



PROJECT/ PROGRAMME TITLE	Monitoring of Common leopard (<i>Panthera pardus</i>) and its Prey in Northern Pakistan
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PROJECT DURATION	24 months
Proposed date for the study to conduct	1 st November, 2008

PROJECT SUMMARY

The Common leopard (*Panthera pardus*) is the most widely distributed of all the wild cats in the world and is found almost in every kind of habitat ranging from the rain forests to the tropics to deserts and temperate regions. Though widely distributed, leopards face several threats to their survival, including direct poaching, diminishing prey base, habitat fragmentation and habitat degradation. It is classified as a “least concern” species in the IUCN red data list (IUCN 2007), though it is critically endangered in many of its range countries and faces an overall declining population trends. Leopard serves as a flagship species in several protected areas of Pakistan. But not much is known about its distribution, population status and general ecology due to lack of scientific work. A false sense of complacency arising out of the fact that it is the most common and widely distributed large cat can put the existing populations in a precarious state. Also the human leopard conflict is on the rise further aggravating the problem. Given the lack of scientific information on the species in Pakistan, the present study aims to assess the population and density, prey availability, food habits and threats to the species across select protected and non protected areas in Pakistan. The study will enhance the understanding the biology of the species and would help to plug in the gap in the application of science towards conservation and management of this flagship species. The study would also help in developing long term monitoring protocols for leopards in Pakistan and would form the basis for a long term radio-collaring project in future.

1. PROJECT DESCRIPTION

1.1 Study Area

Ayubia National Park was established in 1984 with the aims of preserving its beautiful landscapes, forests and biodiversity for scientific research, education and recreational purposes. The initial area of the park was 1684 hectares, expanded through northern extension in 1998 to make it 3312 hectares. The Park lies between the coordinates 34⁰-1N to 34⁰-3.8N and 73⁰-22.8E to 73⁰-27.1E and is located at three hours drive north of Islamabad in the Gallies Forest Division (North West Frontier Province of Pakistan). Mountains of the Ayubia National Park are 40million years old. The rocks are sedimentary of varied variety. Climate of the area is temperate in summer with the influence of monsoons. In winter it is severe cold. Mid December to mid march the snow season prevails. The mean annual rain fall is well above 1500mm in addition to precipitation received in the form of deep snow in winter.

It supports one of the best habitats of the Himalayan Moist Temperate Forests, a sub category of Montane Forests. The National Park supports 31 species of mammals, 203 species of birds, 16 species of reptiles and 03 species of amphibians. The National Park is famous for supporting a healthy population of monkey (*Macaca mulatta*), common leopard (*Panthera pardus*), flying squirrel (*Pteromyini spp.*), koklass (*Pucrasia maculopha*) & kalij ([Lophura leucomelanos](#)) pheasants. In addition to common leopard other carnivore species found here include Red fox (*Vulpes vulpes*), Jackal (*Canis aureus*) and yellow throated marten (*Martes falavigula*). The Park also supports a good

number of medicinal plant species; more than 200 species including endangered *Taxus baccata*, *Phodopyllum* and *Peoni emodi*.

1.2 Study Animal

The Common leopard (*Panthera pardus*) is the most widely distributed of all the wild cats in the world (Nowell and Jackson, 1996). It is found almost in every kind of habitat ranging from the rain forests to the tropics to deserts and temperate regions (Kitchener, 1991). Fossil evidence, some as old as 1.5 to 2.0 million years (Hemmer 1976) suggests that leopards were once more widely distributed than today. The geographical distribution of leopard extends throughout Africa, Central Asia, South-East Asia and North Amur valley in Russia. Leopards are found throughout the Indian sub-continent with the exception of deserts, the Sundarban mangroves, and densely settled areas (Khan 1986, Johnsingh *et al.* 1991). In spite of being the most common of the big cats, Myres (1976) recommended that it remain in Appendix-1 of CITES because its extensive hunting had depressed populations in several parts of Africa. Common leopard is classified as a threatened species in the IUCN Red list data book. The status assessment of mammals conducted by IUCN in 2004 and categorized the common leopard as a critically endangered species of the Pakistan. According to the Global Cat species Vulnerability ranking, common leopard is categorized as 5(a), while regionally it is placed in category 4(a).

The leopards in Pakistan are mainly found in high mountain forests of Punjab, NWFP and AJ&K. Common leopard though widely distributed in Pakistan is quite unique in most of its habitats. Except for a few places in NWFP such as Gallies, where a reasonable degree of protection has helped this species to grow in numbers, its populations have declined in other parts. Protection measures in NWFP and Gallies have led to a new problem. The leopards now cover a wider area, including several settlements in the forested mountains of the NWFP causing conflict between humans and the leopards. Lack of protected areas sufficiently large in size with enough food for leopards and insufficient number of protected areas in the leopard habitat with no interconnected corridors have forced the growing population to establish territories on the peripheries, thus bringing them close to human settlements. Apparently in order to make up for the deficiency of natural prey, leopards have started attacking the domestic livestock and poultry. In the absence of viable policy to compensate farmers for the loss of their animals, the herder community is ill prepared to tolerate leopards around their villages. In spite of the damages to the livestock and the retaliatory killings by the farmers, the overall situation of leopard conservation stayed reasonably well until a leopard in June 2005, killed 06 women in 10 days. This resulted in tremendous hue and cry on part of the local communities, culminating in a demand for the total elimination of leopards. The recent problem poses a serious threat to the survival of this flagship species of the Ayubia National Park, Pakistan. The total population of leopards in Pakistan is not exactly known and very limited information about the species ecology and behavior is available at national level. Without the population estimation and prey base assessment it is not possible for the conservationists to suggest an effective conservation strategy for the leopards at national level. Further, the proposed study will investigate the critical factors that affect the leopard distribution within and outside the park. This study will also form the basis for a long term radio tracking project to investigate the natural history and ecology of the species in the study area so that long term effective conservation measures can be framed based on sound scientific data.

2. JUSTIFICATION FOR THE STUDY

- Leopard is a flagship species in the large number of protected areas in Pakistan, yet little is known about its population status, ecology and behaviour.
- The human leopard conflict is on the rise and scientific monitoring is essential to suggest practical mitigation measures.
- Lack of scientific data makes it difficult to plan and implement conservation measures.
- The study will be the first of its kind and will be an essential step in enhancing our understanding of a threatened species. The study will also add to the existing scientific knowledge of leopard ecology.

3. OBJECTIVES OF THE STUDY

There is no baseline information about the status of leopards in the study area. Considering the need to address the pertaining issues, the following objectives have been framed for the study.

1. To estimate population and density of leopard in the study area in a mark-recapture framework using camera traps
2. To estimate ecological density and biomass of wild prey in the study area
3. To determine food habits and dietary preferences of leopards in the study area
4. To determine primary threats to leopards in the study area
5. To develop a long term conservation-monitoring program for leopards in Pakistan

4. METHODOLOGIES TO ACHIEVE THE SET OBJECTIVES

4.1 Camera trapping in a mark-recapture framework

Camera traps will be used in a mark-recapture framework to estimate the population size and density of leopards across various sites within the study area. We will use both side cameras to obtain good quality photograph of both the flanks of the animal to avoid any ambiguity in identification. Reconnaissance survey will be carried out along various sites to determine the best locations for camera placement based on cues such as pugmarks, scats, scent marks, rake marks etc. Cameras will be placed in a systematic grid based design (2X2 km) to maximize the accuracy and precision of estimates. Sampling period will be determined by plotting the number of unique individuals captured against sampling interval. Sampling will be carried out for at least 15 more days once an asymptote is reached (i.e. no more new individuals are being captured). Leopard individuals from photographs will be identified independently by two to three experienced people. Pattern recognition softwares will also be used to identify individual leopards to maximixw the accuracy of identifications.

Capture histories of leopards thus identified will be built in standard X-matrix format (Otis *et al.* 1978; Nichols 1992). Program CARE-2 (Chao and Yang) will be used to estimate the population size and the corresponding standard error. Density of the leopards will be estimated using traditional (1/2 MMDM, full MMDM) as well as the recent density estimation models (Spatially Explicit Maximum Likelihood Estimators; see Borchers and Efford 2007).

4.2 Distance sampling through line transects

Density of prey species will be estimated using the line transect method (Anderson *et al.*, 1979, Burnham *et al.*, 1980, Buckland *et al.*, 1993). Transects will be cut and marked so as to cover major vegetation types and terrain classes. Each transect will be 2 to 3 km long, but may be shorter in certain difficult terrains. Transects will be walked in different seasons with three to four repeats for each transect. The data will be collected in the early morning hours (0600 hrs to 0900 hrs) with the help of two observers. The following will be noted during every transect walk:

1. Species, group size, sex and age category with the help of a binocular.
2. Sighting angle, with the help of a hand held compass.
3. Sighting distance with the help of a laser range finder.

Data thus collected will be analysed using program DISTANCE (Buckland *et al.*, 1993, Laake *et al.*, 1993). Prey biomass will be calculated by multiplying the estimated densities with the average weight of the prey species. We will also attempt to correct for population structure in biomass estimation if feasible.

4.3 Food habits of leopards

Leopard scats will be collected from roads and trails on an opportunistic basis. However effort will be stratified across various zones of human disturbance viz. least disturbed, moderately disturbed and highly disturbed. Scats will be collected in paper bags, sundried in field itself and labeled properly mentioning date of collection and GPS location.

Once in the laboratory, the scats will be oven dried at 60°C for 48 hours. The scats will be then broken and washed under running water. The contents then will be sieved using sieves of varying mesh size and prey remains will be thus separated. The items thus separated will be examined and hair samples will be used to identify the prey items using features such as medullary and cuticular structure (Mukherjee *et al.*, 1994) and comparing them against the reference samples. Frequency of occurrence of various prey species will be assessed and non prey items such as grass and soil will be excluded from the biomass analysis. Ackerman regression equation (Ackerman *et al.* 1984) originally developed for Puma (*Felis concolor*) will be used to estimate the relative number of prey species killed by Leopards.

4.4 Determining primary threats to Leopards

Threats to the survival of leopards will be primarily determined through interviews of local communities, forest officials and other stakeholders in the area.

5. MAJOR ACTIVITIES TO ACHIEVE THE OBJECTIVES

5.1 Major activities to achieve the objective 1:

- Design the study in selected study area's including protected areas, reserve and guzara forests
- Conduct feasibility study, and identify the places for the camera trap deployment through a thorough reconnaissance.
- Collect and document the habitat related information through specific data sheets and scientific equipments (GPS, GIS, etc)
- Deploy camera traps for population and density estimation of leopards.
- Develop Digital Elevation Model (DEM) for common leopard and derivation of slope, aspect and hill-shade datasets from DEM
- Identify core habitat and buffer zone of common leopard through GIS
- Analyze and interpret the collected data.
- Write a comprehensive report.

5.2 Major activities to achieve the objective 2 & 3

- Establish line transects and collect information about the different prey species
- Collect scats from the trails used by the leopard regularly in the study area
- Analyze the scats in the laboratory
- Report writing

5.3 Major activities to achieve the objective 4 & 5

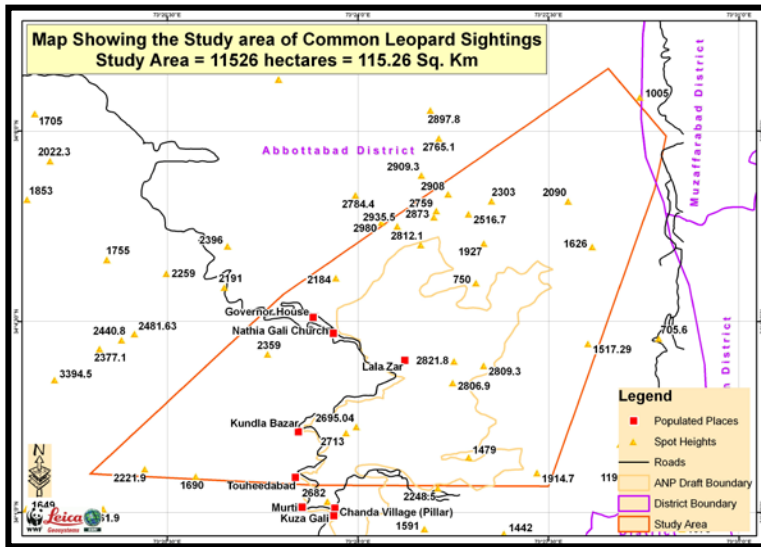
- Hold meetings with the local communities
- Hold meetings with the wildlife department officials
- Review the existing record related to leopards killing
- Review the existing wildlife act and policy
- Hold meetings with the Ex-wildlife managers

6. EXPECTED OUTCOME OF THE STUDY

- Population and densities of the leopards will be determined in the major sampling areas
- The status of the prey species will be determined, which will be crucial in understanding the distribution of leopards and causes of conflicts
- The food habits of the leopards will be determined and comparisons of food habits along with prey availability data will help determining causes of conflicts.
- Long term monitoring protocols for leopards will be developed through this study.
- The immediate and proximate threats to the existing leopard populations will be determined.
- The study will suggest effective conservation measures based on rigorous scientific data.
- The study will form the basis for a long term radio-collaring project on leopards which will go a long way in determining the ecology and behaviour of leopards.

Annex A:

MAP of the Study Area



Annex B: LITERATURE CITED

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Annex C: Project Budget: 39283.33US \$ (2631983.11PKR)

Monitoring of Common Leopard Northern Pakistan

Field Expenses	Units	Rate	Pak Rs.	USD
Salary (Research officers)	1	25000	300000	\$ 5000
Salary (field assistants)	2	12000	144000	\$ 2400
Stipend for the students	2	12000	144000	\$ 2400
Field travel				
Vehicle fuel				\$ 5,000
Field food				\$ 2,000
Accommodations				\$ 1,500
Equipment				
Trap Cameras (I prefer to use the deer camps)	40	20000	800000	\$13333.33
Film, batteries and processing				\$ 1,200
Basic field needs (binos, GPS, etc)				\$ 2,000
Camp equipment				\$ 500
Office supplies	30	1200	36000	\$ 500
Postage/shipping	5	1800	9000	\$ 150
GIS costs				\$ 5,00
Laboratory costs				\$ 3,000
Publications/printing				\$ 300
Contingency				\$ 500
Total				\$ 39283.33