

Documenting the presence of the Anatolian leopard: A pilot study in K ro lu Mountains

FINAL REPORT TO PANTHERA FOUNDATION

January 2010, Ankara

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Reporting Period: November 1, 2008 – October 31, 2009

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SUMMARY

The Anatolian leopard (*Panthera pardus tulliana*) is a Critically Endangered felid form that was last documented to exist in 1974. Since recent reports indicate a continued presence in northwestern Turkey, we aim to provide unequivocal evidence for its survival through a combination of techniques such as GIS-based modeling, camera trapping and scat analysis with traditional field work for signs at sites with high probability of leopard occurrence.

The leopard's global range reaches its northwestern most extent in Turkey, where it was relatively widespread until about 50 years ago when persecution and habitat loss caused a serious decline. The last documented evidence of its presence was a shot individual about 100 km west of Ankara, although anecdotal reports of sightings and shot individuals continued to circulate (Kayalı & Savul 2000, Bilgin et al. submitted).

The study region is to the northwest of Ankara, the capital city of Turkey. It covers western parts of Ankara and southern parts of Bolu provinces. At the centre of this 350,000 hectares large region is the Koroğlu Range. This is a largely uninhabited area covered with pine forests and oak scrub. Further south, the landscape gets drier but winters are mild with little snow. Wild ungulate species in the area are wild boar (*Sus scrofa*), red deer (*Cervus elaphus*) and the endemic Turkish mouflon (*Ovis orientalis anatolica*), which was reintroduced to the region in 2005.

First, we have modeled the probable range of the Anatolian leopard and produced maps indicating sites with highest probability of leopard occurrence for warm and cold seasons separately. After narrowing down our study focus to a 100 sq.km. area with high expected leopard occurrence in both seasons as well as good logistics, we carried out systematic camera-trapping from December 2008 till December 2009. Camera traps were placed 0.5-4 km apart at sites representative of available altitudes, aspects and habitat types. At least 15 camera traps were functional at any time throughout the period (except for the first two months). We also performed regular surveys for possible evidence in the field, interviewed relevant people, and gathered probable leopard sighting records in and around the study site.

Within a total of 3930 trap-days, we obtained 1080 successful wildlife events and documented 13 wild mammal species. Of those, two are felids (*Lynx lynx* and *Felis datus*) and were reported from that site for the first time. For both species, these were the first or second documentation with camera traps in Turkey (Ambarlı et al., submitted). Although no leopards were photographed, a scrape and a track of suitable dimensions were recorded but considered inconclusive. Three recent sighting records by others in 2004/2005 and 2007 were detailed enough to be considered reliable.

During the project, we found out that hunting and forestry operations create significant disturbance during winter and summer, respectively. Livestock grazing in the area was of limited impact. We proposed a temporary hunting ban and discussed logging plans with the local forestry manager. A one year ban is now in place for the 2009-2010 hunting season. Amendments to the forest management plan to make it more wildlife friendly are under consideration.

Overall, although we could not obtain concrete evidence for leopard existence, abundant prey base (such as red deer, wild boar and smaller species), reliable sighting records in the past and recent times, and the presence of an almost intact fauna indicate ongoing presence of the leopard and we believe it is only a matter of time before unequivocal evidence is obtained.

INTRODUCTION

The Anatolian leopard (*Panthera pardus tulliana*) is a Critically Endangered felid form that was last documented to exist in 1974. Recent reports indicate a continued presence in northwestern Turkey. Within the scope of this project, we aim to provide unequivocal evidence for its survival through a combination of techniques such as GIS-based modeling, camera trapping and scat analysis with traditional field work for signs at sites with high probability of leopard occurrence. A positive outcome would generate strong interest for further research and would help the leopard as a flagship species for nature conservation.

The leopard's range reaches its northwestern most extent in Turkey, where it was relatively widespread until about 50 years ago when persecution and habitat loss caused a serious decline. The last documented evidence of its presence was a shot individual about 100 km west of Ankara, although anecdotal reports of sightings and shot individuals continued to circulate (Kayalı & Savul 2000, Bilgin et al. submitted).

Study area

The larger study region is situated in inner northwestern Anatolia, and about 100 km west of Ankara, the capital city of Turkey (Figure 1). It includes parts of Ankara and Bolu provinces, and borders the Eskişehir province. At the centre of this 350,000 hectares large region is the Köroğlu Mountains. This is a largely uninhabited area covered with pine and fir forests, oak scrub and highland pastures. Further south, the climate gets drier but winters are mild with little snow.



Figure 1. Location of study area

To be able to work at a smaller geographical scale, we relied on range modeling (see below) and also considered logistics of travel and safety. Thus, we narrowed down our study focus to a 100 sq.km. area west of Beypazarı; it featured high expected leopard occurrence in both summer and winter, included previous record localities, and had good logistics. This smaller area (hereafter the “study area”) is dominated by the Depel Mountain and surrounding valleys. Vegetation

composition and structure depend on the altitude and historical human use. The lower parts (500 to 1000 meters) are covered by Turkish pine (*Pinus brutia*) and other typically Mediterranean plants such as *Paliurus spina-dristi*, *Pistacia atlantica* and *Cistus* spp., as well as some cropland and orchards. Above this belt, temperate coniferous forest composed of black pine (*P. nigra*), junipers (*Juniperus excelsa* and *J. oxycedrus*) and with an understory of oak-dominated scrub (*Quercus pubescens*, *Pyrus eleagnifolia*, *Crataegus* spp.) reaches up to 1650 meters (Fig.2). Above this altitude, there are grass dominated highland pastures which are seasonally utilized by a few sheep and goat flocks.



Figure 2. A scene from the study area

Prey base

As part of this project we tried also to document the presence of suitable prey for the leopard. In Iran, Armenia, Daghestan and Turkey, the leopard is usually associated with rugged terrain and wild goats (*Capra* sp.) and/or wild sheep (*Ovis* sp.) as prey (Khorozyan 2005, Khorozyan 2008, Bilgin & Turak, unpublished). However, in our study area the most common such large ungulates are found to be red deer and wild boar. Although a suitable prey species in the past, the Turkish mouflon was only reintroduced to the area in 2005 and the population size is no more than 80 individuals. In northernmost parts of our study region, Roe deer (*Capreolus capreolus*) also appears to be present as a prey species while it is absent at most of the past and recent leopard record sites. Therefore, leopards in this region probably mainly prey(ed) on wild boar and red deer, both of which have healthy population levels (Fig.3), as well as smaller prey such as Eurasian Hare (*Lepus europaeus*) or Eurasian badger (*Meles meles*).

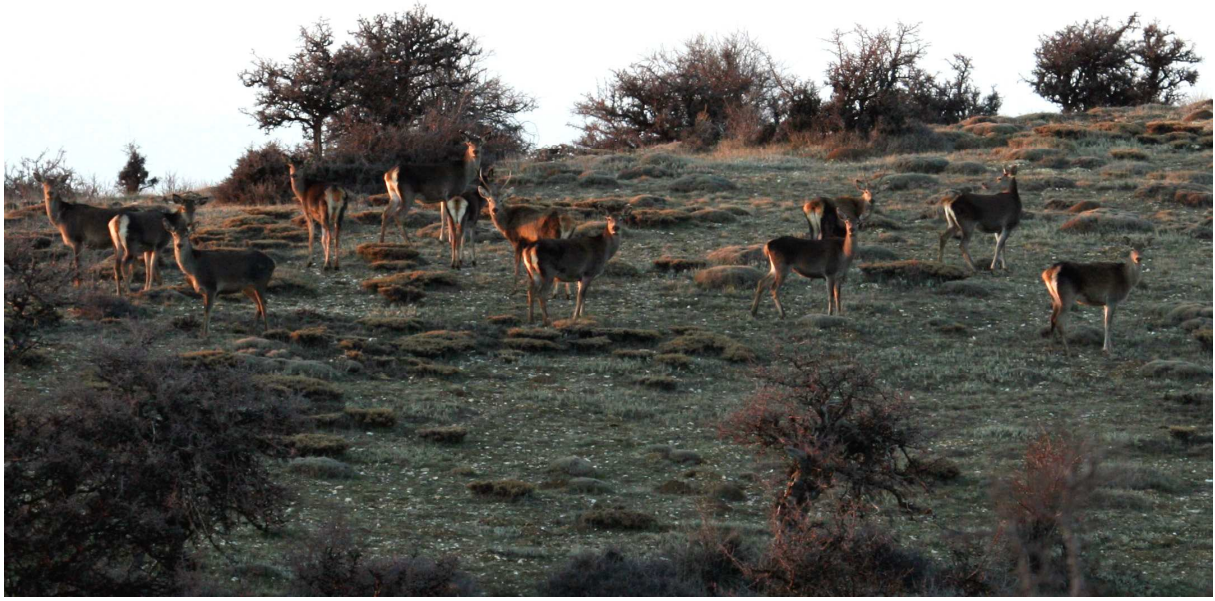


Figure 3. Red deer does and young of the year aggregate in late autumn

ACTIVITIES, RESULTS AND DISCUSSION

Modeling the probable range of Anatolian leopard

In order to utilize limited available resources (time, researchers, equipment), a modeling exercise was carried out to identify parts of the study region where the probability of encountering a leopard is higher than elsewhere. Climate data were downloaded from the WORLDCLIM web site, other layers were available at METU. IDRISI Andes software was used to model the probable range. Fuzzy set membership values were assigned to digitized topography, climate, vegetation and human presence (settlement and road density) layers based on available literature, gathered data, and expert knowledge. Then the resulting composite suitability layer was improved with the help of past records and expert evaluation. Two separate habitat suitability models were prepared, one for the warm season and one for the cold season, when snow depth is expected to limit leopard occurrence in parts of the study area (Bilgin & Turak, unpublished). Figure 4 shows the probable leopard distribution in cold and warm seasons.

The habitat suitability model revealed a large summer range suitable for the species. However, due to constraints posed by snow cover in the cold season (M. Hötte, pers.comm.; I. Khorozyan, pers.comm.) the species was assumed not to be able to use its entire available summer habitat. Therefore, camera-trapping and track survey efforts were concentrated in the southwest corner of the study region (see map), where suitable warm and cold season habitats co-occur. In addition, most of the past leopard records were from this sector (see below).

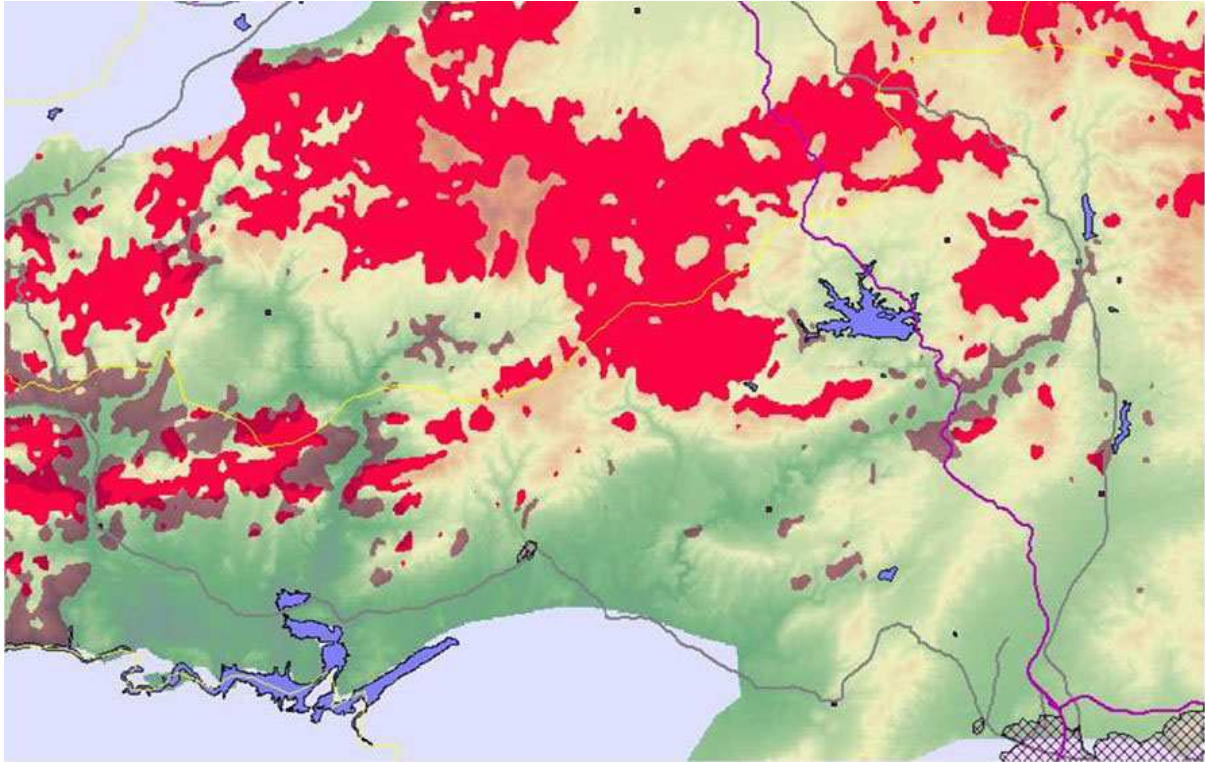


Figure 4. Map of K ro lu K ro lu Mountains with overlaid probable leopard habitat suitability model for warm (red) and cold (maroon) seasons. The city of Ankara is in lower right corner.

Camera-trapping

The camera-trap survey began in December 2008 and continued for one full year. Since December 2009, the surveyed area was increased and several camera traps are currently in the field. The camera-traps were placed within the study area at sites where leopards potentially use, such as along ridge tops, near passes or landmarks (Fig.5). They were placed 0.5-4 km apart at sites representative of available altitudes, aspects and habitat types. At least 15 camera traps were in the survey area at any one time except for the first two months of placement, when they were added as suitable sites were discovered.

25 DeerCam DC300 brand camera-traps were used in the trapping survey. Rechargeable 9V batteries were used for first 2 months of the survey for the camera sensors and they were replaced by alkaline batteries due to short battery life. Rechargeable AA batteries were used for cameras themselves with a long lasting capacity. We began with 400 ISO film rolls but then shifted to 200 ISO rolls because of high grainy photos of 400 ISO rolls. The survey area was visited 30 times with an average of 12 days per month and each trap location was visited twice a month on average (not all camera traps were visited in each field trip). Alkaline 9V batteries were replaced every 2 months whereas AA batteries of the cameras were replaced in every visit. Film rolls with more than 20 pictures were replaced with new ones and the films were processed in Ankara, after each field trip.

Until now, after a total of 3930 trap-days, we have obtained pictures of 13 wild mammal species. These are Red Deer, Wild Boar, Eurasian Hare, Caucasian Squirrel (*Sciurus anomalus*), Brown Bear, Wolf, Golden Jackal (*Canis aureus*), Red Fox (*Vulpes vulpes*), Eurasian Lynx (Fig. 6), Jungle Cat (Fig

7), Eurasian Badger, Stone Marten (*Martes foina*) and Southern White-breasted Hedgehog (*Erinaceus concolor*).

Overall, 1080 successful wildlife events were recorded in 3930 trap-days (an “event” is defined as a picture or pictures of the same individual or group taken once or consecutively within 20 minutes). Therefore the efficiency is $1080/3930 = 0.27$ photos per trap-day or 1 photo per $3930/1080 = 3.63$ trap-days.



Figure 5. A camera-trap placed on a juniper along a ridge



Figure 6. An Eurasian lynx captured at the camera trap location shown in Fig. 5.

There are at least two more carnivore species that are known to exist in the survey area, but with no pictures. These are the Eurasian Otter (*Lutra lutra*) and the Least Weasel (*Mustela nivalis*). Overall, our camera trapping has revealed an intact and diverse carnivore and herbivore fauna within a 100 sq.km. area. The reasons for such richness are thought to be the altitudinal range (500-1850 m) available, creating diverse habitats, and the relatively benign attitude of the local people towards wildlife. In the area also several large and threatened raptors were observed, including Cinerous Vulture (*Aegypius monachus*), Griffon Vulture (*Gyps fulvus*), Egyptian Vulture (*Neophron percnopterus*), Bearded Vulture (*Gypaetus barbatus*), White-tailed Eagle (*Haliaeetus albicilla*), Golden Eagle (*Aquila chrysaetos*), Long-legged Buzzard (*Buteo rufinus*) and Goshawk (*Accipiter gentilis*). Few areas in Turkey bear such a diverse carnivore/raptor fauna, pointing to the uniqueness of our study area in this respect.

Two species are worth further comment since they are felids and were not known in the area before. The first one is the Eurasian lynx; its first camera trap picture was startling since we were not aware of lynx presence in the area. Neither track surveys nor interviews with the locals provided any cue for the presence of this species in this part of the K ro lu range. This was good news for conservationists since it was one of the first camera-trapped Eurasian lynx photos in Turkey. The other lynx photos came from north-eastern Turkey where we helped a camera-trap survey within the context of another conservation project during the same period (Ambarlı et al. 2009, submitted). So far, 8 lynx events were recorded at our study site, from which a minimum of 3 individuals were identified.

The other species concerned is the jungle cat. In the recent past, Turkey experienced a huge loss of wetlands to drainage, especially in inner Anatolia. As a wetland specialist, the jungle cat also lost most of its habitat and range in this region. Hence, the camera trap pictures (Fig. 7) of the species here were very important and hopeful in an inner Anatolian province.



Figure 7. A jungle cat along the course of Alada  river

Track surveys and scat collection

The study area was visited twice a month for a combination of camera-trapping and animal tracking surveys. Before the project started, we found a carnivore track (Fig. 8), much like a leopard's track in shape, size and ratios (smaller toes and a large pad) on November 17th 2007. However, some features of the track (pointed pad top and the angle of toes at two sides) made us think that it may possibly be a large canid track.

In February 2009 we found a scrape with a scat at the end, very similar in shape and size to the scrapes made by Persian leopard (*P. p. saxicolor*) in Iran (Ghoddousi et. al 2008). The scrape length was approximately 50 cm and its width was 30 cm. Pine needles were pushed with a small amount of soil towards the end of the scrape and a scat was present at the end on a spiny cushion plant (Fig. 8). There were also several suspicious scrapes on animal trails mostly along the ridges. Since they were made quite a while ago, it was difficult to be certain of the animal made them. We placed camera traps at close distances to those scrapes. Unfortunately, we could not manage to capture any big cat except the Eurasian lynx.

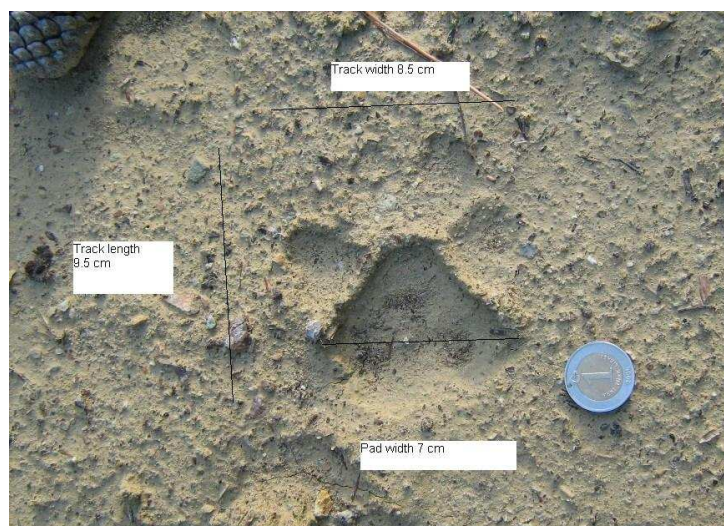


Figure 8. A suspicious leopard track

Because the survey area is home to a diversity of other wildlife, and since domestic livestock use the area in summer, trails are everywhere, making animal tracking harder for us. Therefore, we mainly focused on the passes, ridges and dirt roads which are occasionally also used by foresters and shepherds.

Track and Scat Surveys

A) Ankara Province, Beypazarı District

Depel Mountain, Southern Part (500-1600m): This part of Depel Mountain is covered by Turkish pine forest and junipers from 500 m up to middle elevations (1000m). More sparse parts have many openings and a higher proportion of junipers and oak scrub. After 1000 meters black pine forest starts reaching up to 1650 meters.

Beginning with autumn 2007 this area was regularly visited for track surveys and camera-trapping. Because the soil type is not very suitable for track formation, it is very hard to see animal traces in warmer seasons. Therefore, animal track surveys were mostly made after rainfall. In March 2008, a footprint with a wide pad and no nail marks was found on a dirt road. However, after some consideration, we thought that it should belong to a wolf which might have slipped on mud. The majority of the footprints on the higher dirt roads belonged to red deer, wild boar, hare, wolf, red fox, and some to lynx, badger and jackal. Badgers and jackals use these roads only seasonally because of the high elevation and hibernation (badgers).

Camera-trapping along several ridges and valley bottoms revealed a high diversity of mammal fauna with 13 species. All the lynx and jungle cat photos were from this part of the area.

Depel Mountain Northern Part (700-1600 m): This part of the mountain is covered by dense black pine forest. Generally, red deer does with fawns use this part of the mountain which creates a permanent prey source for larger predators. Wild boar also utilize this part in warm seasons. Animal tracking is easier due to shading of the dense forest and humidity. The soil is wet in some parts all around the year. Red deer, hare, fox and wolf tracks were the majority of the animal tracks here. This area was regularly visited mostly in 2009. Unfortunately, Beypazarı Forestry Directorate launched selective timber production (logging old trees) in this part of the mountain in May 2009 which will continue for another two years. Camera-trapping revealed 7 mammal species with no felid pictures here.

Depel Mountain Ridge (1600-1850 m, Fig.3): Except in the height of the winter, track surveys were made regularly on a dirt road running through the ridge. In autumn 2008 aggregated red deer herds and many brown bear droppings were seen and found throughout the ridge with some lynx-like feces and some wolf tracks. Then in spring 2009 we found deer, hare, and wolf and fox tracks on the road. After May 2009 the ridge was also partly used by a sheep flock. The shepherds claimed an attack to the sheep by a predator, hearing the sheep trying to escape from the predator which had caught the sheep at its throat. When they reached the attack site they saw the sheep with its throat bleeding but the predator was gone. An additional badger track was found on the ridge and camera trapping revealed 4 species (red deer, hare, wolf and fox) here.



Figure 9. The field team on a long walk towards a camera-trap location which is inaccessible by the car in deep snow.

Elmabel Ridge (1100-1300m): This low mountain is covered with black pine forest patches with openings along the ridge. The main woody species in the openings are hawthorn trees and oak scrub. The area is exposed to moderate grazing pressure in the warm seasons and at least two or

three sheep flocks roam the area. The last leopard shot in 1974 was at the Bağözü village, which lies on the eastern slopes of Elmabel Ridge and the last sighting (see below) in Beypazarı district was near the western end of this mountain.

Animal tracks and camera-trap pictures showed the presence of deer, wild boar, hare, wolf, fox, badger and stone marten. No felid tracks or pictures were obtained on this ridge.

Nuhhoca Village, Keçenindoruk Ridge (1200-1350m): This ridge is nearer to Bolu, Seben District where a male leopard was shot in 1967 by a local hunter. The slopes of the ridge bear black pine, juniper and oak mixed forest and Turkish pine forest in lower elevations. It is a very narrow ridge with rocky parts at the sides. Some deer, wild boar and wolf tracks were found along it, although it was hard to track animals here due to rocky structure. Sheep grazing takes place in some parts of the ridge. Recently, a camera trap was placed here but no films are processed yet.



Figure 10. PI in front of Keçenindoruk Ridge and Koroğlu Mountains behind, while climbing up to Depel Mountain.

B) Ankara Province, Nallıhan District

Gökçeöz Village (550-1400 m): The mountain ridge near this village also has a border with Seben district of Bolu where a male leopard was shot in 1967. The mountain is mostly covered by black pine forest at high elevations but juniper, oak and Turkish pine occur patchily on the lower, partly rocky slopes of the mountain. We found many red deer, wild boar and some wolf tracks along this mountain; also saw a deer stag grazing in a forest opening. This area is not accessible in the winter.

Sarıyar, Kızıtarla Ridge (460-810 m): Kızıtarla and other nearby ridges are former Turkish mouflon habitats to where the species was reintroduced in 2004. The ridge is covered by secondary steppe with sparse juniper, turpentine (*Pistacia* spp.) and oak shrubs. One side of the ridge faces the Sarıyar Dam Reservoir and this side of the ridge is very rocky with many caves.

Red deer, wild boar, Turkish mouflon and hare are the main prey species here, providing a good prey base. Other species that roam the area are wolf and golden jackal. We found tracks of all of these species and saw a small red deer herd and some mouflon ewes with new born lambs during a two day-long survey. This area is not very far from İğdecik where a female leopard was seen with a cub in 2007.

C) Eskişehir Province, Mihalicçık District

Ortadömen to İğdecik Village (460-600 m): This is a rocky area covered with Turkish pine and juniper woodland. We made a track survey and placed 4 camera traps here. There were some red deer tracks and droppings; also diggings and droppings of wild boar and Eurasian badger in the area. Also we found brown bear and golden jackal tracks in another part of the area. The only species camera-trapped was badger. In 2007, a leopard and her cub were observed here over several months by different people. Because the area was not suitable for an adult leopard to live permanently, we concluded that it was a temporary place to raise a cub safely because the area was rocky and with cliffs.

Sündiken Mountain Northern Range (400-1800 m): This mountain range is covered by Turkish pine-juniper mixed forest at lower altitudes, oak and juniper mixed forest at middle, and black pine forests at the higher altitudes. Northern slopes of Sündiken Mountains are in the middle of two leopard record localities, namely İğdecik (2007) and Çatacık Forest (1972). There are very steep rocky cliffs at the northern side of the mountain facing the Gökçekaya Dam Reservoir. Also, these mountains have more rocky parts compared to the Beypazarı District. Because this mountain range is hardly accessible and hard to climb up, only one survey was made in late 2009 when tracks of red deer, wild boar and wolf were seen on dirt roads, and digs and droppings of wild boar, and droppings of red deer were found on the slopes. Interviews with shepherds indicated the presence of brown bear, wolf, lynx and the above mentioned herbivores in the area. A camera trap was placed on a trail at 1700 m altitude, going towards a rocky patch and where many deer, boar and hare tracks were found (Fig. 11). The camera will be checked in another survey in February 2010 and some other camera-traps will be placed on good pass sites on the mountains.



Figure 11. A camera-trap placed on an oak tree on a rocky part of Sündiken Mountain

Evoking public awareness for the conservation of the Anatolian leopard

Interviews with locals, hunters and shepherds

Throughout the project period we carried out interviews with many locals, hunters, and especially shepherds, to find any signs of leopard existence in the study area. The leopard shot in 1974 in Beypazarı District was known by almost everyone interviewed in spite of no publicized sightings or other records were heard since then. Interestingly, most of the people we interviewed were not aware of existence of any current felid species in the area. The most mentioned species were deer, wild boar, hare, wolf, fox and badger. Though we found the tracks, scats and camera-trapped at least three individuals at the same or nearby locations where three shepherds grazed their livestock and where hunters visited regularly, no one mentioned the presence of Eurasian lynx at the Depel Mountain. Even the brown bear was mentioned to exist in the study area, for which we estimate possibly only one individual.

For the leopard sight records since 2000, we also interviewed the persons who encountered the animals in the area to verify the accuracy of the records and to learn more about the details of the encounters.

Investigation and revision of past and some recent records from the region

Some leopard records came from Koroğlu Mountains and some nearby mountains, especially in 1960-70's and 2000's:

- A man claims that his father has seen a leopard shot by hunters when he was a child in the second half of 1960's in the Kızık highland pastures, Seben District, Bolu Province. No further evidence was found.

- A leopard was shot in Abant District of Bolu Province in 1967 (Kumerloeve 1972). This record may actually refer to the one reported the same year from Seben (see below).
- In 12th January 1967 a male leopard was shot in a forest 5 kms west of the Seben town (Bolu) province by a villager during a wild boar hunt. Then the skin of the animal was sold to a fur merchant in Istanbul. (Fig. 12)



Figures 12 & 13. A male leopard shot near Bezer village 12th January 1967 on display (left) The male leopard which was shot near Bağözü village on 17th January 1974 is now on exhibit at the MTA Natural History Museum (right).

- In 17th January 1974 a male leopard mauled a woman breaking her arm at two points. The leopard was then shot by a villager on the same day. The stuffed specimen is exhibited in the MTA Natural History Museum in Ankara (Fig. 13).
- In early 1990s, a driver working for the Beypazarı Provincial Forestry Directorate saw a leopard crossing the road while he was driving at night from the Eğriova forests west towards Beypazarı. He described the animal as if it was “sliding” on the road which is typical for a leopard trying to move unseen (M. Duran, pers.comm., 2007).
- One night in June 2001, two forest engineers returning from field work saw a large cat with a long tail on the road from 20 meters distance in Çamlıdere district of Ankara. The animal jumped into the roadside afterwards (Bilgin et al. submitted).
- In autumn 2004, two hunters saw a “cheetah” in the valley bottom near Depel Mountain of Beypazarı District on a seldom used road while driving back home from a wild boar hunt. It was a rainy night with lightening and the animal was sitting on the road, “curved like a C”. They described the animal’s very long tail with a tuft at the end. After a while the animal jumped up the slope and disappeared.
- In 20th June 2004 or 2005, on a foggy day, a worker of Beypazarı Provincial Forestry Directorate saw a leopard in Eğriova Forest. The snow depth was 15 centimeters. He was alone some distance back of a group of other workers when a large animal jumped down from a tree. He described the animal the size of Kangal breed dog, looking more like a cat but with a longer face and “crystal clear bluish eyes” looking keenly at him. The fur of the animal was spotted at the back but whitish yellow at the belly. It was not a lynx as he encountered lynxes for many times. This animal was long tailed and like the leopards he had seen in wildlife documentaries. He was scared of the animal and retreated carefully (Rahim, pers.comm., 2009).

- In autumn 2007, two fishermen reported to a large cat near Sarıyar Dam while fishing. They first saw the tail of the animal and thought it a large snake moving its head up and down. After a while they realized that it was the tail of the animal. In the following one or two month's period (until November 2007) another person independently reported to have seen the animal at night with a cub sitting on the rocks (Fig. 14), spotting the animals usually from their eye shine. Unfortunately, we got this news five months after they were last seen.



Figure 14. The rocky area near İğdecik village along the Sarıyar Dam Reservoir where a female leopard was spotted by fishermen and stayed there for two months with a cub.

- A leopard skin (Fig. 15) was reported from a hotel in situated on the Koroğlu Mountains. After contacting the hotel manager we learned that the specimen was shot in 1960s in the Taurus Mountains (pers.comm).

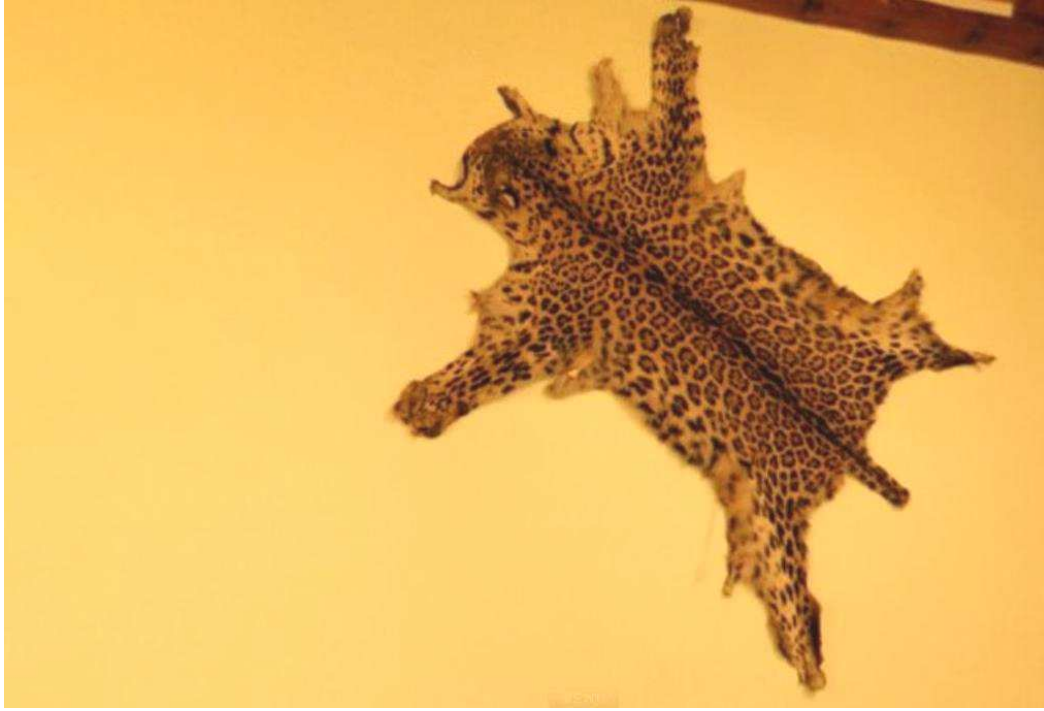


Figure 15. The leopard specimen with a cut tail in a hotel in the K ro lu Mountains and said to be shot in southern Turkey.

Although there is a gap of a decade with no records during the 1980s, there are four sight records after 2000, one of which belongs to a female with a cub which indicates that the species may still have a viable population in these mountains. Since mostly covered by forest vegetation, to observe carnivore species in these mountains is difficult, although some of them have healthy populations.

Impact of forestry, hunting and grazing activities on wild populations in the study area

From May 2009 until the end of project period, the study area experienced forestry activity, especially on the northern side of Depel Mountain. Unfortunately, this activity affected the wild mammal populations, apparently altering their seasonal land use and distribution patterns. We found out that there was a significant decrease in deer observation events during the timber production period compared to the previous year. Not only the noise caused by the chainsaws, but also the vehicle traffic and presence of 11 forestry worker and their families for 7 months at the production site, created significant disturbance. Forestry activities are planned to continue for the next two years. However, we arranged meetings with the local forestry manager of Beypazarı District and the chief of the Planning Department in Ankara to discuss the importance of the area for wildlife and to consider some amendments in the forest management plan to make it more wildlife friendly.

Hunting is another factor that creates disturbance especially in late autumn and throughout the winter season. The area is mostly used for hare and partridge shooting. Also, up to 5 red deer stags are hunted for trophy in the rut season (October and November); we also suspect some red deer poaching taking place. We proposed a one year hunting ban for the 2009-2010 hunting season, which was accepted by the Central Game Commission and is in operation now.

The 100 km² study site is also used by several sheep and goat flocks which are a disturbance factor of limited impact. In colder seasons only the lowlands are used for grazing while higher



Figure 16 (clockwise from upper left): a) A flock of Angora goats; b) the shepherd and his Akbash breed dog; c), an Eurasian lynx; and d) a female wolf with the backquarters of a goat kid, all taken at the same camera-trap station. The wolf's 3 cubs were photographed at another camera-trap station.

ground use begins with June and lasts until late November. Lower livestock density compared to past decades is making the area more hospitable for wildlife with a decreased competition for grazing and with lower density of livestock guardian dogs (LGDs). However, the negative effect of LGDs on deer calf mortality rates in the birth season is admitted by the shepherds. On the other hand, there is a trade-off in wolf and livestock relationship. Wolves also prey on livestock which decrease the pressure on deer and wild boar populations. It was observed that flocks with lower number of guard dogs were most affected by wolf predation. Kangal and Akbash are the two most common Turkish breeds used as LGDs. Wolf predation was also proved by camera-trapping where nearly 800 Angora goat breeds were grazed in the company of 2 adult and 2 juvenile Akbash guard dogs.

LESSONS LEARNED, FOLLOW UP ACTIVITIES AND REQUESTS

Our approach involved a stepwise selection procedure for the study area - first making use of habitat modeling, then combining presence of past records and suitable logistics led us to concentrate our efforts to the southwestern sector of the Koroğlu Mountains (Ankara Province). We made an extensive camera-trapping effort, supported by track surveys and interviews especially within this 100 km² area where the target species was last documented in 1974.

We learned how to best place camera traps and got very good results as the project progressed. The DeerCam brand is simple to operate and generally reliable, although film (instead of digital) media meant some loss of efficiency and higher processing costs. Battery life was variable, depending on the type (rechargeable vs. one-use, alkaline vs. regular) and brand as well as the weather conditions. Both the local people and foresters were easy to communicate with and have

provided valuable information. The documentation of the presence of abundant prey base (such as red deer, wild boar and smaller species) and addition of four new records to the already known reliable leopard sighting records in the region are among the most useful results of the project.

There were also some setbacks. A car accident temporarily demoralized the team and limited access for a while. One camera trap was inundated by rising water levels near a river and became useless. Another two camera traps could not be used after several months due to camera malfunction. Still another was stolen by unknown people, probably hunters from another region, who used wire cutters to remove it.

At the end of one year, we could not manage to provide unequivocal evidence of the leopard in the area in spite of a sufficient prey base and the documentation of two other smaller felid species. However, this should not mean that the leopard is extinct in the K ro lu range. Detection of rare secretive animals is inherently difficult and requires considerable effort. Despite almost 4000 trap-days of effort, we could manage to capture the brown bear (a species whose presence in the area was already known through other means) only once, and toward the end of this period. The leopard probably occurs at even lower densities than the brown bear. Moreover, our study area might have been visited by wandering leopards in the recent past but obviously it was not part of a larger, permanent leopard territory during the project period. Unexpected levels of disturbance due to logging in 2009 might also have kept the more wary leopard away. One solution to this apparent situation of working at the wrong scale is to expand the area covered, especially towards sites where other recent sightings were recorded. We intend to place camera traps more widely spaced than previously and carry out track surveys over a larger area of suitable habitat. Indeed, during the last month of the project, we started to put this strategy into use and expanded our survey region to over 1000 sq.km. This approach would overcome the limitations of working intensively in a small area, and hopefully will provide us with the first photographic leopard evidence. We expect to fund the follow-up study with our own resources and hope to continue our links with WCS and Panthera Foundation.

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ACKNOWLEDGEMENTS

We would like to thank to Panthera Foundation and Wildlife Conservation Society for funding this research project and providing the camera-traps. We would also like to thank to Deniz  z t for providing a four wheeled car throughout the project period. DKM (Nature Conservation Centre) and Damla Beton also provided four wheeled cars several times in the first months of the project period. The Turkish Ministry of Environment and Forestry gave permission. In addition

to the team members, the following people helped with the fieldwork: Mustafa Durmuş, Seda Emel Tek, Hasan Şevki Çifçi, Yılmaz Kaplan and Lütfiye Özdirek. We are grateful to them all.

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