FINAL REPORT

WOLF PREDATION ON DOMESTIC AND WILD UNGULATES IN CENTRAL TURKEY:
CONSERVATION THROUGH REDUCING CONFLICT BETWEEN WILDLIFE AND LIVESTOCK HUSBANDRY

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I. BACKGROUND

The wolf (*Canis lupus*) 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.

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, 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). Specifically, 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). The success of wolf resides in its ability to reasonably estimate the vulnerability of individual prey. 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).

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 has been no study 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).

Wolves and Humans

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, 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).

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.

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 (i.e. when wolf perceives humans as prey) and defensive attacks (i.e. when wolf is provoked by humans). Predatory attacks are attributed to wolves that have lost their fear of humans and, like defensive attacks, are quite rare. On the other hand, rabid attacks are recognized as the most common reason of wolf attacks. Rabies is a well-known 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. 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.

The wolf 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, the wolf 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).

In Turkey, persecution of wolf is regarded as the only means to control livestock depredation. However, this carnivore is also persecuted for its pelt, which has been sold in Turkey.

Objectives

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.

II. METHODS AND OUTCOMES

The study site, Bozdağ is a Wildlife Protection Area within the city province of Konya (Fig. 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 Mouflon Breeding Station which covers some 3500 hectares. Bozdağ is under the influence of the continental climate; hot summers and cold winters with precipitation usually in the form of snow (Arıhan & 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 the wolf and Turkish mouflon (*Ovis gmelinii anatolica*) (Arıhan, 2000).

Bozdağ region is especially important because of serving as a habitat for the last remaining population of the Turkish mouflon. 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 Arıhan (in Arıhan & 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.

There are nine villages encompassing the Turkish Mouflon Breeding Station and these are, Kızılcakuyu, Karadona, Yağlıbayat, Ağsaklı, Beşağıl, Göçü, Karakaya, Divanlar, and Akbaş (Fig. 2). There is also a small town called Yarma to the southwest of the station. 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. 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.

Thirteen shepherds from nine villages and a small town around the Turkish Mouflon Breeding Station were interviewed to investigate animal husbandry practices and depredation events and to assess attitude towards wolf (Fig. 3). Interviews were executed in two sessions and the first session on September 30-31, 2004, which was the pilot study, included 3 interviews

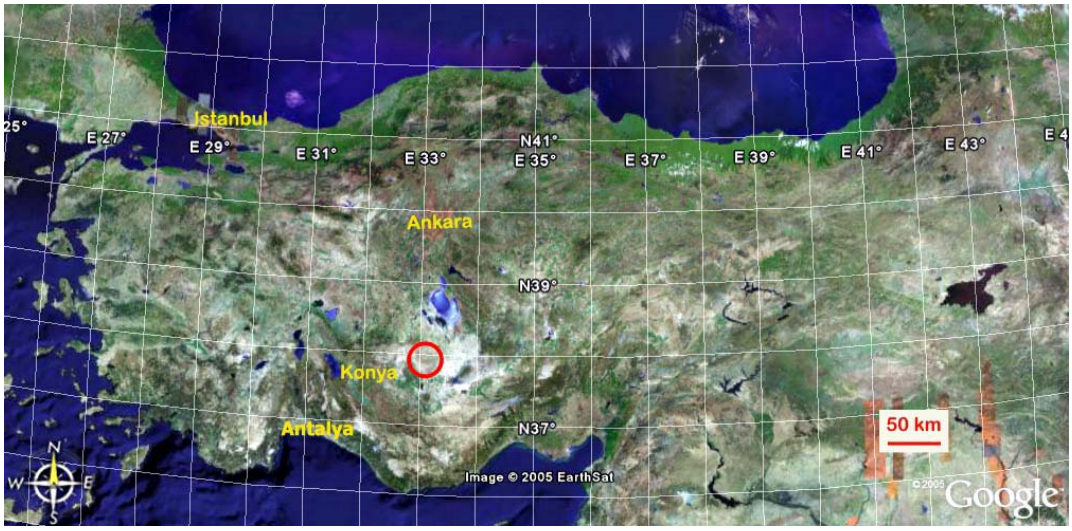

Figure 1. Location of the study site on the map of Turkey.
(The map is obtained from Google Earth)

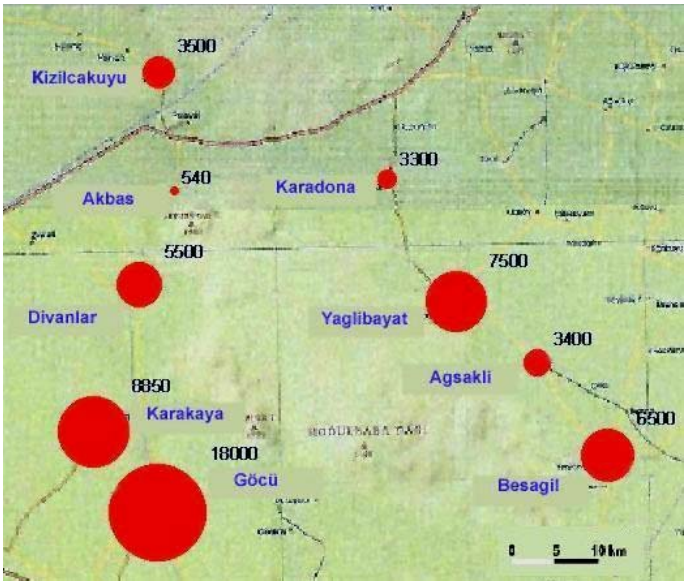

Figure 2. Map of the study site showing the number of sheep at each village.
(According to the records of the Konya Province Directorate of Agriculture.)

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;

Figure 3. Interview with shepherds. (30.07.2005)

1) **Information on the interviewee** (e.g. where the interviewee is from, whether he likes to be a shepherd, whether he received training for being a shepherd, and past experiences with wolves.)

2) **Information on the livestock and husbandry practices** (e.g. what the flock size is, whether they are protected in corrals during the night.)

3) **Information on livestock guarding dogs** (e.g. how many, and what breed the livestock guarding dogs are, what is the reaction of LGDs towards wolves or to strangers.)

4) **Information on wolf attacks** (e.g. how frequently wolves attack, detailed description of the last attack and the time of the year when wolf attacks occur often.)

5) **Attitude towards wolf**

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.

The field trips and interviews revealed that each flock is attended by a shepherd and a number of mixed breed livestock guarding dogs (LGDs) (Fig. 4), 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 annually 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 fewer depredations. 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.

Figure 4. Mixed breed shepherd dogs (Kızılcakuyu, 30.08.2005).

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, no more than one 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 latest depredation event 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 the wolf as in Europe because of the respect this predator has gained in Turkish history and epics. Therefore, the public in rural areas may tolerate depredation unless it is too frequent and the losses are not too big. However, current level of depredation at Bozdağ is perceived as more than that can be tolerated, therefore the majority called for the eradication of the carnivore. This harsh attitude can be relaxed by decreasing sheep losses to wolves through preventive husbandry practices as proposed above.

Wolf attacks on humans in Turkey do not seem to be very frequent according to records of the Ministry of Health on rabid attacks, and on news stories but the lack of documentation makes a diagnosis inconclusive. Moreover, false information given by the news sources exacerbates the already unfair bad reputation of wolf. No verified record of human deaths due

to wolves 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 the rabies virus (Sillero-Zubiri & Laurenson, 2002), vaccination of those animal populations would decrease its occurrence, and may even eliminate this disease from Turkey with time.

Obstacles during the project

Radiocollaring of wolves at the study site could not be accomplished because apparently the wildlife authorities exterminated a total of 8 wolves during 2003-2005 through shooting as vermin control. The legality of this action is highly debatable and the authorities are unwilling to discuss any details. This has unfortunately removed almost all wolves in the area and severely restricted our chances of a capture of a wolf. It is hoped that recruitment from adjacent land will colonize this locality and once more enable us to try captures.

This project 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.

III. BUDGET

We had received € 6,859.75 and we spent € 4,447.52 for the field trips and equipments explained in the below table. We purchased snares instead of leghold traps because of the higher risk of harming the animal in the latter. Due to the economical conditions and inflation rate in Turkey, we realized that we had underestimated the customs and permit fees and transportation costs. During the project, we used the camera traps, binoculars, GPS devices and sound recorders belonging to our lab at the Department of Biology in Middle East Technical University.

Item	Explanation	Cost (€)
Telemetry Equipment	6 Radio collars 1 receiver 1 antenna	1,960.00
Snares	10 Relaxing Lock/Live Capture Snares	37.22
Customs, taxes and permit fee of telemetry equipment	An Institute of Turkish Standards (DIE) permit was required	1,468.03
Field costs	Transport to the field, per diem, local transport for a total of 10 field trips	894.73
Books	*Wolves : Behavior, Ecology, and Conservation* by Mech & Boitani (2003)	36.59
	Coexisting with Large Carnivores: Lessons from Greater Yellowstone by Clark, Rutherford & Casey (2005)	50.95
TOTAL		**4,447.52**

All expenditure is documented and proof can be made available at request.

IV. FUTURE PROSPECTS

We plan more field trips to the area to increase the number of interviewees thus to increase the reliability of our findings. We also plan to produce brochures informing the locals about behaviour of wolves and ways to prevent livestock depredation so that these can help mitigate the human wildlife conflict in the Bozdağ region. In addition, we will continue with our trials of capturing wolves to fit them with the radio collars. Upon fitting the collars, the animals need to be tracked regularly.

Turkish mouflon has been reintroduced to two habitats in the former range of this ungulate by the Ministry of Environment and forest of Turkey. Both of these locations are known to inhabit wolf packs, hence we plan to collect scats and monitor the diet of wolves. Moreover, a similar project as we have done in Bozdağ could be carried out in these sites to propose solutions to new conflicts between humans and wildlife. New conflicts may arise in these sites because wolves would possibly change predation habits and if they succeed in predation on mouflons, they may increase in number. As a result, their pressure on domestic livestock may increase at times when preying upon mouflon is difficult such as when there are fewer mouflons left.

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