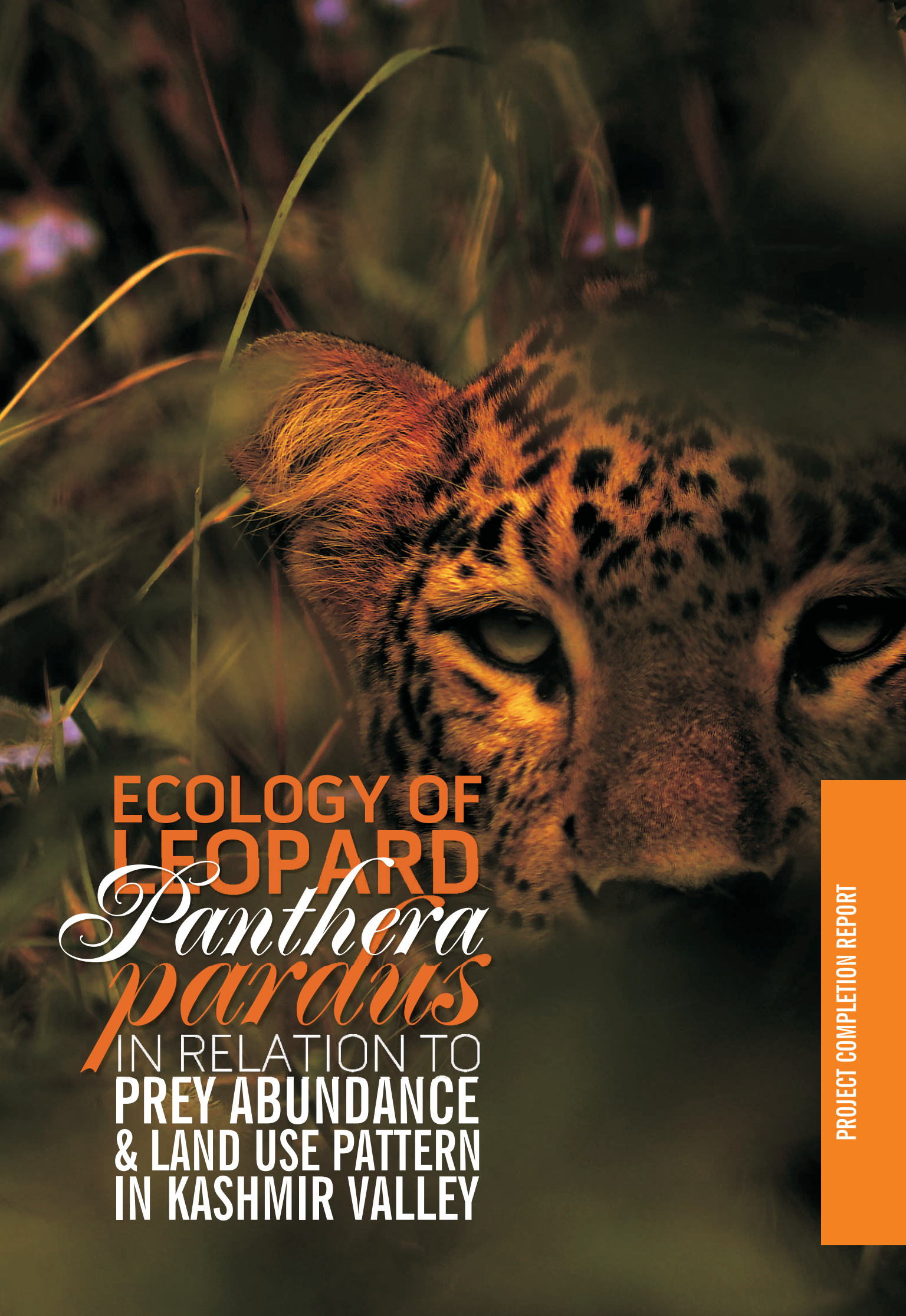

# ECOLOGY OF LEOPARD *Panthera pardus* IN RELATION TO PREY ABUNDANCE & LAND USE PATTERN IN KASHMIR VALLEY

PROJECT COMPLETION REPORT

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*(SR/SO/AS-28/2009)*

**2014**

# ECOLOGY OF LEOPARD *panthera pardus*

# IN RELATION TO PREY ABUNDANCE & LAND USE PATTERN IN KASHMIR VALLEY

*Nilanjan Chatterjee*


Principal Investigator
**Dr. Bilal Habib**

Co- investigator
**Dr. Gopi G.V.**

Researchers
**Athar Noor and Zaffar Rais Mir**



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## # 4 RESULTS



## # 5 DISCUSSION



## # 6 REFERENCES



*Amol Nargolkar*

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# EXECUTIVE SUMMARY

Globally, leopard (*Panthera pardus*) is the most widely distributed and persecuted cat amongst large cat species. In India, it largely coexists with other feline species like the tiger (*Panthera tigris*) across much of its distribution range and with lion (*Panthera leo*) and clouded leopard (*Neofelis nebulosa*) in certain areas of its distribution range. Owing to its very high adaptability for surviving in varieties of habitats and opportunistic feeding behavior, it is often found to be at the center of the human-wildlife conflict. Retaliatory persecution, poaching, habitat loss and declining natural prey are some of the factors which lead to its population decline, despite being accorded protection through national and international legislations. In Kashmir Himalayas it is at the top of the food chain and an apex predator that aids in regulating prey populations. However, there has been an increase in the human-leopard conflicts in the valley which, if left unnoticed, will worsen the conservation prospects of this threatened felid. Hence, this long term study was initiated to address two major issues:

1. Conservation and management planning of the leopards in the valley is impeded by the paucity of reliable empirical ecological information and
2. Current threat levels will have to be assessed to understand and predict the impacts of anthropogenic pressure on leopards.

The objectives of the study were to estimate leopard population and prey abundance, to study the leopard feeding habits and to determine the ranging behavior of leopards. Dachigam National Park was selected to undertake ecological studies on leopards. Only the lower Dachigam was chosen as an intensive study area as the upper reaches of Dachigam are mostly high alpine areas where leopards do not inhabit.

In order to study prey abundance, line transect methodology was adopted. Transects (n = 13) were laid and monitored in the study area to obtain seasonal prey abundance. In order to estimate smaller prey (rodents) abundance, Sherman traps (n = 49) were used to estimate density. Feeding habits of the leopards were studied by collecting leopard scats (n = 714) which were later analysed using standard protocols. The population of leopard in the study area was estimated using camera traps (n = 12 pairs), deployed in 2x2 km grids in the study area to individually identify leopards with their unique coat patterns. The ranging pattern of leopards was studied by tracking the leopards (n = 3) fitted with Vectronics GPS collars.

Amongst large prey, Himalayan grey langur and Hangul were sighted with enough records to be amenable to analysis in program DISTANCE version 6.0. In total 170 groups of langur comprising of 2679 individuals and 206 groups of hangul comprising of 829 individuals were sighted across different seasons in the study area. Overall density (±SE) of langur was estimated to be 16.32 ± 1.87 $km^{-2}$ and of hangul 5.11 ± 0.51 $km^{-2}$ in the study area. Langur density was highest (22.05 ± 5.12/$km^2$) in winter season and lowest (9.35 ± 3.03/$km^2$) in summer season whereas, Hangul density was found to be highest (9.51 ± 1.71/$km^2$) in spring season and lowest (2.31 ± 0.51/$km^2$) in summer season. In case of rodents, the density was found to be highest during summer season (2014 ± 830.71/$km^2$) and lowest during winter season (1172.6 ± 442.74/$km^2$).

In case of dietary spectrum of leopard in Dachigam, small rodents contributed the maximum (48.05%) in

terms of percent frequency of occurrence followed by langur (14.04%). Hangul contributed 2.05% while Himalayan serow contributed only 0.20% and rhesus macaque contributed the least (0.10%) to the diet of leopard. Minimum sample size required to study food habits of leopard varied from 66 to 86 scat samples in different seasons. Jacobs' index calculated from biomass availability and biomass consumption indicates that small rodents and langur were preferred in all the four seasons. Preference of hangul was slightly higher (-0.79) during winter season as compared to summer season (-0.90).

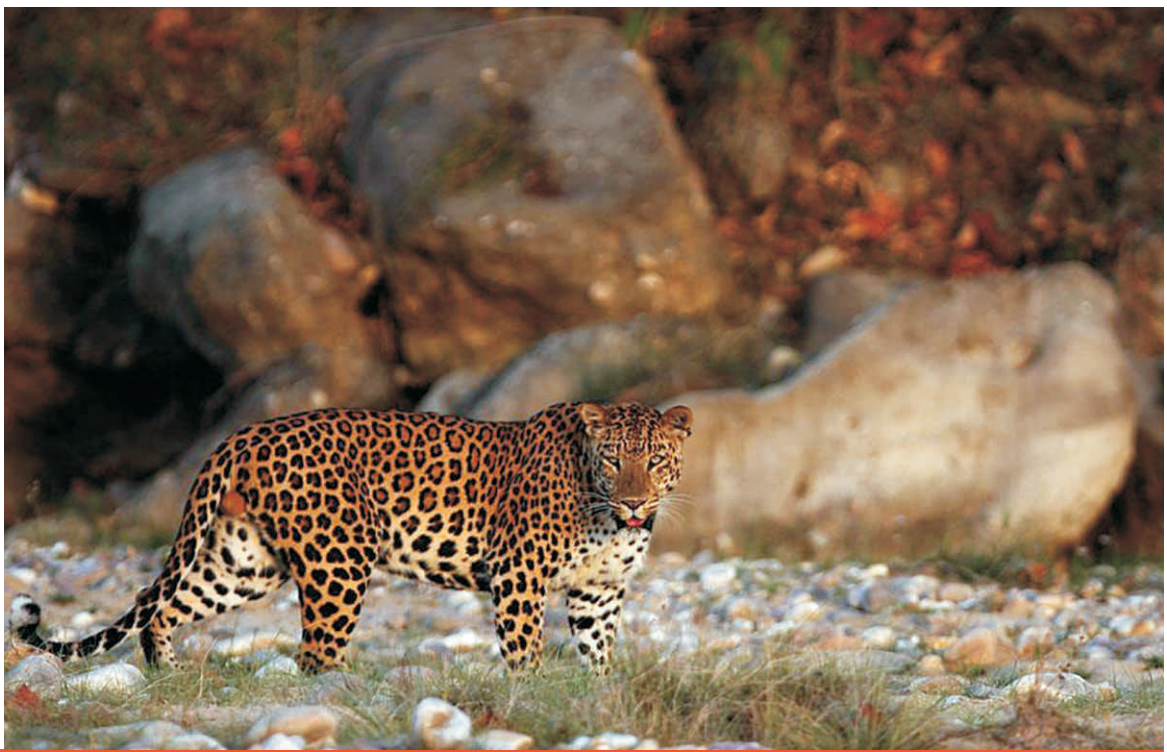
A total of 396 trap nights resulted in a total of 14 leopard photographs with 3 individual leopards. Amongst the three individuals, 2 males and 1 female was photo-captured. Although, the Null ($M_0$) model was selected based on highest criterion score, we selected the Heterogeneity ($M_h$) model because leopards are territorial animals and it accounts for heterogeneous capture probabilities between individuals. The density estimate produced by average home range radius (HHR) was 2.11 $\pm$ 1.06 individuals per 100 $km^2$ which was found best as density of the leopard in the study area. The relative abundance index of the leopard in the sampling duration turned out to be 3.5 per 100 trap nights.

The maximum home range (100% MCP) of the female F74 was $\sim$ 74 $km^2$ which was recorded during summer season. The summer home range (100% MCP) of the male was 1.96 times larger than the female leopard. The least home range ($\sim$ 41.4 $km^2$; 100% MCP) came up during the winter season. The increasing trend represented by the ranges (100% MCPs) of this female was winter $<$ spring (48.42 $km^2$) $<$ autumn (67.9 $km^2$) $<$ summer. The leopards showed large variation in daily distances moved during the lean season of summer. Daily displacements of the leopards were not normally distributed (Kolmogorov-Smirnov Test) for the male: M73 ($D = 0.119$, $df = 105$, $p = 0.001$), female: F71 ($D = 0.191$, $df = 105$, $p = 0.000$) and female: F74 ($D = 0.092$, $df = 105$, $p = 0.029$). Daily displacement was longer for the male leopard (median displacement = 588 m) than the female leopard (median displacement = 367.44 m). The total distance travelled by the male leopard (398.71 km) was greater than the female leopards: F74 (374.16 km) and F71 (62.91 km). In case of female leopard F74, the median daily distance travelled was highest during the winter season (0.664 km) followed by autumn (0.528 km), spring (0.506 km) and summer (0.367 km)

Findings of this study indicate that leopards are facing prey scarcity in the area, thus making them to rely upon suboptimal prey and occupy home ranges larger than other studies in the subcontinent. Leopards being opportunistic feeders have also started feeding on domestic prey in absence of sufficient wild prey, thereby elevating the human - leopard conflict in the region. Human - animal conflict being the major threat to large carnivores all across their distribution range is a big impediment in leopard conservation in the study area as well.

## OBJECTIVES AS STATED IN PROJECT PROPOSAL

1. Estimation of prey density across different sites and developing a relationship between density of prey base and leopard abundance.
2. Study variation of food habits across different sites and seasons in Kashmir valley.
3. Estimate density, abundance and distribution of leopard across different study sites.
4. Study movement pattern, home range size and social organization of leopards across different sites.



G.S. Bhardwaj

## DEVIATION MADE FROM ORIGINAL OBJECTIVES

All objectives aimed in the project proposal have been fulfilled as proposed.

To start with we selected Dachigam National Park for conducting ecological studies on leopards as well as their prey for the following reasons:

1. It is the first National Park in Kashmir valley with pristine ecosystem.
2. It boasts of the flag ship species of the State – Hangul (Cervus elaphus hanglu), the last surviving population of European Red Deer in India.
3. Vital role of this red deer sub-species as it is functionally a part of prey-predator dynamics where leopard (as a predator) is at the top level of the ecological pyramid.
4. More accessible in comparison to other areas of the valley which are relatively either difficult to approach or have very little lean period to work because of climatic conditions and socio-polictical reasons.

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भारतीय वन्यजीव संस्थान
Wildlife Institute of India
P.O. Box # 18, Chandrabani
Dehradun - 248 001 (Uttarakhand)
**t.** (0135) 2646283; **f.** 0135-2640117
**w.** www.wii.gov.in; **e.** bh@wii.gov.in

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