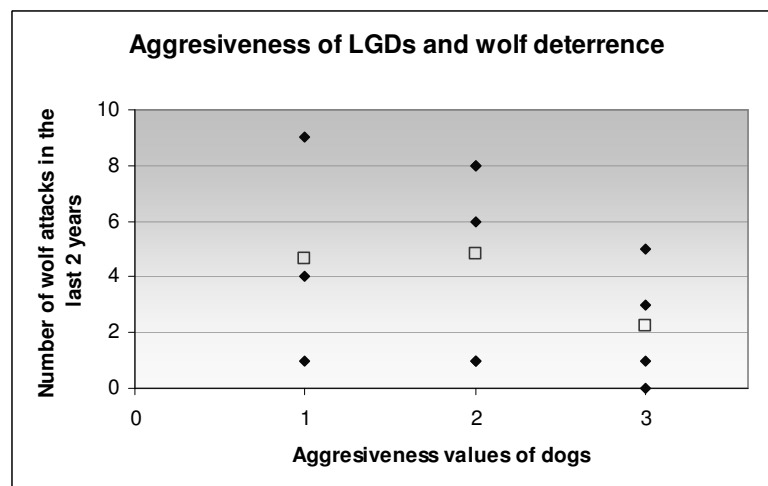


Figure 3-10. Aggressiveness of dogs and its effect on depredation. Aggressiveness values: 1, dogs that are not aggressive; 2, dogs that chase either strangers or sheep of other flocks; 3, dogs that are aggressive and that chase both strangers and sheep of other flocks.

As Fig 3-10 shows, aggressiveness of LGDs may also reflect their ability to deter wolf attacks. However, the difference was not significant and it might be due to small sample size. Interviews with other shepherds in the area are required to reveal the relationship between the aggressiveness of LGDs and wolf deterrence, if there is one.

3.2.3 Effects of Shepherds

Shepherds seem to play an important role in the protection of sheep but to avoid sheep losses to wolves, they need to know whether there are wolves in the vicinity of the flock. Therefore, shepherds were asked how they understood when the wolf is near and their answers were grouped in 5 categories. As Fig 3-11 represents, LGDs serve as a tool to signal wolves in the vicinity to 61% (46% + 15%) of the shepherds. The fretful behaviour of sheep appeared as the second indicator of the carnivore by being used by 46% of the shepherds.

Signs indicating a wolf nearby

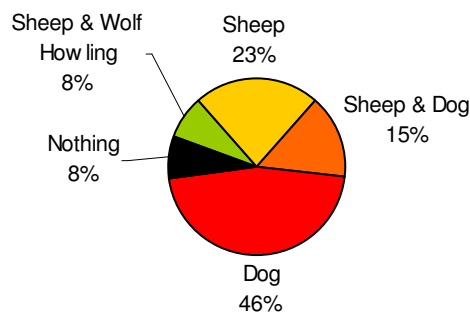


Figure 3-11. Signs that are stated by shepherds to indicate a wolf in the vicinity.

None of the shepherds saw the wolf at the last depredation event they experienced, but they stated that when they realize that there is a wolf close to the flock, they turn their torchlight on and scan the terrain to locate it. It is usually after the shepherd locates the wolf and calls the dogs that the dogs attack the wolves. This also indicates the unsuccessful wolf deterrence by the LGDs at the study site.

According to the statements of shepherds and local people, wolves split the flock in two and make it difficult for the shepherd to manage the whole flock and take advantage of this impaired protection of the livestock. Therefore, the ability of the shepherd to keep the livestock together seems to be a key factor to decrease livestock loss to wolves. Therefore, the shepherding education seems to be appropriate for the aim of decreasing sheep loss.

Shepherds were also questioned about their past experiences with wolves. Except for the youngest shepherd, who has been a shepherd for only 5 years, all the shepherds had encountered a wolf. However, only 5 out of 12 shepherds stated to have heard a wolf howl. This result is surprising because flocks graze not far away from each other and howls are known to be heard from several kilometres away (Mech & Boitani, 2003). Moreover, in two villages (Göçü and Karakaya), one of the shepherds claimed not to have heard a wolf howl, while the other claimed the opposite (Appendix B).

Another important point is that the sheep lost to wolves is not financially a burden for the shepherds. Only when there is obvious negligence and the loss is too many, the shepherd is not recruited the next season. Moreover, none of the shepherds – except for the ones that are also the holder of the livestock- had any sheep that they own in the flock. Therefore, these factors may affect the feeling of responsibility of some, but not all shepherds.

To investigate any statistically significant relationships between wolf attacks and factors like flock size, number of LGDs per 100 sheep and years of experience of shepherds, flocks are classified as *best* and *worst* flocks according to the number of wolf attacks they had experienced in the last two years. The flocks that were subjected to less than or equal to 3 attacks in two years are grouped as *best* flocks and the rest as *worst* flocks.

Table 3-2. Differences between number of attacks, flock sizes, number of LGDs per 100 sheep and years of experience of the shepherds of best (experienced ≤ 3 attacks) and worst (experienced > 3 attacks) flocks.

Flocks:	Average number of attacks in 2 years	Average flock size	Average number of LGDs/100 sheep	Average years of experience of the shepherds
<i>Best</i>	1.17	508	0.92	22.5
<i>Worst</i>	6.67	592	2.13	20.5
<i>p</i>	<i>0.03</i>	<i>0.14</i>	<i>0.01</i>	<i>0.28</i>

As Table 3-2 represents, the number of wolf attacks of *best* and *worst* flocks were significantly different ($p < 0.05$), so the two groups are truly distinct. Flock sizes and years of experience of the shepherds had no significant difference, whereas, the number of livestock guarding dogs per 100 sheep differed significantly among two groups ($p = 0.01$). However, contrary to our expectations, the number of LGDs per 100 sheep was lower for the best flocks, which experienced less attacks. Consequently, this suggests that instead of their numbers, the behaviour of LGDs is more important in protection of livestock from wolf attacks.

3.3 Attitudes of the Local People

Perception of wildlife is an important factor in conservation of especially carnivores that are usually in conflict with local people. The interviews showed that perception of wolf in Bozdağ is generally negative. Of thirteen interviewees, only three shepherds agreed that wolf has a place in the Bozdağ ecosystem (Fig 3-12). The reason they put forward was that this canid may have a role in the balance of nature. When they were asked about their opinions on the current number of wolves in the area, two of them stated that they are too many. One interviewee, who was a livestock holder, had the most positive approach and admitted to not know whether wolves were too many, adding that wolf damage is negligible if adequate precautions are taken. On the other hand, ten shepherds expressed dislike of coexisting with wolves and only one of them disagreed with the extermination of wolf in the region. Interestingly, this shepherd from Yarma had lost 20 sheep to wolves in 2003 (Hacı Ömer, *pers comm.*).

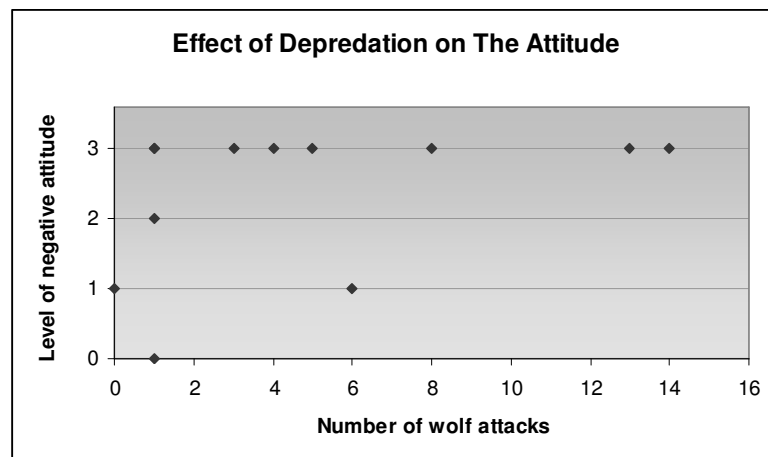


Figure 3-12. Effects of depredations experienced to the level of negative attitude. Levels of negative attitudes are as follows: 0, “wolves must live in the region”; 1, “wolves can live in the region but they are too many”; 2, “wolves must not live in the region but they should not be exterminated”; 3, “wolves must not live in the region and they must be exterminated”.

Three out of five livestock holders preferred all the wolves in the area to be killed. Nevertheless, the only interviewee that had the most positive approach was also a livestock holder. Therefore, with these data, there are no grounds to conclude that livestock holders have a more negative perception of wolves in general. Further research covering more livestock holders and shepherds is needed to reveal the differences in attitude, if there is any.

Previous studies on human attitude towards wolves have shown that education and past experiences with wolves have a considerable effect on how they are perceived and as education level increases, sympathy to wolves increases but a past experience with wolves, such as being subjected to wolf depredation affects the perception of wolves negatively (Naughton-Treves et al., 2003; Røskaft et al., 2003). The education level in shepherds in Turkey is generally low and most of them have experienced at least one depredation. Therefore, our results revealing a generally negative attitude towards the wolf at Bozdağ are not surprising.

3.4 Wolf Attacks on Humans and Rabies

In the last few years, number of news on wolf attacks on humans has increased in the local media. However, in most news stories, the wolf is blamed based on circumstantial evidence. According to the records of the Ministry of Health, only two wolf attacks on humans occurred between 1995 and 2005. One of them is the highly publicized rabid wolf attack on 18.12.2004 in Hakkari, Yüksekova, where 15 citizens were bitten. It was confirmed that the wolf was carrying rabies virus after laboratory diagnosis at The Etlik Central Veterinary Institute. The record of the second attack states that it occurred on 03.01.1997 in Siirt, Kurtalan and 2 out of 3 attacked people died because of rabies. However, the rabid animal has not been verified to be a wolf.

Table 3-3. Rabid wolf records of the Etlik Central Veterinary Institute (Ankara)

Year	City - Province
2000	Van
2001	Diyarbakır
2001	Artvin – Arhavi
2002	Erzincan – Üzümlü
2002	Elazığ – Keban
2004	Hakkari – Yüksekova
2004	Erzincan – Üzümlü
2004	Erzincan – Üzümlü
2004	İstanbul - Gaziosmanpaşa

The Etlik Central Veterinary Institute holds the records of rabid wolves, several heads of which were sent to the institute's laboratory. There are nine rabid wolf records between the years 2000 and 2004 (Table 3-2) but the institute does not hold information on the number of people injured or lost.

Ministry of Environment and Forest stated that they did not hold records of rabid wolf cases in Turkey although rabies is an important wildlife disease. The rabies records of World Health Organization (Table 1-1) present too big a decrease in the rabies in Turkey between the years 1987 and 1995 that can not reflect the reality. However, since the cases are not recorded properly, no conclusion could be made. Apparently, Turkey lacks reliable data on the extent of its wildlife rabies but it needs to be researched and recorded to eliminate this disease from the country as Europe did many years ago.

In addition, news stories since June, 2000 are compiled from internet sources (see Appendix C). The news stories fell in 4 main groups (Fig 3-13):

- 1) A wolf or wolves were seen in or in the vicinity of the human settlement but no attack occurred.

- 2) A wolf or wolves attacked livestock or domestic dogs.
- 3) A wolf or wolves attacked humans
- 4) A wolf or wolves were blamed for an attack that was later disproved.

News Stories on Wolf Attacks (n=51)

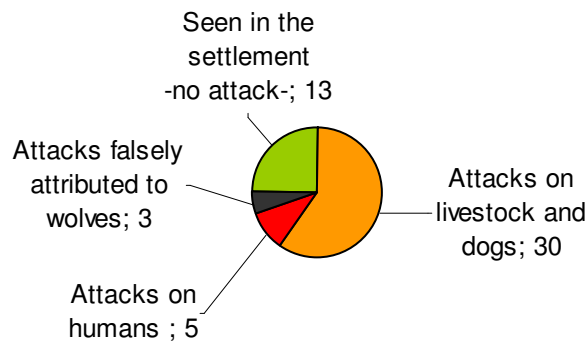


Figure 3-13. News stories on wolf attacks during years 2000-2005 compiled from web pages of 21 news sources.

According to the news stories, there were 5 cases of attacks on humans in the last 5 years and none of them resulted in death. However, wolves were blamed for the death of a 10-year-old in November 2004 and it had a big media coverage raising hatred towards wolves but the dog which actually attacked the boy was later found. The role of rabies in wolf attacks that made it to the news is not certain because injured people receive vaccination and rabies is diagnosed only when the wolf that has attacked is killed.

Media often has a huge influence on public perceptions and therefore the news stories can be regarded as an indirect indicator of the attitude of public. Figure 3-14 represents the distribution of news on wolves in time. The light and dark gray bars show the number of news and number of events respectively. In years 2000, 2002,

2003 and 2005, each event was published in one news source, however, in 2004, number of news is disproportionate with number of events. This is because of two highly published events, one in Kayseri (29.11.2004), in which a boy was killed by a dog identified later; and the other in Hakkari (18.12.2004), in which 15 citizens were injured. The latter event was made news by 10 different news sources. Additionally, as Table 3-2 shows, there has been an increase in the rabid wolf records and high number of news on 2004 may be related to this, as well. However, the lack of wildlife rabies records makes it impossible to interpret whether there had been a rabies outbreak in 2004.

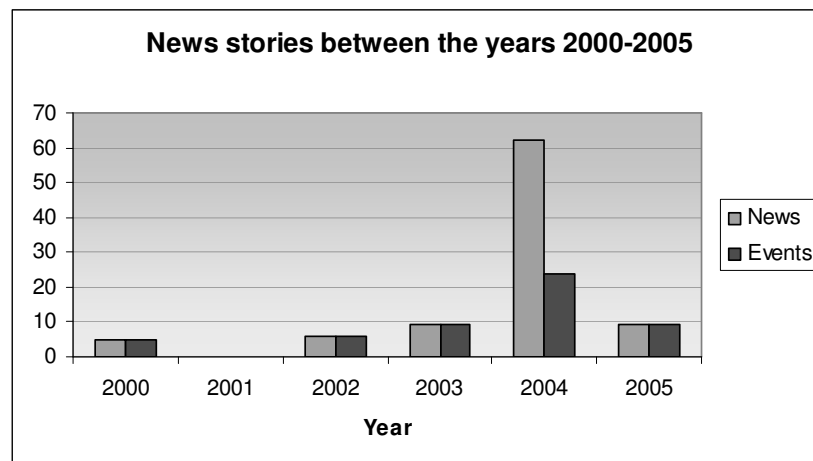


Figure 3-14. Number of news stories and number of individual events between the years 2000-2005.

3.5 Estimated Damage and Proposed Solutions

The reasons of conflict between humans and wolf are multifaceted and thus the mitigation of the conflict can be achieved only by a multidisciplinary approach and by application of sound management plans by the governmental organizations. However, the needs and thoughts of the local people should not be overlooked

during the decision making process in this top-down administration. For this reason, interviewees were asked about their opinions on the ways to decrease livestock depredation because depredation is recognized as the basis of the human-wolf conflict. Half of the interviewees stated that good dogs must be used to decrease livestock losses (Fig 3-15). Use of a gun, either to shoot at the sky to frighten away wolves or to shoot them was the second most proposed method followed by good shepherds that stay awake at night as a precaution. The other methods include attaching bells to many sheep and “bağcak” that is the term the locals use to refer to a rope tied at one end to the leader sheep of the flock and to the ankle of the shepherd at the other end which -just like bells- serve as an indicator of restlessness of sheep resulting from an approaching wolf.



Figure 3-15. Methods to decrease wolf depredation on livestock proposed by the shepherds.

Four of the interviewees stated no method or practice that could decrease the livestock losses to wolves unless all wolves were killed. The views of these shepherds represent the most negative perception of wolf and they demand eradication of this carnivore. Although hunting wolves has been banned in Turkey since 2004, the actual practice of this legal protection is uncertain. Chapron et al.

(2003) have shown that wolf populations are sensitive to high killing rates and that is the reason why wolves no longer exist in many parts of the world. Therefore, since we lack information on the status of this carnivore in Turkey, if persecution of wolf is not strictly controlled, their numbers may fall significantly.

To present wolf damage to livestock in Bozdağ in monetary terms, the financial loss of the livestock holder in two years was calculated. According to the Turkish Standards (TS 384, 18.04.2003) the price of butchery sheep is 8 YTL per kilogram live weight. Arık et al. (2002) states 1,5 years old White Karaman sheep to weigh approximately 54kg on average. Consequently, the amount of money that the livestock holder will be paid at the market is approximately 432 YTL per sheep (54 kg x 8 YTL/kg). It would be safe to assume the loss caused by a wolf kill as half the price to eliminate the profit of the holder. In other words, when the wolf kills a sheep, the loss of the livestock holder is approximately 216 YTL. Cost of sheep loss per flock each year is calculated using the formula below:

$$\frac{\text{Cost of sheep loss to wolves}}{\text{flock . year}} = \frac{\text{Number of wolf attacks}}{\text{flock . year}} \times \frac{\text{Number of sheep lost}}{\text{attack}} \times \text{Cost of the loss of 1 sheep}$$

Since the average number of wolf attacks per year experienced by each flock was found as 1.96, if we assume that wolves kill 0.5 sheep at each attack (i.e. 1 sheep every two attacks) the cost of sheep loss by each flock per year is calculated as 212 YTL. If wolves are assumed to kill 3 sheep at each depredation event, the cost becomes 1270 YTL.

The results showed that more LGDs do not deter wolves, whereas the more aggressive LGDs do. Moreover, keeping more dogs costs more. If we assume the cost of one dog per day as 0.5 YTL, the cost all through the year makes 182.50YTL.

The flocks in Bozdağ are attended by on average 6 (± 1.66) dogs. Therefore, a livestock holder needs to pay approximately 1095 YTL a year for the LGDs. Apparently, the flocks that had more than 6 LGDs and yet experienced more attacks suffer more financially.

The total cost of wolf depredation in Bozdağ under current circumstances is illustrated in Table 3-3 that also presents the cost in a hypothetical scenario in which wolves did not exist in the region.

Table 3-4. The cost of wolf depredation calculated for 0,5 and 3 sheep loss at each attack and for when there were no wolves.

	The cost (YTL) per flock per year		
	With wolves		Without wolves
	0,5 sheep killed per attack	3 sheep killed per attack	
Sheep depredation	212	1270	0
Maintenance of LGDs	1095 (6 dogs)	1095 (6 dogs)	182 (1 dog)
TOTAL	1307	2365	182

Subtracting the cost in the “without wolves” condition from the others gives the extra expenditure not only because of wolves, but also because of the current ineffective husbandry methods employed and the figures are 1125 YTL and 2183 YTL for losses of 0,5 and 3 sheep per depredation event, respectively. In other words, the cost of wolf depredation resulting from current ineffective measures against the attacks range between 1125 YTL and 2183 YTL.

If the husbandry methods are assumed to be representative of the region, the cost of wolf depredation calculated for Bozdağ could be extrapolated to the whole region. The area covering the provinces of Konya and Karaman holds approximately

2,300,000 sheep (1,859,066 (Governership of Konya, 2005) and 451,921 (Governership of Karaman, 2005) respectively) and by taking the average flock size as 500, the cost of wolf depredation is calculated to be approximately between 5 and 10 million YTL (for 0,5 and 3 sheep loss at each occasion, respectively).

If the livestock holders acquire and keep better dogs, their loss to wolves would decrease without an increase in the money paid for LGDs which may even decrease with less number of higher quality dogs like of Kangal breed.

Preventative livestock husbandry seems to be the most reasonable solution to human- wolf conflict in wolf habitats (Mech & Boitani, 2003). The Alberta Fish and Wildlife Division (1984) recommends that carrion should be buried or removed as soon as possible after a depredation event and ranchers should keep animals out of remote pastures after dusk and pen them in corrals where they can be watched. Using good livestock guarding dogs and improved fencing in corrals are other measures that can be applied (Treves, 2003). In addition, removal of “problem wolves” that repeatedly cause livestock loss would ensure that the depredation level in the region does not increase (Mech & Boitani, 2003).

CHAPTER 4

CONCLUSION

Livestock depredation by wolf is the most generally recognized reason of the human-wolf conflict (Mishra, 1997, Treves, 2003). Because of this, mitigation of human-wildlife conflict necessitates a solution to livestock loss. Although depredation may not be eliminated, it can be reduced. Interviews are performed to assess the vulnerability of sheep and to propose ways to prevent losses to wolf in Bozdağ, in the province of Konya. Bozdağ region is especially important because of the small population of Turkish mouflon (*Ovis gmelinii anatolica*) that is the only wild ungulate prey to wolves in the area. Wolves prey on domestic livestock because of the lack of abundant wild prey and weak protection of livestock.

The study site covered nine villages and the Turkish Mouflon Breeding Station. In addition to a small population of Turkish mouflon (*Ovis gmelinii anatolica*), more than 50,000 domestic sheep graze in flocks in the study site. Each flock is attended by a shepherd and a number of mixed breed livestock guarding dogs (LGDs), which did not show a relationship with flock size. The median flock size was 500 and the average number of attacks that the flocks were subjected to each year was 1,96. Number of LGDs per 100 sheep varied between 0.46 and 3.33 (1.53 ± 1.10) and unexpectedly, the flocks that are attended with less number of dogs experienced on average less depredation. This result suggests that the quality of the LGDs is more important than the number. Although it was not statistically significant, flocks with aggressive dogs that were stated to deter strangers and sheep of other flocks experienced less wolf attacks on average than flocks with dogs that attack neither

strangers nor sheep of other flocks. No correlation could be found between the flock size and wolf attacks in the last two years.

Confining sheep in the corrals that are attended by livestock guarding dogs appeared to be the most reasonable husbandry practice because no depredation is stated to occur in winter when the sheep were extensively confined and this result corroborates findings of Espuno et al. (2005).

When the sheep are grazing in the open, quality of the LGDs might be considered as a predictor of wolf deterrence. In fact, according to half of the interviewed shepherds, better quality dogs would lower livestock losses. Moreover, keeping ineffective LGDs creates a financial burden for the livestock holders. Therefore, ownership or trained LGDs of more skilful breeds can be promoted in areas suffering from wolf depredation. The Akbaş and Kangal breeds are considered as good LGDs because of their aggressiveness to predators (Rigg, 2001) and they might be used for better protection of the livestock.

Further research is needed to reveal numerical and functional responses of wolf and its prey to understand the dynamics of the relationships (Graham et al., 2005) between this predator, small population of free-ranging Turkish mouflon and domestic livestock so that sound measures can be taken to decrease livestock depredation and to conserve Turkish mouflon, as well as wolves.

After a depredation event, most of the shepherds left the dead and seriously injured sheep to dogs to eat and it might be expected that dogs would see sheep as prey at other times, as well. Moreover, not more than 1 LGD per flock is allowed on the mountain pastures between April and August because of a possible harm to small and vulnerable population of the Turkish mouflon. In addition, none of the shepherds saw the wolf during the last depredation and therefore dogs may be

responsible from at least some livestock loss, but it requires further research to conclude on this issue.

In Turkey, there is no such high level of animosity towards wolf as in Europe because of the respect this predator has gained in Turkish history and epics. Therefore, the public in the rural areas may tolerate depredation unless it is too frequent and the loss is too many. However, current level of depredation at Bozdağ is perceived as more than that can be tolerated, therefore, the majority called for an eradication of the carnivore. This attitude can be made more positive by decreasing the sheep loss to wolves through preventative husbandry practices proposed above.

Wolf attacks on humans in Turkey does not seem to be very frequent according to the records of Ministry of Health on rabid attacks and news stories but the lack of documentation makes it inconclusive. Moreover, false information given by the news sources exacerbates the already unfair bad reputation of wolf. No verified record of human death could be found in Turkey between the years 2000 and 2005 and rabies stand out as the primary reason of attacks on humans. Since feral dogs and foxes are seen as reservoirs of rabies virus (Sillero-Zubiri & Laurenson, 2002), vaccination of these animals would decrease and eliminate this disease from Turkey in time.

This study was the first attempt at elucidating human-wildlife conflict which is usually the biggest obstacle in wildlife management in many parts of the world as in Turkey. Following studies in this area and implementation of these results into the national wildlife management plans may serve in mitigating conflicts.

REFERENCES

- Alberta Fish & Wildlife Division. 1984. Status of the Fish & Wildlife Resource in Alberta. 127 pp. In: Busch, R. H. 1995. The Wolf Almanac. The Lyons Press, Guilford. p: 119.
- Andelt, W. F. 1996. Carnivores. In: Krausman, P.R., eds. Rangeland Wildlife. Society for Range Management, Denver, Colorado, pp. 133-135.
- Arıhan, O. & Bilgin, C. (2000) Population biology and conservation of the Turkish mouflon *Ovis gmelinii anatolica* VALENCIENNES, 1856. International Mouflon Symposium, October 27-29, 2000, Sopron, Hungary.
- Arıhan, O. 2000. Population biology, spatial distribution and grouping patterns of the Anatolian Mouflon *Ovis gmelinii anatolica* Valenciennes 1856. M.Sc. Thesis. Middle East Technical University, Ankara, Turkey.
- Arık, İ. Z., Dellal, G., Cengiz, F., Cedden, F. 2002. Anadolu Merinosu, Akkaraman, Ile de France x Anadolu Merinosu (F1) ve Ile de France x Akkaraman (F1) Melezi Koyunlarda İlk Kırkım Canlı Ağırlığı ve Kirli Yapağı Verimi. *Tarım Bilimleri Dergisi*. 12(2): 69-72. (In Turkish)
- Bilgin, C. C., Can, Ö. E. 2001. Status of canids in Turkey. Report to IUCN Canidae Specialist Group
- Boitani, L. 1992. Wolf research and conservation in Italy. *Biological Conservation*. 61(2): 125-132.
- Boitani, L. 2000. Action Plan for the conservation of the wolves (*Canis lupus*) in Europe. Nature and environment, No. 113. Council of Europe Publishing.
- Busch, R. H. 1995. The Wolf Almanac. The Lyons Press, Guilford. 226 pp.
- Can, Ö. E. 2001. The Status of gray wolf (*Canis lupus* L. 1758), brown bear (*Ursus arctos* L. 1758) and eurasian lynx (*Lynx lynx* L. 1758) in Turkey and recommendation for effective conservation programs. M. Sc. Thesis. Middle East Technical University, Ankara, Turkey.
- Can, Ö. E. 2004. Status, conservation and management of large carnivores in Turkey. Report to Convention on the Conservation of European Wildlife and Natural Habitats.

- Carnes, J. C., Van Ballenberghe, V. 2002. Human Injuries Caused by Presumably Healthy Wild Wolves in Twentieth Century North America. In: 14th Annual North American Interagency Wolf Conference. (Presented at the 2002 North American Interagency Wolf Conference. April 22-24, 2002. Boise, ID)
- Chapron, G., Legendre, S., Ferrière, R., Clobert, J., Haight, R. G. 2003. Conservation and control strategies for the wolf (*Canis lupus*) in western Europe based on demographic models. *C. R. Biologies*. 326: 575-587.
- Clarke, C. D. H. 1971. The beast of Gevauden. *Natural History*. 80: 44-51, 66-73 (cited in Mech & Boitani 2003, p. 302).
- Council of Europe. 1979. Convention on the conservation of European wildlife and natural habitats: Bern Convention, 1979 European Treaty Series – No. 104. Bern (available on official site: <http://conventions.coe.int/Treaty/Commun/QueVoulezVous.asp?NT=104&CM=8&DF=29/09/2005&CL=ENG>)
- Cuesta, L., Barcena, F., Palacios, F., Reig, S. 1991. The trophic ecology of the Iberian wolf (*Canis lupus signatus* Cabrera, 1907) – A new analysis of stomachs data. *Mammalia*. 55 (2): 239-254.
- Ericsson, G., Heberlein, T. A. 2003. Attitudes of hunters, locals, and the general public in Sweden now that the wolves are back. *Biological Conservation*. 111: 149-159.
- Espuno, N., Lequette, B., Poulle. 2005. Heterogeneous response to preventive sheep husbandry during wolf recolonization of the French Alps. *Wildlife Society Bulletin*. 32(4): 1195-1208.
- Gade-Jorgensen, I., Stagegaard, R. 2000. Diet composition of wolves (*Canis lupus*) in East-Central Finland. *Acta Theriologica*. 45 (4): 537-547.
- Governorship of Karaman (T.C. Karaman Valiliği). 2005. Ekonomi. <http://www.karaman.gov.tr/trdefault.asp>, 29.09.2005
- Governorship of Konya (T.C. Konya Valiliği). 2004. Muhtelif İstatistikler. <http://www.konya.gov.tr/konya/istatistik/9.htm>, 29.09.2005.
- Graham, K., Beckerman, A. P., Thirgood, S. 2005. Human–predator–prey conflicts: ecological correlates, prey losses and patterns of management. *Biological Conservation*. 122: 159-171.
- IUCN: International Union for Conservation of Nature and Natural Resources. 2004. The IUCN Redlist of Threatened Species. <http://www.redlist.org/>. 19.09.2005.

- Jedrzejewski, W., Jedrzejewska, B., Okarma, H., Schimdt, K., Zub, K., Musiani, M. 2000. Prey selection and predation by wolves in Bialowieza Primeval Forest, Poland. *Journal of Mammalogy*. 81 (1): 197-212.
- Kellert, S. R., Black, M., Rush, C. R. & Bath, A. J. 1996. Human culture and large carnivore conservation in North America. *Conservation Biology* 10: 977-990.
- Kohira, M., Rexstad, E.A. 1997. Diets of wolves, *Canis lupus*, in logged and unlogged forests of Southeastern Alaska. *Canadian Field-Naturalist*. 111 (3): 429-435.
- Kübarsepp, M., Valdmann, H. 2003. Winter diet and movements of wolf (*Canis lupus*) in Alam-Pedja Nature Reserve, Estonia. *Acta Zoologica Lituanica*. 13: 28-33.
- Mech, L. D., Boitani, L., eds. 2003. *Wolves: Behavior, Ecology and Conservation*. The University of Chicago Press, Chicago and London. 448 pp.
- Meriggi, A., Brangi, A., Matteucci, C., Sacchi, O. 1996. The feeding habits of wolves in relation to large prey availability in Northern Italy. *Ecography*. 19 (3): 287-295.
- Meriggi, A., Lovari, S. 1996. A review of wolf predation in Southern Europe: Does the wolf prefer wild prey to livestock? *Journal of Applied Ecology*. 33 (6): 1561-1571.
- Meriggi, A., Rosa, P., Brangi, A., Matteucci, C. 1991. Habitat use and diet of the wolf in Northern Italy. *Acta Theriologica*. 36 (1-2): 141-151.
- Mishra, C. 1997. Livestock depredation by large carnivores in the Trans-Himalaya: Conflict perceptions and conservation prospects. *Environmental Conservation*. 24 (4): 338-343.
- Naughton-Treves, L., Grossberg, R., Treves, A. 2003. Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. *Conservation Biology*. 17 (6): 1500-1511.
- Okarma, H. 1995. The trophic ecology of wolves and their predatory role in ungulate communities of forest ecosystems in Europe. *Acta Theriologica*. 40 (4): 335-386.
- Papageorgiou, N., Vlachos, C., Sfougaris, A., Tsachalidis, E. 1994. Status and diet of wolves in Greece. *Acta Theriologica*. 39 (4): 411-416.
- Patalano, M., Lovari, S. 1993. Food-habits and trophic niche overlap of the wolf *Canis lupus*, L 1758 and the red fox *Vulpes vulpes* (L 1758) in a Mediterranean mountain area. *Revue D'ecologie-La terre et la vie*. 48 (3): 279-294.

- Poulle, M. L., Carles, L., Lequette, B. 1997. Significance of ungulates in the diet of recently settled wolves in the Mercantour Mountains (Southeastern France). *Revue D'ecologie-La terre et la vie*. 52 (4): 357-368.
- Randi, E., Lucchini, V. 2002. Detecting rare introgression of domestic dog genes into wild wolf (*Canis lupus*) populations by Bayesian admixture analyses of microsatellite variation. *Conservation Genetics*. 3: 31-45.
- Røskaft, E., Bjerke, T., Kaltenborn, B., Linnell, J. D. C., Andersen, R. 2003. Patterns of self-reported fear towards large carnivores among the Norwegian public. *Evolution and Human Behavior*. 24: 184-198.
- Schwartz, M. 1997. A history of dogs in the early Americas. Yale University Press, New Haven, U.S. (cited in: Wayne, R. K., Brown, D. M. 2001. Hybridization and conservation of carnivores. In: Gittleman, J., Funk, K., MacDonald, D., Wayne, R., eds. *Carnivore Conservation*. Cambridge University Press, Cambridge. pp. 145-162.)
- Sillero-Zubiri, C., Laurenson, M. K. 2001. Interactions between carnivores and local communities: conflict or co-existence? In: Gittleman, J., Funk, K., MacDonald, D., Wayne, R., eds. *Carnivore Conservation*. Cambridge University Press, Cambridge. pp. 282-312.
- Sillero-Zubiri, C., Switzer, D. 2004. Management of wild canids in human-dominated landscapes. IUCN Canid Action Plan.
- Smietana, W., Klimek, A. 1993. Diet of wolves in the Bieszczady Mountains, Poland. *Acta Theriologica*. 38 (3): 245-251.
- Treves, A., Naughton-Treves, L., Harper, E. K., Mladenoff, D. J., Rose, R. A., Sickley, T. A., Wydeven, A. P. 2003. Predicting human-carnivore conflict: a spatial model derived from 25 years of data on wolf predation on livestock. *Conservation Biology*. 18 (1): 114-125.
- TSE: Türk Standartları Enstitüsü (Institute of Turkish Standards). 2003. Türk Standardı, TS 384.
<https://www.tse.org.tr/turkish/abone/StandardDetay.asp?STDNO=48604&sira=0>. 26.08.2005
- Wayne, R. K., Brown, D. M. 2001. Hybridization and conservation of carnivores. In: Gittleman, J., Funk, K., MacDonald, D., Wayne, R., eds. *Carnivore Conservation*. Cambridge University Press, Cambridge. pp. 145-162.
- White, P. C. L., Jennings, N. V., Renwick, A. R., Barker, N. H. L. 2005. Questionnaires in ecology: a review of past use and recommendations for best practice. *Journal of Applied Ecology*. 42: 421-430.

WHO: World Health Organization. 2005. Health Topics: Rabies.
<http://www.who.int/topics/rabies/en/> . 26.08.2005

APPENDIX A

Interview Questions

The date, name of the shepherd and village are recorded and the following questions are asked to shepherds:

1. How many years have you worked as a shepherd?
2. Where are you from?
3. Have you attended a course on shepherding?
4. Are you happy with being a shepherd?
5. How many sheep are there in your flock and to how many families do they belong?
6. How many sheep were there in your flock and to how many families did they belong to in the past?
7. Are there goats in the flock?
8. Do you have a donkey?
9. Do you own any sheep within the flock?
10. When do you confine sheep in the corral?
11. What is the height of the fence/wall enclosing the corral?
12. What breed are the sheep? (Chios, White Karaman, Awassi, other)
13. At what times during the day in summer, do the sheep graze in the pasture?
Where do they stay when they are not grazing?
14. At what times during the day in winter, do the sheep graze in the pasture?
15. Have you ever heard a wolf howl?
16. Have you ever seen a wolf during shepherding?
17. How do you understand the wolf is near?
18. How many times did the wolves attack this year?
19. How many times did the wolves attack last year?

20. Was the number of attacks higher/lower in the past?
21. How many sheep do the wolves generally kill in an attack?
22. On which months, do the wolves attack more often?
23. When did they last attack your flock? (which month and at which hour)
24. Have you seen the wolf/wolves yourself during the attack?
25. Have you seen the injured/dead sheep?
26. What do you do with the dead sheep?
27. Do you think wolves should live here?
 - a. Yes → What do you think about their current number?
 - b. No → Should all the wolves here be killed?
28. Do you have a livestock guarding dog?
29. How many are they and what breed?
30. Do they chase away wolves?
31. How many attacks did they deter this year?
32. Are there free-ranging dogs here?
33. Do your dogs attack humans and/or sheep?
34. What can be done to protect the sheep better?

APPENDIX B: Interview Data

Table A-1. Data obtained from the interviews

Interviewee ID No.	Interview Date	Village	Name of the shepherd	From	Years of experience	Shepherding Education (Y/N)	Likes being a shepherd (Y/N)	Flock size	belonging to # family(ies)	Types of sheep		
										Chios	W.Karaman	Other
i	Sep. 2004	Karadona	Salih Aygüner	Aksaray	-	-	-	450	-	-	-	
iii	Sep. 2004	Yarma	Hacı Ömer	Aksaray	10	-	N	300	1	all	.	
1	July 2005	Kızılcaкую	İsmet Yalçın	Aksaray	30	N	N	400	7	.	all	
2	July 2005	Karadona	Salih Aygüner	Aksaray	20	N	Y	650	3	.	all	
3	July 2005	Karadona	Mehmet Ercan	Karapınar	20	N	Y	500	2	.	all	
4	July 2005	Yağlıbayat	-	Aksaray	25	N	N	450	1	.	rest Awassi	
5	July 2005	Ağsaklı	Ercan Özcan	Ağsaklı	5	N	Y	300	2	.	all	
6	July 2005	Beşoğl	Ayhan Ulus	Beşoğl	20	N	Y	450	1	30	rest	
7	July 2005	Beşoğl	Ramazan Ulus	Beşoğl	20	N	Y	600	3	.	all	
8	July 2005	Göçü	Bayram Toprak	Dişarbakır	20	N	N	1200	3	.	all	
9	July 2005	Göçü	Adem Yüce	Aksaray	18	N	N	650	1	.	all	
10	July 2005	Karakaya	Şevket Uygur	Aksaray	30	N	Y	300	1	.	all	
11	July 2005	Karakaya	Ahmet Kaya	Aksaray	30	N	N	500	2	.	all	
12	July 2005	Divanlar	Ramazan Koçak	Aksaray	20	N	N	600	1	.	all	

Table A-1. Data obtained from the interviews (*continued*)

Interviewee ID No.	Goat	Donkey	Sheep ownership (Y/N)	Heard howling (Y/N)	Seen wolf (Y/N)	Signs suggesting a w nearby	# attacks this year	# attacks last year	In an attack av. # sheep killed	Attacks generally occur in
i	-	-	-	-	Y	sheep, dog	-	-	-	winter
iii	-	-	N	-	-	-	-	1	-	summer
1	Y	Y	N	Y?	Y	sheep	1	0	all	no generalization
2	Y	Y	N	Y	Y	dog	1	2	60	warm seasons
3	Y	Y	N	Y	Y?	dog	0	0	1-3	warm seasons
4	Y	Y	N	N	Y	sheep, dog	0	1	chance event	all except winter
5	Y	Y	.	N	N	sheep	3	5	all	mostly in summer
6	Y	Y	.	N	Y	sheep	0	1	all	warm seasons
7	N	Y	.	N	Y	dog	0	1	-	Nov., Oct.
8	Y	Y	N	Y	Y	dog	3	3	all	summer
9	Y	Y	N	N	Y	dog	5	4	all	summer
10	Y	Y	N	Y	Y	sheep, wolf howl	2	2	all	autumn
11	Y	Y	N	N	Y	dog	4	4	all	spring
12	Y	Y	N	N	Y	doesn't know	4	1	all	no generalization

Table A-1. Data obtained from the interviews (*continued*)

Interviewee ID No.	Last attack				Dead sheep are	Do you think wolves should live here?		LGDs owned	
	Month	time	seen the wolves?	seen inj/killed sheep?		YES; their # is H / L	NO; all be killed? (Y/N)	#	breed
i	-	04:30	5 ws seen	Y	not left	-	-	4	mixed
iii	summer	05:00	N	Y	left	.	N	6	mixed
1	July 2005	at night	N	N	left to dogs	.	Y	8	mixed
2	June 2005	midnight	N	Y	left	H	.	3	mixed
3	left	no idea	.	4	mixed
4	May 2004	night	N	.	left to dogs	.	Y	5	mixed
5	July 2005	night	N	Y	left to dogs	.	Y	9	mixed
6	April 2004	night	N	Y	left	.	Y	3	Kangal
7	May 2004	-	N	Y	left	H	.	3	1 Kangal
8	no attack	.	.	.	left	.	Y	8	mixed
9	July 2005	night	N	Y (1)	left to dogs	.	Y	6	mixed
10	May 2005	night	N	Y	left to dogs	.	Y	10	mixed
11	July 2005	night	N	N	left to dogs	.	Y	16	mixed
12	July 2005	night	N	Y	left to dogs	.	Y	10	mixed

Table A-1. Data obtained from the interviews (*continued*)

Interviewee ID No.	LGD chases wolves? (Y/N)	# attacks deterred	Dog attacks on		Free ranging dogs (Y/N)	ways to decrease sheep loss to wolves
			humans	other sheep		
i	N	-	-	-	-	good dogs
iii	only the Kangal	-	-	-	N	more dogs, awake (alert) shepherds
1	Y	unknown	Y	N	N	good dogs, weapon
2	Y if sees	yes	Y	Y	N	good dogs (Kangal)
3	Y	unknown	Y	Y	N	-
4	Y	no	N	N	N	nothing can be done
5	Y	no attack	Y	N	N	good dogs, killing wolves (weapon)
6	not encountered yet	no attack	Y	N	N	good dog, good shepherd, bells for the sheep (to reveal anxiety), weapon
7	only Kangal	Y	Y	N	N	good shepherd (educated), bağcak
8	Y	Y	Y	N	N	nothing can be done
9	N	0	N	N	N	nothing can be done if there are wolves
10	Y	2	N	N	Y	good dog, weapon
11	Y	5-6	Y	N	N	good dog, weapon
12	N	unknown	Y	Y	N	nothing can be done if there are wolves

APPENDIX C

News Data

Table A-2. The News stories between the years 2000-2005 that were used in the analysis.

ID (year/month/day)	Type	City	ID (year/month/day)	Type	City
2000/06/19	N	Bursa	2004/11/16	L	Konya
2000/07/03	L	Sivas	2004/11/25	L	Kastamonu
2000/07/22	L	Rize	2004/11/29	DS	Kayseri
2000/08/23	I	Erzincan	2004/11/30	L	Sivas
2000/09/28	L R	Erzincan	2004/12/11	S	Kırıkkale
2002/01/09	N	Bitlis	2004/12/12	N	Van
2002/01/29	L	Çorum	2004/12/14	L	Konya
2002/04/05	I	Erzincan	2004/12/18	I R	Hakkari
2002/11/14	N	Rize	2004/12/18	N	İğdir
2002/12/09	L	Kırklareli	2004/12/21	N	Hakkari
2003/01/02	N	Sivas	2004/12/21	L	Sivas
2003/01/08	L	Malatya	2004/12/22	L	Sivas
2003/01/14	L	Malatya	2004/12/28-1	LS	Aydın
2003/02/21	N	Konya	2004/12/28-2	N	Erzincan
2003/03/19-1	L	Erzincan	2005/01/04	N	Van
2003/03/19-2	N	Van	2005/01/15	I	Hakkari
2003/05/01	L	Kars	2005/02/08	N	İstanbul
2003/05/16	L	Van	2005/02/09	L	Kars
2003/08/01	L	Konya	2005/02/10-1	L	Bartın
2003/10/11	L	Van	2005/02/10-2	N	Hakkari
2004/01/03	L	Kars	2005/02/24	L R	Adıyaman
2004/01/07	L	Batman	2005/02/28	I	Van
2004/01/23	L	Niğde	2005/01/15	I	Hakkari
2004/01/30	L	Kars	2005/02/08	N	İstanbul
2004/05/15	IS	İzmir	2005/02/09	L	Kars
2004/06/01	L	Muş	2005/02/10-1	L	Bartın
2004/06/04	L	Konya	2005/02/10-2	N	Hakkari
2004/06/09	L	Sivas	2005/02/24	L	Adıyaman
2004/06/13	L	Konya	2005/02/28	I	Van
2004/08/26	L	Zonguldak	2005/04/09	LS	Antalya

- * **Type Keys:**
- I ; Human injury caused by an attack
 - L ; Attacks on livestock and dogs
Wolf seen in the settlement without any
 - N ; harm
 - R ; Rabid wolf attacks
 - S ; Attacks proved to be not by wolves