

Human–brown bear conflicts in Artvin, northeastern Turkey: Encounters, damage, and attitudes

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Abstract: The brown bear (*Ursus arctos*) is the largest carnivore in Turkey and has been legally protected since 2003. However, increasing levels of conflict between brown bears and humans have been reported for several regions, especially for Artvin in northeastern Turkey. We documented the conflict in an attempt to understand human attitudes and responses and evaluate existing and potential damage prevention techniques. The study was conducted within landscapes at different scales, ranging from a core area defined by a large valley system to the whole of the Artvin Province. Data on close encounters, injuries, and damage caused were collected through government records, published literature, and open-ended interviews with the local people. On more than two-thirds of close encounters recorded, no harm occurred to bear or people. Bear attacks on humans were rare and only occasionally led to non-fatal injuries. Nevertheless, several bears were shot and killed in the study area during the study (2002–2005), apparently as a consequence of damage experienced by farmers. Interviews indicated a widespread belief that bears have become more of a problem. Bear damage was reported mostly in late summer for field crops and orchards and in spring for beehives. Precautions taken by villagers relied mostly on locally available technologies and varied in effectiveness against bears. We propose that introduction and implementation of modern techniques of exclusion such as portable electric fences around valuable resources (e.g. bee yards), improvements in bear awareness, and effective cooperation among various stakeholders would reduce human–bear conflict to acceptable levels in the region.

Key words: Artvin, attitudes, brown bear, conflict, damage prevention, Turkey, *Ursus arctos*

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Brown bears (*Ursus arctos*) are the largest carnivore species that is still widespread in Turkey. Historically, they ranged over most of the country, missing only from the coastal plains and the open steppes (Turan 1984). Currently, the species occurs in most of northern and eastern Turkey as well as locally in the west and south, but its numbers have declined in much of its range due to forest fragmentation and human persecution (Can and Togan 2004).

Until very recently, the brown bear was not legally protected under the now obsolete Hunting Law of 1937 (Official Gazette of Turkish Republic 1937). It is unknown how many were killed each year despite the fact that bears are more respected and positively perceived than other predators in Turkey and elsewhere in Europe (Ermala 2003, Andersone and Ozolins 2004, Can and Togan 2004, Kaczensky et al.

2004), yet a significant number local populations must have been affected. Prior to 2003, the species was protected only through annual decrees by the Central Hunting Commission. However, in 2003 law 4915 banning the killing of bears except for controlled trophy hunting was introduced (Official Gazette of Turkish Republic 2003). As of 2008, the fine for illegal killing of a bear is 18,000 YTL (New Turkish Lira, equivalent to about US\$14,000, Turkish Ministry of Environment and Forestry 2007). However, the ban was temporarily removed in late 2007 to allow for the trophy hunting of several problem bears, a decision which was heavily criticized by conservationists.

The northeastern part of Turkey, where settlements are small and scattered, is known for its relatively high levels of bear-related conflict due to an apparent increase in livestock mauling or deaths and raids on beehives, agricultural fields, and orchards by bears (Ambarlı 2006). As elsewhere in

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the world where such conflicts are common, there is growing resentment among villagers who usually blame conservation authorities and may use illegal means to get rid of problem bears (Woodroffe 2000, Rao et al. 2002, Treves et al. 2004, Gunther et al. 2004, Kaczensky et al. 2004).

In Turkey, human deaths due to bear attacks are uncommon. In the last 5 years, only 2 documented deaths were recorded in the archives of the Gendarmerie (a military police force in small towns and rural areas): a villager was killed in 2003 in Kastamonu (Can 2004) and another in 2005 in Kars (Sarıkamış Gendarmerie Command, Kars, Turkey, personal communication, 2005). So far there are no confirmed records of predatory attacks in Turkey, unlike the fatal case in Romania where a rabid bear was implicated or recent fatal cases in Greece and Finland (Löe and Röskafth 2004, Cooke and Shapiro 2005, Vougiouklakis 2006, Giorgio et al. 2007).

Sound scientific data is necessary for making management decisions related to bears and for sustainable management of bear populations (Servheen et al. 1999). However, there has not yet been detailed field research on the bears of northeastern Turkey. The only quantitative data are from fixed point counts carried out intermittently since 2001 by the Directorate of Nature Conservation and National Parks (NCNP) in Artvin Province (unpublished data, NCNP, Artvin, Turkey). Our objective was to shed light on the reasons for human-brown bear conflicts in Artvin, Turkey.

Study area

We selected our study area within Artvin province, a well-known hotspot of wildlife conflict (Can and Togan 2004; unpublished data, Archive of Commander of Artvin Province Gendarmerie, Artvin, Turkey; unpublished data, NCNP, Artvin, Turkey). Artvin lies in northeastern Turkey, bordering the Republic of Georgia, and exhibits strong geographic and climatic variability (Fig. 1). The landscape is dominated by high mountains rising from the coast and deep valleys that cut through them. About three quarters of potential bear habitat overlaps human settlements. Due to difficulties in obtaining reliable data at the scale of the province, we used separate geographical scales for different types of data (see Methods).

The study concentrated on an 800 km² area in the Yusufeli County in southeastern Artvin, between

40°33' to 41°06'N and 41°08' to 41°54'E (Fig. 1). The landscape is characterized by the Kaçkar massif in the north and River Çoruh in the south, where altitudes range from 550 m to over 3900 m. Lower parts are dry and warm; higher elevations are cool and humid with long, snowy winters. The vegetation ranges from Mediterranean scrubland (oak [*Quercus* spp.] and juniper [*Juniper* spp.] woodland) near the valley bottom through coniferous forest (dominated by *Picea orientalis*, *Abies nordmanniana*, and *Pinus sylvestris*) to rhododendron (*Rhododendron* spp.) scrub and alpine meadows (Eminağaoğlu and Anşın 2003, Güner et al. 2004).

Yusufeli County has a human population around 25,000, with half living in rural areas. The population density was 13 people/km². The area has a varied economy, mostly of a rural kind; farm plots and orchards are typically very small (~0.5–1 ha). Small numbers of cattle and sheep, typically kept by each household, are sometimes grazed together under the supervision of a household member. Timber production, bee-keeping, and increasingly, nature-based tourism, are important economic activities (Governorship of Artvin 2005).

Methods

We collected data on human-bear encounters through interviews with residents in 2003, 2004, and 2005 and through investigating government records and literature published between 1990 and 2005. We focused on the upper Yusufeli County, with an established conflict history, but damage data were also collected at the province level. Detailed information on sources and temporal scope are in Ambarlı (2006). Interviews were used to gather data on livelihoods, bear encounters, and attitudes toward bears. Data from government records and literature (Özen 1998) were used to document claimed damage and human casualties.

We conducted informal meetings in public places (e.g., coffee houses) and personal visits to 6 villages in Yusufeli County, Artvin Province, during 2004 and 2005 to explain study objectives to local people. Meetings were open to all. We recorded people's complaints about wildlife damage, especially damage by brown bears.

Following these meetings, a list of open-ended questions were developed in line with preliminary interviews to document conflict types, attitudes, bear population levels, bear-caused damage, and cost of

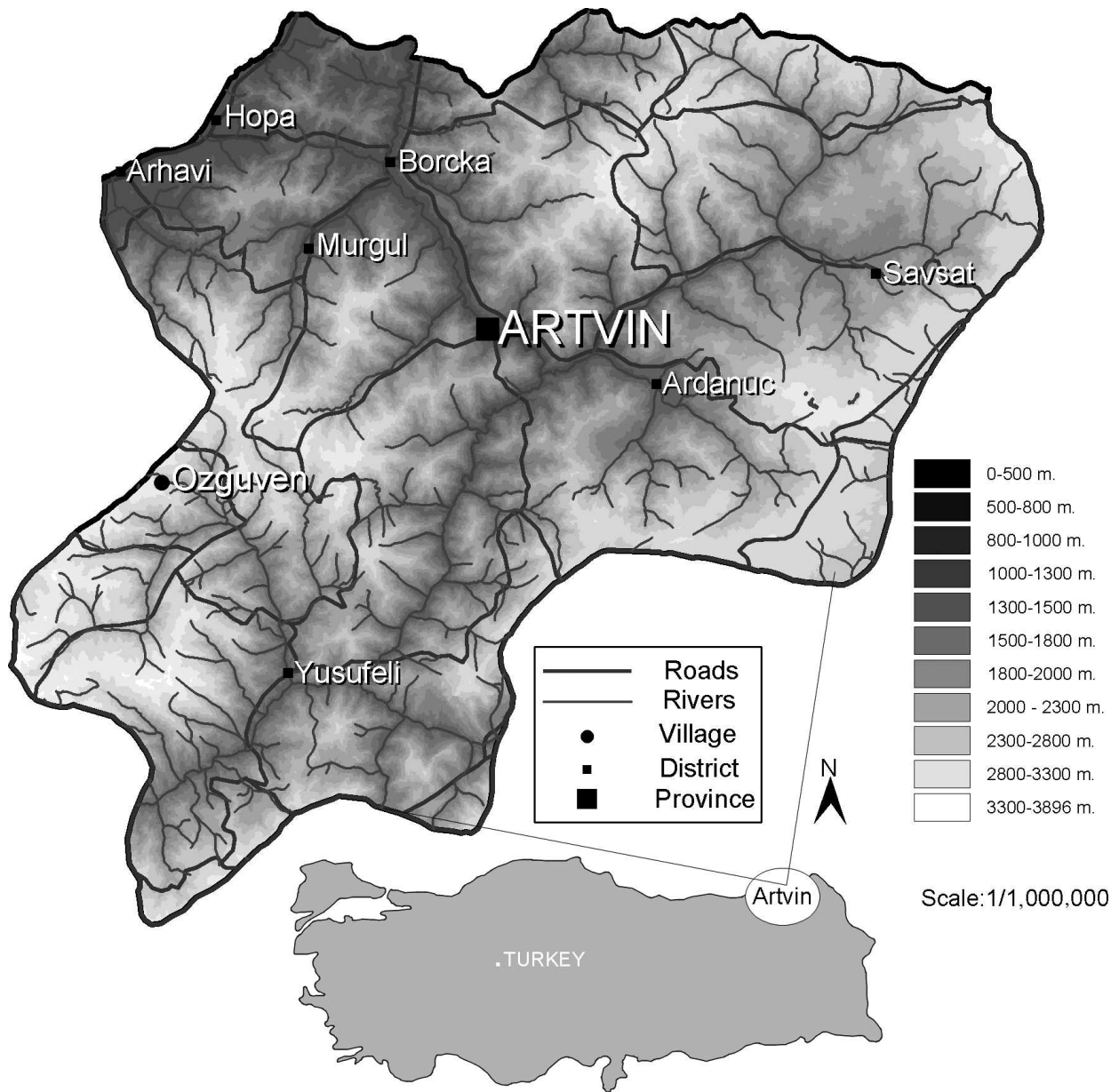


Fig. 1. The study area in Artvin province and Turkey (inset).

the damage. Open-ended questions have a distinct advantage over closed format questions when the primary goal is to learn behavior and attitudes of respondents (White et al. 2005). Interviews were then carried out in several villages, highland pastures, and seasonal settlements that were known to experience frequent conflict incidents. During the study, 19 villages and 20 seasonal hamlets (highland settlements where people live during the summer) were visited.

A total of 67 personal interviews were conducted. It was not possible to obtain a random sample; rather, interviews were held with any willing person encountered during the visits. Similarly, previous research in less developed countries (Fredriksson 2005, Jorgenson and Sandoval 2005, Chauhan and Singh 2006) had to rely on a non-random set of subjects for such interviews rather than using a fully randomized sampling scheme.

Our sampling involved face-to-face interviews with villagers and reflected first-hand experience and knowledge. Moreover, through personal interaction, we believe it was generally possible to judge the authenticity of the claims or cross check them, thus improving overall reliability.

As a measure of potential bias, we compared responses of interviewees that had suffered bear-related damage to those who had not, using a test of independence; we did not find any statistically significant difference between the groups in reported behavior, although they did differ in their attitude toward bear conservation. Therefore, we cannot demonstrate obvious and widespread bias due to non-random selection of our subjects. However, we recognize the restrictions of our limited sample size and accept the possibility of inadvertent biases; hence, our findings should be interpreted carefully.

Interviewees ranged in age from 11 to 82 years (mean age 50.2) and were mostly farmers, but also included other professions. The interviews were mostly conducted with men, but women ($n = 7$) were also represented when possible.

A close encounter was defined as one that involved a person and a bear within 50 meters of each other, except when the person was inside a building. For conflicts that caused bodily damage to people, gendarmerie reports were used. Such events were usually reported to the authorities, whereas livestock and beehive losses were reported to a much lesser extent as there was no wildlife damage compensation scheme. Eight such incidents were recorded, 5 of which involved injured people (unpublished data, Archive of Commander of Artvin Province Gendarmerie, Artvin, Turkey). These were cross-checked and expanded with relevant news reports on the internet.

NCNP does not have a formal incident report format in case of a conflict event. They only accept petitions and occasionally visit the damage site to verify damage. Therefore, we only used data based on such petitions within Artvin (unpublished data, NCNP, Artvin, Turkey). We also made reference to Özen (1998), who collated anecdotal information on human-bear conflicts in the upper part of Yusufeli between 1954 and 1996. All information obtained was rigorously checked for authenticity and correctness, and only data from reliable sources were used for analyses. We used SPSS 15.0 (SPSS Inc. 2006) for tests of independence of attitudes and past bear experience of the interviewees.

Table 1. Types of reaction and outcome in close encounters in Yusufeli, Artvin Province, Turkey, 1998–2005.

	Bear attack	Human harassment	No interaction
Nobody harmed	1	4	14
Human harmed	1	1	0
Bear harmed	0	6	0

Results

Encounters between people and bears

Our interviews provided data on 24 close encounters between 2003–05; an additional 3 encounters (in 1990, 1992, and 1995) were taken from Özen (1998). Of these encounters, 6 occurred while the person was in a vehicle; in the remainder, the person was on foot. More than half of all close encounters ($n = 14$) resulted in no significant interaction between brown bears and people. In 19 close encounters, no harm occurred to bear or humans (Table 1). However, in another 6 cases the bear was the subject of harassment by people and there were casualties of bears. The only 2 cases of attacks by bears without apparent provocation took place under circumstances that brought people close to a bear (Table 1).

During 2002–05, 5 cases of bears injuring humans were reported to the Gendarmerie. All were from outside the core study area. However, from the core area and between 1998 and 2005, we recorded 3 close encounters where people were harmed but not reported to the Gendarmerie. In 1998, a woman was injured by a female bear apparently trying to protect her cubs; the woman had been unaware of the bear's presence next to the agricultural plot she had been working. In 2002, a man suffered a slight injury when he approached a mortally ill bear that he assumed dead. In 2004, a woman was hospitalized due to shock after she encountered a bear inside a barn.

We were able to find reliable information on only 3 bear-caused human deaths. The earliest dated to 1970s and involved a hunter who was probably killed by the bear he shot and wounded (Özen 1998). The second death involved a shepherd who was killed by a bear (with cubs) that attacked his flock in 1999. A third death, also in 1999, occurred under unknown circumstances (unpublished data, NCNP, Artvin, Turkey).

Five bears were reported wounded during 2002–05, and at least 4 of those subsequently died. In 3 of

Table 2. Petitions submitted to NCNP and verified damage events reported by interviewees, by month, in Yusufeli in 2000 and 2002–05.

Month	Beehives	Orchards	Agricultural fields	Livestock	Total damage events
Mar	3	0	0	1	4
Apr	6	0	3	0	9
May	6	0	1	0	7
Jun	3	1	4	0	8
Jul	3	3	3	3	12
Aug	2	4	6	2	14
Sep	2	4	3	4	13
Oct	1	1	1	2	5

these cases, the cause of death was shooting with firearms but with no indication of self-defense by the shooter. At least 1 bear was, according to the man involved, overrun intentionally by a vehicle, although it managed to escape.

Among villagers interviewed, 61% used a firearm, a hatchet, a dog, or some combination of these for protection while working or traveling outdoors; the rest did not resort to any safety measures. Only half of the interviewees knew how to react safely in case of a close encounter (stay calm and move away without haste); the other half either did not know or would run away or shoot at the animal, thus increasing their risk.

Attitudes toward bear protection

Most of the 67 residents interviewed (82%) believed that bears had become a greater problem in recent years, although this percentage may have been influenced by recent bear-related experience of the subjects. When asked whether protection of bears should continue, 47% supported the idea (but roughly half of these only did so if the population was regulated or if damage was compensated), whereas 49% were against any protection. People who we categorized as having suffered damage by a bear were more likely to oppose the continued protected status of bears (62%) than those who had not suffered bear damage (32%; $\chi^2 = 5.233$, $P < 0.05$). Limited trophy hunting was seen as a solution by about half the respondents (57%).

Bear damage to property and protective measures

More than 51% of respondents reported bear damage during 2003–04: field crops and orchards were most frequently damaged (67% combined) followed by beehives (24%) and livestock (9%; Table 2). In 5 years for which official reports were

available (2000, 2002–05), 24 sheep and goats, 15 cows, and 1 dog were reported to have been killed by bears in Artvin Province. During 2003–04, damage took place most often in June–July ($n = 20$) and August–September ($n = 27$).

Villagers' precautions against bear damage varied in sophistication and effectiveness. Interviews and independent observations suggested that most local people used one or more types of preventive measures against bears. These included simple exclusion methods, like fences enclosing small fields or metal sheets placed around tree trunks in orchards; frightening devices such as automated sirens, flashlights or random noisemakers fueled with liquefied petroleum gas canisters; and deterrents such as dogs, clothing with human smell, or human presence near ripe crops. However, up to 21% of the respondents took no measures against possible bear damage.

Discussion

Outcome of close encounters and personal protection issues

Most documented close encounters between people and bears ended with no parties being harmed. This suggests to us that, in most cases, such close encounters did not represent a threat to either side. However, human harassment led to some harm, either for the bear or for the people, in 24% of harassment cases.

Within the core study area, bears attacked people in only 2 cases and harmed someone in 1 case. Therefore, the probability of a person being injured in a close encounter with a bear was low (<4%, 1 of 27) despite a considerable proportion of local people who seemed to be unaware of appropriate behavior in a close encounter with bears.

Among the measures cited for protection in such encounters, bear deterrent spray was an obvious

omission. The most widely recommended precaution against bear attack is capsicum spray (Linnell et al. 1996, Smith et al. 2008). However, the reaction of local people to the spray canisters suggested a lack of knowledge about this method of personal protection. This may be because in Turkey capsicum spray is not only difficult to obtain but also illegal to keep.

Damage and consequences for bears

Our findings on the predominant type of damage are somewhat different from those of similar studies in Europe (Kaczensky 1999, Mertens and Promberger 2001). For an estimated 100–150 adult bears within 800 km² (Ambarlı 2006), we documented only 19 sheep or goats and 4 cattle in 6 incidents in the worst year (2004). Granting that our information is likely incomplete, the rate of livestock depredation (~0.2 sheep/bear/year) is lower than other areas in Europe. For comparison, brown bears were estimated to kill an average of 5–10 sheep annually in eastern and southern Europe or up to 100 sheep in Norway (Sagør et al. 1997, Linnell et al. 2002). We suggest that this disparity is explained by the higher rates of attendance of livestock in Turkey by shepherds or sheep dogs.

Although up to 21% of those interviewed used no direct measures to minimize risk of damage from bears, we observed that most people around Artvin used various protective measures against bear damage. Such measures included highly effective methods such as placing traditional beehives (*karakovan*) at least 10 meters high on trees or building elevated hive platforms on poles covered with metal sheets to prevent access. However, anecdotal evidence suggests that the effectiveness of other measures was not high, and this may have led some property owners to resort to illegal means of killing nuisance bears.

Agricultural fields and orchards are most vulnerable to bear damage because local residents are not aware of effective, legal techniques to exclude or frighten bears. The traditional methods used probably lead to habituation. Moreover, damage frequency seems to have increased due to a drop in human activities such as farming and stockbreeding, which in turn was caused by many residents moving to big cities for better jobs after 1990 (Turkish Statistical Institute 2001). Therefore, as bears started to reoccupy former habitats, conflicts might have increased especially at such parts of Yusufeli.

Because official record keeping is at best fragmentary, it is difficult to establish whether the apparent

increase in encounters and damage was real or perceived. However, interview results (82% alleged an increase in recent bear-related problems) and an upsurge in the number of petitions demonstrate that the human–bear conflict has gained significance over time.

Attitude toward bears

Most interviewees linked the increase in conflict with the bear hunting ban in place for the last decade. Therefore, it should not be surprising that up to 79% of those interviewed preferred a management approach that involved population regulation. Some suggested that if damage was compensated, they would agree for full protection of the species, indicating that economic considerations were probably important.

Approximately half of respondents considered commercial trophy hunting as a solution to limit brown bear damage. Most opponents of strict protection were from villages that obtained more money from trophy hunting than other villages. Other opinions were that it would not work or would lead to conflict between residents standing to gain from trophy hunting and those who would not.

Recommendations

Modern techniques of exclusion and scaring that are used effectively all around the world are also relevant for our study area (Servheen et al. 1999, Swenson et al. 2000). One such method is permanent or temporary electrical fencing around beehives, small agricultural plots, and garbage dumps (Linnell et al. 1996, Huygens and Hayashi 1999). The introduction of electric fences should be extended and supported by the government or conservation organizations. Elevated metal platform for beehives is also an effective technique to prevent bear damage, but it is not feasible for mobile beekeepers. Its efficacy depends on its height (a minimum of 2.5 meters), structure, and the presence of a 60 cm overhang to discourage bears from climbing. Livestock guarding dogs (LGDs) might also be helpful as deterrents and as an early-warning system (Linnell et al. 1996). However, the overall acceptance of dogs in the study area seems to be low, and the utility of LGDs needs to be demonstrated if widespread adoption of this technique is indicated.

Compensation mechanisms with total or partial coverage of damage can be offered as another

method to remedy the conflict. However, although it will reduce resentment among farmers and help finance damage, compensation may not solve the real problem or may even create additional problems (Bulte and Rondeau 2005). Considering the difficulties in assuring sustainable funding for compensation, its susceptibility to abuse, and lack of experts (such as bear advocates of Austria [Kaczensky et al. 2004]), we do not recommend compensation as a viable solution (see Can and Togan 2004 for a differing view), at least for the time being.

Culling of problem bears may be incorporated into the framework of public hunting. However, there is widespread skepticism among researchers about the effectiveness of lethal control (Treves and Karanth 2003). Furthermore, identifying, tracking, and hunting a problem bear is difficult to put into practice as NCNP does not have relevant institutional capacity (Can and Togan 2004).

Human-bear conflict in northeastern Turkey can probably be reduced by implementing effective damage prevention and other ecological and social approaches. This requires effective collaboration among locals, NCNP, and researchers. A regional bear management plan prepared with a participatory approach may contribute to long-term viability of brown bears in Turkey through reduced damage and better understanding of local bear ecology. The involvement of all interested parties is crucial because successful conservation of brown bears and other carnivores depends on sociopolitical landscapes and favorable ecological conditions (Treves and Karanth 2003, Graham et al. 2005).

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