XI Internal Annual Research Seminar

31st August, 2015

Programme & Abstracts

Nilanjan Chatterjee

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

PROGRAMME

XI - INTERNAL ANNUAL RESEARCH SEMINAR

PROGRAMME

Seminar Chairperson: Sh. Vinod Rishi, Former ADG (WL), MoEFCC

Monday, 31st August 2015

0930 – 0935 h	Welcome	**Dr. K. Sankar, Research Coordinator, WII**
0935 – 0950 h	Opening Remarks	**Dr. P.K. Mathur, Dean, FWS**

TECHNICAL SESSION – I

Himalayan Ecosystems and Drivers of Change

Chair : Dr. S. Sathyakumar, Scientist-G

Co-Chair(s) : Dr. Bilal Habib, Scientist-D

Dr. Gopi, G.V., Scientist-D

0950 – 1020 h	Assessment and monitoring of climate change effects on wildlife species and habitats in the Indian Himalayan Region – A new initiative **Dr. Tapajit Bhattacharya, Dr. Nishikant Gupta, Project Scientists** **Mr. A. Arun Kumar, Project Associate**
1020 – 1040 h	Assessment of habitat quality for wild ungulates in lower parts of Kailash Sacred Landscape, Eastern Kumaon **Ms. Sweta Singh, Project Biologist**
1040 – 1100 h	Distribution and population estimation of ungulates in Changthang region, Ladakh, Jammu & Kashmir, India **Mr. Hussain, S.R., Junior Research Fellow**
1100 – 1120 h	**Tea**
1120 – 1140 h	Understanding the causes of diversity gradients along the Himalaya in flycatchers **Mr. Ashutosh Singh, Junior Research Fellow**
1140 – 1200 h	Discussions and remarks by Session Chair and Co-Chair

TECHNICAL SESSION – II

Wetland Fauna and Their Habitats

Chair : Dr. S.A. Hussain, Scientist-G

Co-Chair : Dr. J.A. Johnson, Scientist-D

Dr. C. Ramesh, Scientist-C

1200 – 1220 h Abundance and Distribution of waterbirds in Changthang Wildlife Sanctuary and Gharana Wetland Conservation Reserve

Mr. Neeraj Mahar, Junior Research Fellow

1220 – 1240 h Stream fish assemblages in relation to local habitat variables in upper Subansiri River, Arunachal Pradesh.

Mr. Sutanu Satpathy, Junior Research Fellow

1240 – 1300 h Discussions and remarks by Session Chair and Co-Chair

1300 – 1345 h Lunch

E - POSTER SESSION

1345 – 1430 h Digital Presentations (list attached)

TECHNICAL SESSION – III

Large Carnivore Ecology

Chair : Dr. Ruchi Badola, Scientist-G

Co-Chair(s) : Dr. K. Ramesh, Scientist-D

Dr. Gautam Talukdar, Scientist-D

1430 – 1450 h Home range, movement and activity pattern of Tigers and Leopards from Tadoba Andhari Tiger Reserve, Maharashtra

Ms. Madhura Davate, Junior Research Fellow

1450 – 1510 h Assessment and monitoring of current status and future scenario of reintroduced tiger population in Sariska Tiger Reserve, Rajasthan

Mr. Dibyendu Mandal, Project Biologist

1510 – 1530 h Ecology of Asiatic lions in Gir using telemetry– achievements & way ahead

Mr. Stotra Chakrabarti, Junior Research Fellow

1530 – 1545 h Discussions and remarks by Session Chair and Co-Chair

1545 – 1600 h Tea

TECHNICAL SESSION – IV

Wildlife Techniques, *Ex-situ* Conservation & Molecular Genetics

Chair : Dr. Bitapi Sinha, Scientist-G

Co-Chair(s) : Dr. S.K. Gupta, Scientist-D

Dr. Samrat Mondol, Scientist-D

1600 – 1620 h Evaluation of methods to estimate wild ass population in the Rann of Kutch, Gujarat

Mr. Qamar Qureshi, Scientist-G

1620 – 1640 h Initial screening of genetic variation of Sambar (*Rusa unicolor*) population from the Kaziranga N.P. using mtDNA Control region

Mr. Mirza Ghazanffar Ullah, Junior Research Fellow

1640 – 1700 h Metapopulation dynamics of tigers in Terai Arc Landscape, India

Mr. Suvankar Biswas, Junior Research Fellow

1700 – 1720 h Assessment of the conservation potential of threatened primates across Indian Zoos

Ms. Nilofer Begum, Junior Research Fellow

1720 – 1740 h Discussions and remarks by Session Chair and Co-Chair

CONCLUDING SESSION

1740 – 1755 h Comments on the Internal Annual Research Seminar by Invited Guests and Dean, FWS

1755 – 1815 h Concluding Remarks **Sh. Vinod Rishi, Seminar Chairperson**

Dr. V.B. Mathur, Director, WII

1815 – 1820 h Vote of Thanks **Dr. K. Sankar, Research Coordinator**

****

List of E - Poster Presentations

1. Management Planning of Kusheshwar Asthan and Baraila Bird Sanctuaries of Bihar.
   Ms. Michelle Irengbam, Senior Project Fellow

2. Assessing Conservation Values of Mangroves in Gujarat and Goa.
   Mr. N. Gokulakannan and Mr. Shahid Ahmed Dar, Project Biologists

3. Tigers and their prey in Dibang Wildlife Sanctuary.
   Mr. Aisho Sharma Adhikarimayum, Junior Research Fellow

4. Population genetic structure and gene flow in brown bear (*Ursus arctos isabellinus*) populations in India and assess extent of gene flow between populations of India and Pakistan: A New Initiative.
   Mr. Sujeet Kumar Singh, Research Biologist

5. Evaluation of Ecosystem Services of Munnar High Range Mountain Landscape - A review.
   Ms. Chongpoi Tuboi, Project Associate

6. Assessing compatibility of development plans and land-use patterns with the objectives of biodiversity conservation and resource planning in Munnar Landscape.
   Mr. Debojyoti Mukherjee, Project Associate and
   Ms. Akanksha Saxena, Project Fellow

7. MStriPES Monitoring System for Tigers– Intensive Patrolling and Ecological Status
   Mr. Sougata Sadhukhan, Project Biologist

8. Ecological status of leopards in Kalesar National Park and Wildlife Sanctuary, Haryana, India: Preliminary Results Preliminary Results
   Ms. Pallavi Ghaskadbi (Volunteer)

9. Preliminary Study on Landscape Sustainability Challenges from Mining Regimes in West Singhbhum
   Mr. Surya Prasad Sharma, Project Biologist

10. Human Wildlife Conflict and incentive based management in and around Rajaji-Corbett Forest Corridor
    Mr. Tanveer Ahmed, Technical Assistant

*****

ABSTRACTS

Oral Presentations

Assessment and monitoring of climate change effects on wildlife species and habitats in the Indian Himalayan region – A new initiative

Dr. Tapajit Bhattacharya, Dr. Nishikant Gupta, Project Scientists & Mr. A. Arun Kumar, Project Associate

The impact of climate change on wildlife species and their habitats in the Indian Himalayan Region (IHR) is less studied. Therefore, it is appropriate to carry out scientific investigations to assess impacts of climate change/variability on wildlife species and their habitats in order to formulate and apply directed management strategies for long-term conservation in the IHR.

Long-term monitoring sites would be selected in different biotic provinces of the IHR. Bhagirathi Basin has been selected as the initial site. Other sites would be selected later.

Four major focal themes viz., terrestrial (mammals, birds, herpetofauna, insects, soil micro flora and fauna), aquatic, human and spatial ecology have been identified. Preparation of species list (elevation range, geographical extent) for each faunal group based on literature survey in being carried out. Reconnaissance survey has been conducted in eight sub-basins of Bhagirathi. Trail sampling (n= 18, 218 km), road survey (n= 28, 1483 km), scanning (n= 21, 15 hrs), camera trapping (n=8, 12 nights), riverine surveys (n= 39) and local interviews (n= 26, 66 individuals) were carried out. Detection of focal species, accessibility, disturbance gradient and habitat types were considered for selecting potential sampling sites. Detailed literature survey was carried out to identify models and climate change scenarios. The spatial data was verified by visual means for modelling and analysis.

Lists of Himalayan mammals (n = 143 excluding chiropterans), birds (n = 980) and butterflies (n = 417 western Himalaya only) has been prepared. During reconnaissance survey, presence of 24 mammals, 95 birds, 9 reptiles, 8 amphibians, 7 fishes, 70 butterflies, and 23 morphospecies of odonates were recorded. A spatial database (n >16) of the geographical layers to be used has been prepared and verified. A number of potential models for species distribution, landscape and climate change have also been listed.

Combining the findings of all the thematic groups, 10 potential sites have been identified in Bhagirathi basin for intensive studies. Field work and spatial modelling will commence following an integrative study design combining specific methods of all themes.

Keywords: *Himalaya, climate change, micro-flora, fauna, communities, climate modelling*

Project Title	:	Assessment and Monitoring of Climate Change Effects on Wildlife Species and Ecosystems for Developing Adaptation and Mitigation Strategies in the Indian Himalayan Region
Principal Investigator(s)	:	Dr. V.B. Mathur, Dr. Abhijit Das, Dr. Asha Rajvanshi, Dr. Gautam Talukdar, Dr. G. S. Rawat, Dr. J.A. Johnson, Dr. Pratap Singh, Dr. K. Ramesh, Dr. Ruchi Badola, Dr. S. Sathyakumar, Dr. K. Sivakumar and Dr. V.P. Uniyal
Researcher(s)	:	Dr. Nishikant Gupta, Ms. Sujata Upgupta, Dr. Tapajit Bhattacharya, Mr. A. Arun Kumar, Dr. Devendra Kumar, Dr. Krishnendu Mondal, Dr. Manish Bhardwaj, Ms. Aashna Sharma, Ms. Kamalika Bhattacharya, Mr. Naitik Patel, Ms. Pamela Bhattacharya, Ms. Ranjana Pal, Mr. Shashank Arya, Ms. Sohini Chaudhuri, Ms. Tanvi Gaur, Ms. Anshu Shukla, Ms. Neha Aswal, Ms. Pooja Kala, Ms. Priyanka Kashyap, Ms. Shagun Thakur, Mr. Shailendra Raut, and Ms. Sonam Priyadarshani
Funding Agency	:	Department of Science & Technology, Govt. of India
Project Duration	:	2014-2019

Assessment of habitat quality for wild ungulates in lower parts of Kailash Sacred Landscape, Eastern Kumaon

Ms. Sweta Singh, Project Biologist

Present study aimed at assessing the quality of forested habitats for wild ungulates and also identifying ungulates that can be used as an indicator for habitat quality in the lower parts of Kailash Sacred Landscape-India for twin goals i.e., (i) to ascertain the health of forest ecosystems for sustaining services and functions; (ii) to compare the structure of community managed forests with those of reserved forests.

Reserved and Community managed forests in lower parts of KSL-India, Pithoragarh district (Eastern Kumaon) covering an area of about 60 km^2 in human dominated landscape.

Forest fragments covering both Reserved and Community managed Forests were delineated using GIS and Remote Sensing Tools. The forest patches around 22 villages falling under sal (*Shorea robusta*), chir pine (*Pinus roxburghii*), and banj oak (*Quercus leucotrichophora*) were assessed in terms of patch size, anthropogenic pressures, infestation by alien invasive species, and habitat use by three wild ungulates viz., *Rusa unicolor, Muntiacus muntjak,* and *Sus scrofa.* Direct and indirect signs of these ungulates were recorded along 32 transects of 1-2 km length across these forests. Peoples' dependence on these forests was quantified based on questionnaire surveys, water and forage availability in the forest patches.

Since reserved forests had larger Mean patch size (5.82 km^2), also being Sacred Natural Sites represented better forested habitat whereas due to anthropogenic pressure, close to human habitation and smaller Mean Patch Size (1.21) Community managed forests showed relatively poor habitat quality. Of the 22 patches 6 patches showed potential for quality habitat for Barking deer and Sambar with an area of more than 1km^2, 1km average distance from settlements, continuous source of water but only one patch showed presence of *Rusa unicolor* whereas 6 patches showed presence of *Muntiacus muntjak*. Even though *Sus scrofa* showed highest RAI (0.052), it did not show any significance response to positive and negative variables.

Of the three forested ungulates barking deer responded significantly to the positive and negative variables, whereas wild pig did not show any significance response to any of the variables, at the same time since Sambar was present only in one patch therefore, its response to any variable cannot be considered significant. Thus, we can conclude with using Barking deer as surrogate for assessing quality habitat.

Keywords: *Ungulates, pellet count, habitat quality, community managed forests, reserved forest.*

Project Title	:	Execution of Implementation Plan of the Kailash Sacred Landscape Conservation and Development Initiative.
Principal Investigator(s)	:	Dr. G. S. Rawat and Dr. S. Sathyakumar
Researcher(s)	:	Ms. Sweta Singh (Project Biologist)
Funding Agency	:	ICIMOD, Kathmandu, Nepal
Project Duration	:	2013-2017

Distribution and population estimation of ungulates in Changthang region, Ladakh, Jammu & Kashmir, India

Mr. Hussain. S.R, Junior Research Fellow

To estimate population and distribution of major prey species of wolf and other sympatric carnivores in Changthang, Ladakh.

The study was conducted in Changthang region of eastern Ladakh in Leh district, Jammu and Kashmir. The region is a typical cold desert characterized by dry plateau of rolling plains at an average altitude of 4500m and spans over 27,000 km^2.

We followed double observer simultaneous point count distance sampling method. Total area surveyed was ~ 23,000 km^2. Area was divided into 15x15km grids and alternate grids were selected to cover the entire landscape. We conducted 7 temporal replicates at each point and a total of 218 point surveys could be completed. Distribution of Kiang was modelled by MaxEnt (ver. 3.3.3k), while for other species rule-based habitat masking was applied. Count data was analysed in program Distance version 6.2 using the conventional distance sampling.

We analysed data only for Kiang, Blue sheep and Tibetan argali as sightings for other species were insufficient. However, reliable population estimates could be obtained only for Kiang and Blue Sheep. Suitable habitat for Kiang was 5188.28 sq. km, while Blue sheep was found present over 9168.76 sq. km. area. Population of Kiang and Blue sheep was estimated to be 4461.92 ± 1867.78 and 2017.13 ± 1558.69, respectively.

We found the method best suited for common species with wide range and even distribution (Kiang and Blue sheep) in the Trans-Himalayan landscape. The chances of missing the sightings were high for the rare species with patchy or specific and limited distribution (Tibetan Gazelle, Tibetan Antelope, Yak). Smaller grids and more replicates could help in assessing population estimates of such species.

Keywords: *Simultaneous point count, Trans-Himalaya, Kiang, Blue sheep, Tibetan argali*

Project Title	:	Ecology and Conservation of the Himalayan Wolf.
Principal Investigator(s)	:	Dr. Bilal Habib, Dr. Y. V. Jhala and Mr. Salvador Lyngdoh
Researcher(s)	:	Mr. Shivam Shrotriya (Senior Research Fellow) and Mr. Hussain, S. R. (Junior Research Fellow)
Funding Agency	:	Grant-in-aid
Project Duration	:	2010-2017

Understanding the causes of diversity gradients along the Himalaya in flycatchers

Mr. Ashutosh Singh, Junior Research Fellow

To investigate the causes of avian diversity gradients specifically in two phylogenetically coherent groups of flycatchers representing Ficedula/Muscicapella and Niltava/Cyornis genus along the Himalaya.

Fieldwork for this study was carried out at select sites in the eastern Himalaya (North Bengal and Sikkim) and western Himalaya (Himachal Pradesh, Jammu & Kashmir and Uttarakhand).

Breeding flycatcher species numbers and their distribution were assessed within 5 hectare grids (35 Nos.) established along elevational gradients in both eastern and western Himalaya. Habitat characteristics (foliage density, tree diversity and density, and basal area) were recorded to understand the causes of the diversity gradients in flycatchers. The flycatcher species were also examined for morphological measurements and observations of their foraging behaviour were made. To study vocalization differences song recordings of flycatcher populations across the east and west Himalaya were compared. Additionally, blood samples of flycatcher populations of select species were collected and examined to study genetic differentiation along the Himalaya.

The results show that out of the 22 species in the study, 8 are found in both the east and west, 11 are confined to the east and 3 are confined to the west. Along the elevational gradient the number of flycatcher species peaks at about 2000 m in the east, and to plateau from about 2000 m - 3000 m in the west. The higher number of flycatcher species in mid-elevations were found to correlate well with the estimated foliage density. Further, vegetation sampling in the eastern Himalaya showed maximum tree species at 500 m elevation (102 species), maximum tree density at 1000 m (45.8 trees/ha) and maximum basal area at 2000 m (65.71m²/ha). Basal area being an indicator of productivity correlates with the higher flycatcher numbers. Foraging behaviour and morphology showed maximum morphometric differences among flycatcher species occurring in the mid-elevations indicating expansion of niche space resulting in higher species diversity.

The comparisons of songs of *Ficedula superciliaris* populations, which occurs in both eastern and western Himalaya showed significant differences. Analysis for the genetic differentiation in the flycatchers is in progress.

Our findings suggest that the mid-elevation peaks in flycatchers are likely a result of maximum niche expansion since the morphological and foraging diversification is much higher in this zone. This is also supported by our results on habitat association which suggested higher productivity in this zone. This is again the cause for the flycatcher diversity gradient from east to west Himalaya.

Keywords: *Himalaya, flycatchers, mid-elevation peak, foraging behaviour.*

Project Title	: Causes of avian diversity gradients along the Himalayas.
Principal Investigator(s)	: Mr. Suresh Kumar, R., Dr. Pratap Singh, Dr. S.K. Gupta and Dr. Dhananjai Mohan
Researcher(s)	: Mr. Suresh Kumar Rana (Junior Research Fellow) and Mr. Ashutosh Singh (Junior Research Fellow)
Funding Agency	: Department of Science & Technology, Govt. of India
Project Duration	: 2013-2016

Abundance and distribution of waterbirds in Changthang Wildlife Sanctuary and Gharana Wetland Conservation Reserve

Mr. Neeraj Mahar, Junior Research Fellow

To quantify the current status of waterbirds with special reference to Bar-headed Goose (BHG) and Black-necked Crane (BNC) in J & K.

The study was conducted at Changthang Wildlife Sanctuary, a Trans- Himalayan refuge for breeding waterbirds with an area of 4000 sq. km and Gharana Wetland Conservation Reserve, an Important Bird Area (IBA) close to Indo-Pak Border with a small area of ~1 sq. km.

We applied total count methods using vantage points in Changthang. A total of 87 points were surveyed at 14 wetlands in September, 2014. For Gharana, wetland was divided into four blocks and block wise total counts were conducted with three temporal replicates on consecutive days in February, 2015.

We recorded a total of 22 species belonging to 11 families from Trans-Himalayan wetlands of Changthang, of which 12 species are known to breed there. Also, 31 species belonging to 12 families of waterbirds were recorded from Gharana. Among the wetlands of Changthang, waterbird abundance and diversity was the highest at Statspuk Tso with 15 species and the lowest at Kyon Tso II with only one species. Overall, N=303 BHG and N=19 BNC were recorded from the different wetlands of Changthang. At Gharana, Common Teal (N=207.67±36.43) was the most abundant species, while only two individuals of BHG were recorded.

Our findings confirmed that Statspuk Tso was the richest and the most diverse wetland in Changthang as reported by the previous studies as well. The low abundance of BNC was expected owing to the beginning of winter migration. Nonetheless, winter migration also allowed us to record the passage migrants like Red-necked Phalarope and Green Sandpiper. At Gharana, comparatively more species were recorded than previously published studies, while the abundance of BHG was found relatively low unlike the past records. Continuous cross-border firing and bursting of crackers by the farmers might be disturbing BHG, which are generally found in agriculture areas.

Keywords: *Bar-headed Goose, Black-necked Crane, Red-necked Phalarope, Trans-Himalayan Wetlands, Passage migrants.*

Project Title	:	A study of the distribution pattern, habitat use and movement of breeding waterbirds with special reference to Black-necked Cranes and Bar-headed Geese using satellite telemetry in Changthang Cold Desert Wildlife Sanctuary, Ladakh and Gharana Wetland Conservation Reserve, Jammu & Kashmir.
Principal Investigator(s)	:	Dr. S. A. Hussain, Dr. Bilal Habib, Dr. Gopi G.V., Mr. Jigmet Takpa, Mr. Intesar Suhail and Mr. Tahir Shawl
Researcher(s)	:	Mr. Neeraj Mahar (Junior Research Fellow)
Funding Agency	:	Department of Wildlife Protection, Government of Jammu & Kashmir
Project Duration	:	2012-2016

Stream fish assemblages in relation to local habitat variables in upper Subansiri river, Arunachal Pradesh

Mr. Sutanu Satpathy, Junior Research Fellow

An understanding of ecological patterns and gradients in any ecosystem is important to comprehend which habitat variables are decisive in forming and characterizing a community. In this study we correlate riverine characters with fish assemblages using multivariate analyses.

The Subansiri river enters India through the Upper Subansiri District in Arunachal Pradesh. Within the river system Sampling was done at 21 sites through an altitudinal gradient of 250-1000m within the district.

At every site, a 100m stretch was selected for collecting information on habitat variables such as mean width, depth, water velocity, altitude, habitat variability (runs, riffles and pools), substrate variability (sand, gravel, pebbles, etc.), water temperature. Underwater observations and fishing techniques viz. cast netting, gill netting, drag netting along with other locally made contraptions were used to record fish species. Taxonomic confirmations for the fish were done based on reliable literature. 21 sites were chosen for statistical analysis and the habitat variable data was subjected to Non Metric Multidimensional Scaling (NMDS). Catch per Unit Effort (CPUE) was calculated on the basis of number of individuals caught per stream.

A total of 34 fish species (15 genera, 7 families and 2 orders) have been recorded so far, of which two *Glyptothorax* species, one *Exostoma* species, and 1 *Botia* species have been recorded as new for the river system. The NMDS scatter shows 4 sites have unique positions based on species assemblage structures and diversity when compared to the rest of the sites. Interestingly these same sites are scattered at unique positions when the NMDS is carried out on the basis of habitat variables.

Intensive sampling clearly indicates high species richness and pristine to moderately modified habitat conditions in the upper Subansiri river basin. Some extremely rare and highly endemic fish species have been collected. The NMDS results suggest that width, depth, habitat diversity and altitude are most significant in determining fish species assemblages.

Keywords: *Non metric multidimensional scaling, sisorid catfishes, north east India, hydroelectric dam.*

Project Title	:	Ecology, taxonomy and conservation of fish diversity in Subansiri river basin, Arunachal Pradesh, North East India.
Principal Investigator(s)	:	Dr. J.A. Johnson, Dr. K. Sivakumar and Dr. Gopi, G.V.
Researcher(s)	:	Mr. Sutanu Satpathy (Junior Research Fellow)
Funding Agency	:	Department of Science & Technology, Govt. of India
Project Duration	:	2013-2016

Home range, movement and activity pattern of tigers and leopards from Tadoba Andhari Tiger Reserve, Maharashtra

Ms. Madhura Davate, Junior Research Fellow

The objective of the study was to study home range, activity and movement pattern of tiger and leopard. Precise estimates of such parameters at individual and population level are crucial in designing strategies for long term conservation program.

Tadoba-Andhari Tiger Reserve in Chandrapur District of Eastern Maharashtra spreads over an area of 1700 sq.km with moderately undulating terrain. It is a tropical dry deciduous forest with Bamboo (*Dendrocalamus strictus*) and Teak (Tectona *grandis*) being the dominant species, which provides suitable habitat for a wide array of faunal species.

Two tigers were fitted with GPS Plus Iridium Collars with activity and mortality sensors and four leopards were fitted GPS Globalstar collars. Tiger collars with two way communication systems were pre-programmed to record locations at an interval of five hrs which was later intensified to record locations at two hr and one hr interval. Activity pattern derived from camera trap photographs was compared with individual activity pattern of tigers using data from activity sensors. Leopard collars with five hr interval were tracked on ground to obtain activity and movement information.

The study revealed that 200 fixes (1.5 month) were adequate to attain the home range stabilization for the established individual tigers. For tigers, home range of female was ~40 sq. km with two cores of 18-24 sq. km respectively, while male had home range of 100 sq. km with a core of ~70 sq. km. The average distance between consecutive fixes for the female and male tiger was 827 meter and 462 meter respectively. Activity pattern did not differ significantly between data from camera trap photographs and radio telemetry. Home range of male leopard was ~90 sq. km and for female leopard was ~40 sq. km while another relocated female leopard was observed to be moving over a large area showing homing.

Proportion of core area utilization with respect to home range area is similar for male and female in tigers; however it showed differences in space usage with female using two core areas while raising two cubs and male confined to one core area. Leopards showed variability in area utilization with respect to their dominant and transient status and presence of tiger in the vicinity.

Keywords: *activity, daily distance moved, home-range, radio-telemetry, Tadoba*

Project Title	:	Long term monitoring of tigers, co-predators and prey species in Tadoba Andhari Tiger Reserve and adjoining landscapes.
Principal Investigator(s)	:	Dr. Bilal Habib, Mr. G.P. Garad, Dr. Parag Nigam, Dr. Vinay Sinha
Researcher(s)	:	Ms. Madhura Davate (Junior Research Fellow), Mr. Anil Dashahre (Junior Research Fellow) and Mr. Nilanjan Chatterjee (Junior Research Fellow)
Funding Agency	:	National Tiger Conservation Authority and Maharashtra Forest Department
Project Duration	:	2013-2017

Assessment and monitoring of current status and future scenario of reintroduced tiger population in Sariska Tiger Reserve, Rajasthan

Mr. Dibyendu Mandal, Project Biologist

Reintroduction of large predators such as tiger to small, isolated reserves is an intensive process and requires active management. Before the reintroduction of tiger in Sariska, it was assessed that the National Park area (274 km^2) of Sariska Tiger Reserve (STR) can sustain 15 adult tigers based on prey availability. Aim of this study was to assess the current scenario after seven years of tiger reintroduction and evaluation for future population management.

STR (1200 km^2) is situated in the Aravalli Hills in the semi-arid landscape of western India.

Densities of prey species were estimated using line transect data (Effort: 667.09 km, 2013 - 15). Tiger diet was determined from analysis of scats (324) and kills (143). Predator selectivity for age-sex of prey species was estimated using selection indices to assess more accurate densities of carrying capacity. Population Viability Analysis (PVA) was used to predict viability of the tiger population (100 years) under different management scenarios; i.e. mortality with or without supplementation.

The prey selection by tiger for different age-sex class was in following order: sambar adult male> sambar adult female> nilgai adult male> sambar young> chital adult male>wild pig adult male> nilgai adult female. Combined density of preferred prey age-sex class of prey species was 27.2±5.13 (SE) animals/km^2, which is capable of sustaining 5.44±1.02 (SE) tigers/ 100 km^2 corresponding to a population of 33±6 (SE) tigers across 600 km^2. Present livestock density (111.29±10.97 (SE)/ km^2) is much lower than the livestock density estimate (221.33/ km^2) assessed before tiger reintroduction in STR, which is attributed to the fact that 463 families have been resettled outside STR. Two tigresses have littered thrice after 4-6 years of reintroduction and utilizing inviolate areas created after village relocation.

PVA showed, if the current population is not supplemented at all, the extinction probability is 100%. If the population is supplemented every 3-5 years with at least two individuals (one male and one female) for next 15-20 years, the extinction probability is nil.

Regular supplementation along with village relocation is very crucial for the long term survival of tigers in Sariska Tiger Reserve.

Keywords: *tiger, prey selection, carrying capacity, future scenario*

Project Title	:	Monitoring of reintroduced tigers (*Panthera tigris tigris)* in Sariska Tiger Reserve, Rajasthan, Phase-II.
Principal Investigator(s)	:	Dr. K Sankar, Dr. P. K. Malik and Dr. Parag Nigam
Researcher(s)	:	Mr. Dibyendu Mandal (Project Biologist)
Funding Agency	:	National Tiger Conservation Authority, Govt. of India
Project Duration	:	2015-2018

Ecology of Asiatic lions in Gir using telemetry – achievements & way ahead

Mr. Stotra Chakrabarti, Junior Research Fellow

Long-term data on demography, distribution, behaviour, prey and habitat needs of an endangered is essential for its conservation. Herein, we report the status of WII's ongoing lion research in Gir in terms of lion and prey populations monitoring and lion range uses and discuss our future research plan.

20,000 km^2 Gir landscape comprises of the dry deciduous Gir Protected Area (PA) (1,880 km^2) and vast tract of agro-pastoral landscape in Saurashtra peninsula, Gujarat. The landscape outside the Gir PA is of multiple-use and is characterized by mosaics of grasslands, croplands, orchards, *Prosopis sp*. thickets and human habitations.

Distance sampling based on line transects (n = 91 temporal replicates; 315 km walk) was used in Gir PA to estimate prey population. A new innovative mark-recapture approach specially designed for lions was tested in Gir, wherein grids of 25 km^2were sampled by repeated search visits to each grid to search and identify individual lions. Also, the software LION *Version 2* on Visual Basic is under trial which would help in a computer generated observer-bias free interface to identify unique lions and maintain a database of individual lions. Four adult lionesses ranging between 6-12 years of age were fitted with radio-collars (GPS equipped) in the human-dominated landscape outside the Gir PA. Continuous (24 hour) monitoring of these lionesses for 3 subsequent predation events (816 hours) was done to understand activity budget, predation and habitat use.

Major wild prey species of lion like chital, sambar, nilgai and wildpigs were estimated to be at densities of56.1 (±8.3), 2.4 (±0.5), 0.3 (±0.1) and 3 (±1.3) per km^2respectively. Females outside PA had home ranges (95% MCP) averaging at 106.5 (±45.1) km^2, with core area (50% Fixed Kernel Home Range) of 51.5 (±15) km^2.

Our results suggest that chital, the major prey of lion within Gir PA, has reached equilibrium densities since 1994. Home ranges of breeding lionesses were twice that of lionesses inside the PA. We aim to radio-collar additional lions in the upcoming year to better understand behaviour, ranging pattern, dispersal and breeding requirements of lions inside and outside the PA.

Keywords: *density, lion, mark-recapture, prey population, radio-telemetry.*

Project Title	:	Ecology of the endangered Asiatic lions using satellite and GPS telemetry.
Principal Investigator(s)	:	Dr. Y.V. Jhala
Researcher(s)	:	Dr. Kausik Banerjee (Research Associate) and Mr. Stotra Chakrabarti (Junior Research Fellow)
Funding Agency	:	Department of Science & Technology, Govt. of India and WII
Project Duration	:	2013-2016

Evaluation of methods to estimate Wild Ass population in Rann of Kutch, Gujarat

Mr. Qamar Qureshi, Scientist-G

To evaluate various approaches of population estimation for long term monitoring of species distributed in large multiple use landscape.

Khur is highly endangered wild equid with its range restricted now to single locality in India. We evaluated distance based sampling using three different means i.e., foot, vehicle, and aerial (airplane and Unmanned Aerial Vehicle, UAV) transects. Foot transect were systematically spread across Eastern and Southern fringe with random start. Total of 98 foot transects have been laid. We also collected habitat and observer related variables to evaluate their effects on detection of animals. The Aerial survey was conducted using fixed wing Cessna aircraft covering 413 km. We have tested UAV for field application and developed protocols for video and photo captures as well as automatic process of information extraction.

Density of wild ass was 6.99 (± 1.16) in summer. In winter the wild ass density was 7.4 (±1.3), there is no significant difference in densities between seasons. The work is in progress and will able to address the current design issues. There has been a change in land use pattern after Sadar-Sarovar dam project come into existence as well as extent of area under *Prosopis spp* has increased over time. We analysed temporal change in landscape.

The three methods we have used have seems to have different application, aerial survey will be useful for large scale monitoring, UAV will be useful and cost effective to cover large areas and foot transect though equally robust as UAV is costly and time consuming. The sampling is in process and final year work will be more conclusive. Habitat has changed over time with *Prosopis spp* dominating most of the areas and will have effects on wild animals as well as livestock.

Keywords: *Monitoring, aerial survey, unmanned aerial vehicle, transect*

Project Title	: Evaluation of Methods to Estimate Wild Ass Population in Rann of Kutch, Gujarat.
Principal Investigator(s)	: Mr. Qamar Qureshi and Mrs. Nita Shah
Researcher(s)	: NA
Funding Agency	: Gujarat Forest Department
Project Duration	: 2012-2016

Initial screening of genetic variation of Sambar (*Rusa unicolor*) population from the Kaziranga N.P. using mtDNA control region

Mr. Mirza Ghazanfar Ullah, Junior Research Fellow

Sambar is an important species having a wide variety of distribution in India and inhabitant of almost every forest area ranging from Himalayan foothills to the Southern boundary and Eastern Himalayas to the Western Ghats. Not many ungulates have adapted itself to a wider variety of forest types and environmental conditions than Sambar. Sambar belongs to genus *Rusa* and phylogenetic revisions in this group apparently indicated that this genus is taxonomically more fragile among cervids. Moreover, our previous study indicated that the sambar of Southern India is genetically differentiable from Central and Nothern India. It also suggested including Northeast sambar populations for a drawing a comprehensive genetic variation among this species in India. Hence, a dedicated phylogeographic and population genetic study was warranted including Northeast population that may highlight its speciation pattern, adaptive radiation and population genetic structure.

Kaziranga National Park (430 sq km) lies on the south bank of the river Brahmaputra and its southern boundary follows, for the most part, the river Mora Diphlu that runs parallel to National Highway NH 37 (the main arterial highway in Assam).

Non-invasive samples (Faecal pellets = 32 and antlers= 3) were collected from the study site. Species identification was done using mitochondrial cytochrome b gene. Extracted DNA was amplified using the partial fragment (~550 bp) of mitochondrial DNA (mtDNA) hypervariable control region for the comparison of genetic variation to evaluate the intra-species variation among Sambar population of Kaziranga National Park (KNP) with other populations.

Of these 35 samples, 25 samples showed successful amplification and only 15 samples were of Sambar origin. In our preliminary findings, we observed unique haplotypes within the KNP population. These were clustered in a different clade when compared with the central and southern Sambar populations. The observed mean distance between northeast and southern Indian populations was higher than that of between northeast and central populations.

Our pilot study suggested that Northeast Sambar populations have unique haplotypes among the populations and not clustering with Southern and Central Sambar populations. However, more number of samples and genetic markers are required for further insight into the phylogeny of Sambar.

Keywords: *Rusa unicolor, non-invasive, control region, haplotypes*

Project Title	:	Genetic Assessment of Sambar (*Rusa unicolor*) Population in North-East India.
Principal Investigator(s)	:	Dr. S. K. Gupta and Dr. S. A. Hussain
Researcher(s)	:	Mr. Mirza Ghazanfar Ullah (Junior Research Fellow)
Funding Agency	:	Department of Science & Technology, Govt. of India
Project Duration	:	2015-2017

Metapopulation dynamics of tigers in the Terai Arc landscape, India

Mr. Suvankar Biswas, Junior Research Fellow

Terai Arc landscape retains about 22% of existing Indian tiger population. The ecology of tigers, population and prey estimates and disturbance patterns are fairly well studied in some of the areas here, and a deeper understanding of population dynamics would be critical to evaluate the evolutionary potential of the remaining populations. In this study, we aim to combine field and molecular tools to investigate source sink dynamics, direction and rate of gene flow, population structure, and social dynamics across this landscape. Understanding such patterns of population genetics, structure, connectivity and local population dynamics is of critical importance in prioritizing conservation efforts.

In the pilot phase of this work, we focused on standardizing a suitable method for sample collection, storage, and DNA extraction from carnivore feces. We collected 319 geo-referenced large carnivore faecal samples (based on morphological characteristics). DNA was extracted twice from each feces after swabbing the outer layer to collect host DNA. Species identification was performed using previously developed species-specific mitochondrial DNA markers. Currently molecular sexing and individual identification from tiger faecal sample is under process.

We confirmed 52 tiger and 102 leopard samples from 319 field-collected feces. These samples were collected from Rajaji Tiger Reserve, Lansdowne Forest Division and Jhilmil Jheel Conservation Reserve. Molecular sexing of tiger and leopard is standardized with previously collected blood DNA samples. PCR amplification of a panel of 14 microsatellite loci for individual identification is in progress in the laboratory.

Through our pilot work, we validated a new protocol for faecal sample collection, storage and a cheaper DNA extraction method from wild carnivores/ herbivores. Currently individual identification and molecular sexing from tiger and leopard feces is in progress.

Keywords: *Terai Arc landscape, tiger, connectivity, population structure, social dynamics.*

Project Title	:	Metapopulation dynamics of tigers in the Terai Arc landscape, India.
Principal Investigator(s)	:	Dr. Samrat Mondol, Dr. Bivash Pandav and Dr. Gautam Talukdar
Researcher(s)	:	Mr. Suvankar Biswas (Junior Research Fellow)
Funding Agency	:	WCT-Panthera Global Cat Alliance Funds and Department of Science & Technology, Govt. of India
Project Duration	:	2015-2018

Assessment of conservation potential of threatened primates across Indian zoos

Ms. Nilofer Begum, Junior Research Fellow

Indian zoos house nine primate species prioritized for Conservation Breeding Programs (CBP). Achieving *ex-situ* conservation goals for these species entails intensive management towards maintaining viable captive populations. Analysis of pedigree records maintained as studbooks provides an effective tool for fulfilling these goals. Here we assess the development and status of seven primate populations with reference to their conservation potential based on demographic parameters.

The species include: Lion tailed macaque (LTM), Pig tailed macaque (PTM), Stump tailed macaque (STM), Golden langur (GL), Nilgiri langur (NL), Phayre's leaf monkey (PLM) and Hoolock gibbon (HG); housed all across Indian zoos

Pedigree databases maintained in SPARKS *v* 1.66 program (ISIS 2004) were analysed using PMx *v* 1.2 (Ballou *et al.* 2011). Due to the small population size and limited parentage records, analysis of genetic parameters (using PMx) were not performed. Relevant demographic parameters such as census trends, age-structure, reproductive history and mortality patterns were considered for assessing the conservation potential.

The *ex-situ* populations of these primates originated from few individuals (N<5). The species have been maintained in captivity for periods ranging from 16 (PLM) to 66 (LTM) years, while mean annual size ranged from 10 (GL) to 38 (LTM) individuals per year. Wild-born individuals formed >50% of the historical populations for five of the species. Breeding was low and reproductive output of wild-born specimens (except LTM) was distinctly higher (% contributions: LTM-39, PTM-81, STM-79, GL-92, NL-64, PLM-92 and HG-100) than captive-born specimens. Mortality (<1 year) of captive-born individuals ranged from 0% (PTM) to 41.2% (GL) while post-acquisition mortality (<2 years) of wild-born individuals varied from 0% (PLM) to 37% (GL). The living populations were characterized by small sizes (N<50 in six species); housed as small groups/isolated individuals across multiple institutions. Age-sex distribution of living population indicated that a significant proportion of specimens were reproductively active (except STM) (% composition: LTM-55, PTM-59, STM-10.2, GL-80, NL-60, PLM-46, HG-68); however, with limited reproductive output.

The long term survival of these primate populations is constrained by small founder size, limited reproductive output and unviable group sizes at multiple locations, resulting in population decline (λ<1 except PTM). The primary factor responsible may be sub-optimal captive management. Population management and animal keeping based on the scientific understanding of species biology can ensure maintaining long-term populations for effective *ex-situ* management.

Keywords: *Captive, conservation breeding, population, primates, zoos*

Project Title	:	Development and maintenance of studbooks for selected endangered species in Indian zoos.
Principal Investigator(s)	:	Dr. Parag Nigam and Shri P.C. Tyagi
Researcher(s)	:	Dr. Anupam Srivastav (Project Consultant) and Ms. Nilofer Begum (Junior Research Fellow)
Funding Agency	:	Central Zoo Authority, Govt. of India
Project Duration	:	2012- 2017

ABSTRACTS

E-Poster Presentations

Management planning of Kusheshwar Asthan and Baraila Bird Sanctuaries of Bihar

Ms. Michelle Irengbam, Senior Project Fellow

To develop management plans for Kusheshwar Asthan Bird Sanctuary (KABS) and Baraila Jheel Bird Sanctuary (BJBS), wetlands located in the Lower Gangetic plains in Bihar.

Located in the Darbhanga district of northern Bihar KABS has a geographical area of 2710 ha while BJBS occupies an area of 1278.04 ha in the Vaishali district of northern Bihar. Both are wetlands of National Importance identified by Government of India under National Wetland Conservation & Management Programme. KABS is also an Important Bird Area (IN-BR-06, criteria A1 DD).

Questionnaire surveys, Stakeholders' consultation, Field observations, Soil and water analysis, vegetation analysis using quadrate and transects, Point and total count methods, etc. were used to collect data. Summary statistics were derived from the dataset. RS and GIS were used to prepare relevant maps.

179 plant species belonging to 53 families and 186 plant species belonging to 56 families were reported from BJBS and KABS respectively, of which Poaceae was the dominant family. 58 and 79 species of birds of which 29 and 45 species were waterbirds, were identified in BJBS and KABS respectively. Bird species such as Gadwill, Temminck's Stint, Painted stork, Wooly necked stork, were reported for the first time from these sites. Fifty species of fish were reported from both the wetlands.

Water qualities of both the wetlands were found to be normal except for DO (Dissolved oxygen) which was slightly higher than prescribed levels for category D wetlands (propagation of wildlife and fisheries).

The ecological risks to the wetlands can be grouped into four major categories: changes in the water regime, water pollution, physical modification and exploitation of biological products. Clogged inlet and outlet water channels were one of the major concerns of both the wetlands. Water pollution due to agricultural and brick-farms runoff were a high level risk factor. Unregulated resource extraction was a threat to the wetlands.

Social and management issues include lack of clarity of land ownership, lack of boundary demarcation, high dependence of the local communities on the wetlands and lack of alternative livelihoods, lack of awareness and willingness of the local communities for conservation of the wetlands.

Site and state level stakeholders workshops were held, where the findings were presented and discussed with the forest department, local people, line agencies and other scientific institutions. Based on the feedbacks received and the agreements reached, management strategies are currently being formulated for both sites.

Keywords: *Conflict issues, resource dependence, vegetation analysis, wetlands, waterbird*

Project Title	:	Management Planning of Kusheshwar Asthan and Baraila Bird Sanctuaries of Bihar.
Principal Investigator(s)	:	Dr. S.A Hussain, Dr. Ruchi Badola, Dr. Gopi G.V., Dr. Gautam Talukdar and Dr. Bitapi C. Sinha
Researcher(s)	:	Ms. Michelle Irengbam (Senior Project Fellow), Mr. Aftab Usmani (Senior Project Fellow) and Mr. Tanveer Ahmed (Senior Research Biologist)
Funding Agency	:	Bihar Forest Department
Project Duration	:	2014-2015

Assessing conservation values of mangroves in Gujarat and Goa

Mr. N. Gokulakkannan , Project Biologist and
Mr. Shahid Ahmad Dar, Project Biologist

The total mangrove area along the Indian coast is estimated to be approximately 4,628 km^2. In order to expand the areas under conservation and maintaining ecological integrity of coastal and marine habitats, 11 Ecologically Sensitive Areas have been categorised under Coastal Regulation Zone-I of revised CRZ 2011 notification. Conservation of mangrove regions requires detailed mapping and delineation. In this context, this study aimed to evaluate conservation value of outside marine protected area mangroves in Gujarat and Goa before declaring their status as highly sensitive area.

Entire Gujarat and Goa coast outside Marine Protected Area (MPA):

The clusters were mapped in google earth at an eye altitude of 1km and subsequently area of each cluster was calculated using the program Arc GIS. In each site at a random point, a line transect was laid perpendicular to the creek. A total of three plots were laid at every 20 m interval along the transects. In each plot the species, total number of trees, saplings, seedlings, tree height, canopy cover, GBH were recorded. Along with quantitative data on mangrove vegetation structure, the associate flora, the associate vertebrates and invertebrates were collected in plots of 10 x 10 m during the study period. A matrix was developed to identify the areas of “High Conservation Value (HCV)” on the basis of five different criterias i.e. Ecosystem resilience, Ecosystem function, Biodiversity uniqueness, Socio-cultural value, Socio-economic potential.

A total of 53 and 24 clusters were observed outside Marine protected areas of Gujarat and Goa coast, respectively. A total of five species of mangroves were recorded in Gujarat coast with homogenous vegetation patches. Goa coast had a total of eleven species of mangroves with most of the patches having heterogeneous vegetation of two or more species.

Contiguous mangrove patches falling outside the marine protected areas in Gujarat and Goa have been identified and assessed for conservation values. Geotagging of biodiversity data and habitat information in each of the identified mangrove patches is underway. They are duly supported by the checklists, maps, photos and video clips collected during the study period.

Keywords: *Ecologically sensitive areas, coastal regulation zone, mangroves, Gujarat, Goa, marine protected area*

Project Title	: Determination of Conservation value of Mangroves of Gujarat and Goa.
Principal Investigator(s)	: Dr. Gopi.G.V, Dr. K. Sivakumar and Dr. Gautam Talukdar
Researcher(s)	: Mr. N. Gokulakkannan (Project Biologist) and Mr. Shahid Ahmad Dar (Project Biologist)
Funding Agency	: National Centre for Sustainable Coastal Management, Govt. of India
Project Duration	: 2014–2015

Tigers and their prey in Dibang Wildlife Sanctuary

Mr. Aisho Sharma Adhikarimayum, Junior Research Fellow

Recent surveys documented signs of wild tigers in the temperate forests of the Dibang Valley District in Arunachal Pradesh. This landscape is unique in having tiger population at over 2065 m altitude, representing one of the very few tiger habitats at such high elevation in India. However, there is a complete lack of knowledge on the ecology of tigers, co-predators and their prey species. This study was initiated to (1) determine the distribution and abundance of tigers, co-predators and their prey species in different land use, land cover types and disturbance regimes in and around the Dibang Wildlife Sanctuary; (2) evaluate the effects of environmental features and anthropogenic pressure on their occupancy patterns; (3) determine the factors governing the niche differentiation among these species; (4) assess local people's knowledge, beliefs, attitudes and perceptions about conservation of tigers; and (5) identify areas that have high conservation value for long term monitoring and developing conservation strategy.

The Dibang Wildlife Sanctuary in Arunachal Pradesh covers an area of 4149 km^2 and lies between 950 17’ and 960 38’ E and 280 38’ and 290 27’ N.

A preliminary sign survey was carried out in the months of February and March 2015. A total of 6 sign surveys were conducted in Dri and Angi Pani valley covering 22.87 and 16.3 km effort length respectively. The intensive fieldwork will start from September 2015 onwards. Carnivore relative abundance and occupancy estimation will be carried out using camera traps. Relative abundance index (RAI) will be used for deriving prey densities. Diet and food preference of tiger, leopard and wild dog will be estimated from the scat analysis and from the kills. Questionnaire surveys will also be carried out to assess the human wildlife interactions.

In Dri Valley, the encounter rates were 0.35, 0.04, 0.08, 0.21 and 0.04 for tiger, leopard, small cats, small carnivores and barking deer respectively and encounter rates in Angi Pani valley were 0.18, 0.12, 0.06 and 0.24 for black bear, barking deer, wild pig and serow respectively.

Preliminary result reveals, the sanctuary holds a good diversity and abundance of tigers and co-predators and their prey. Future systematic long term research and monitoring of the entire landscape is being planned and will be undertaken.

Keywords: *Dibang Wildlife Sanctuary, tiger, co-predator, prey, Idhu Mishmi, Arunachal Pradesh*

Project Title	:	Establishing ecological baselines for long term monitoring of tigers, co-predators and prey species in Dibang Wildlife Sanctuary and its adjoining landscapes in Arunachal Pradesh, India.
Principal Investigator(s)	:	Dr. Gopi. G. V, Dr. Y.V. Jhala and Mr. Qamar Qureshi
Researcher(s)	:	Mr. Aisho Sharma Adhikarimayum (Junior Research Fellow)
Funding Agency	:	National Tiger Conservation Authority, Govt. of India
Project Duration	:	2014-2017

Population genetic structure and gene flow in brown bear (*Ursus arctos isabellinus*) populations in India and assess extent of gene flow between populations of India and Pakistan: A New Initiative

Mr. Sujeet Kumar Singh, Research Biologist

The present study is aimed to determine spatial distribution, occupancy, the level of genetic diversity direction and rate of gene flow, genetic connectivity between bear populations within India and between India and Pakistan, and effect of evolutionary forces i.e. gene flow and drift on the population dynamics.

Brown bear distribution range in Jammu and Kashmir, Himachal Pradesh, and Uttarakhand.

We used non-invasive samples (scat & hair) collected as source of DNA from different study sites along with other ecological attributes to evaluate landscape genetic analysis and population status. To standardize the species identification method, we used cytb and D-loop gene of mtDNA genome and screened 30 microsatellites markers for individual identification and population genetics analysis. We proposed to use compatible microsatellite markers with brown bears of Pakistan to document extent of gene flow between two countries. We collected known brown bear scat (n=1), hair samples from Kufri Zoo (n=1) and BNHS (n=4) and tissue samples from WFCG repository (n=2). We also used suspected bear samples (n=7) collected from Ladakh region of Jammu and Kashmir.

Progressively, we extracted DNA from scat (n=8), hair (n=5) and tissue (n=2) samples. All scat, hair and tissue samples were amplified with carnivore specific cytb gene and D-loop and after sequencing of PCR product and alignment with reference sequences, we identified samples of brown bear origin. We shortlisted microsatellite markers (n=30) for screening on the basis of no. of alleles, Polymorphism Information Content (PIC), level of heterozygosity and compatibility with Pakistan brown bear data. Standardization of microsatellite markers is in under progress.

Conduct field surveys/studies in selected sites and standardize techniques for species identification to correctly identify species from the samples collected from the field. Compare results of genetic analyses with that of results obtained for brown bear population in Pakistan.

Keywords: *Brown bear, population connectivity, gene flow, genetic structure*

Project Title	:	Population genetic structure and gene flow in brown bear (*Ursus arctos isabellinus*) populations in India (Jammu and Kashmir, Himachal Pradesh and Uttarakhand) and assess extent of gene flow between populations of India and Pakistan: Conservation and Forensic Implications.
Principal Investigator(s)	:	Dr. S. Sathyakumar and Dr. S. P. Goyal
Researcher(s)	:	Mr. Sujeet Kumar Singh (Research Biologist) and Dr. Tawqir Basir (Research Associate)
Funding Agency	:	Department of Science & Technology, Govt. of India
Project Duration	:	2015-2018

Evaluation of ecosystem services of Munnar high range mountain landscape - A review

Dr. Chongpi Tuboi, Project Associate

The project was undertaken with an aim to (i) identify the major ecosystem service provided by the Munnar High Range Mountain Landscape (HRML) (ii) derive the numerical value of these services, (iii) identify factors affecting the sustained flow of the identified ecosystem services, and (iv) suggest measures to maintain the continuous flow of these services without impacting the ecological health of the landscape.

HRML lies between $9^0$38' to $10^0$21'N to $76^0$33' to $77^0$18' E covering an area of 3,100 km^2, with Kerala and Tamil Nadu in the east and Periyar River in the west. The present study will be conducted in the three districts of Kerala i.e. Idukki, Ernakulam and Thrissur.

An extensive literature review was conducted to understand the crucial services provided by HRML and six ecosystem services *viz*. i) timber, ii) carbon stock, iii) water provisioning (soil moisture content and water yield), iv) soil nutrient content, v) recreation and vi) Non-timber forest products were selected for analysis. A comparative analysis of all the available methods on the basis of operational ease, cost effectiveness, accuracy, spatial scale and time efficiency was carried out and methods for the present study were selected.

For timber and carbon in above ground biomass, the forest yield method will be used while biomass expansion factor will be used to quantify the carbon in below ground biomass. For carbon in leaf litter and soil dry biomass weight and the Walkley Black method will be used, respectively. Time Domain Reflectometry and timed volume method will be used to assess soil moisture and water yield, respectively. Standard laboratory methods will be used to assess the soil nutrient retention by different LULC classes. Travel Cost Method will be used to assess the recreational value of the landscape. Results of primary data for each ecosystem service will be supplemented with estimates derived from secondary literature.

The net functional and monetary values generated during the project phase using different methods for different ecosystem services could be used as the baseline information for monitoring in future, as well as, contribute significantly in improving the quality of the landscape for sustained flow of ecosystem services and maintenance of its biodiversity value.

Keywords: *Ecosystem services; economic value; functional value; land use land cover classes*

Project Title	: Evaluation of Ecosystem Services of Munnar High Range Mountain Landscape.
Principal Investigator(s)	: Dr. Ruchi Badola and Dr. S.A. Hussain
Researcher(s)	: Dr. Chongpi Tuboi (Project Associate), Ms. Shruti Sengupta (Senior Project Fellow), Ms. Pariva Dobriyal (Senior Project Fellow), Ms. Aditi Dev (Project Fellow), Ms. Amanat Gill (Project Fellow) and Mr. Goura Chandra Das (Project Fellow)
Funding Agency	: UNDP
Project Duration	: 2015-2016

Assessing compatibility of development plans and land-use patterns with the objectives of biodiversity conservation and resource planning in Munnar landscape

Mr. Debojyoti Mukherjee, Project Associate and
Ms. Akanksha Saxena, Project Fellow

To assess compatibility of development plans and land-use patterns with objectives of biodiversity conservation and resource planning in the Munnar Landscape and suggest measures to enhance outcomes of development projects planned in the landscape.

The High Range Mountain Landscape (HRML) is situated in Kerala and is spread across 3,100 km^2 between 9°38' to 10°21' N and 76°33' to 77°18' E within the Western Ghats.

The study will be accomplished through analyses of existing data and GIS information. Field based studies would involve primary data collection through consultations with experts, local administration and locals. Spatial data base on themes such as land use patterns and demographic data, would be generated and would be subjected to analysis using decision support and planning tools such as Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). Review of literature has been carried out to understand site-specific issues and conservation and management in human-dominated landscapes in India. Development of SEA and strategic planning approaches have been based on similar studies in Vietnam, Ghana and China.

A number of studies have focused on the endemic and endangered land and life forms of this landscape, notably the Nilgiri tahr, the *Shola* forests and Asian elephants. Conflicts between development and conservation in the landscape are largely a result of incompatible land use types, leading to loss of biodiversity, man-animal conflicts, invasive weed proliferation, loss of habitat connectivity and quality.

Literature on conservation prioritization in human-dominated Western Ghats landscapes indicates that management of semi-natural and agro-ecosystems needs to be prioritized in plans for conservation of biodiversity in non-protected areas. Community-involvement and development of strategies for balancing tourism have also been identified as key areas for conservation management. Based on extensive review of case studies, an SEA-based approach for conducting the landscape-level assessment in Munnar area has been finalized. Land use and cover maps have been created, and based on these conflict zones have been identified.

Since the study is in its initial stages, field studies are yet to be carried out. This study will suggest a regional plan ensuring compatibility across multiple forms of developments and land use within diverse and distinct areas of the Munnar Landscape. It also aims to provide options to re-align and re-design necessary developmental project objectives for long-term mutually compatible and sustainable practices.

Keywords : *Strategic Environmental Assessment, conservation planning, sustainable development, Western Ghats*

Project Title	: India High Range Landscape Project, Munnar, Kerala (GEF-Munnar Landscape Project).
Principal Investigator(s)	: Dr. Asha Rajvanshi and Dr. A.K. Bhardwaj
Researcher(s)	: Mr. Debojyoti Mukherjee (Project Associate) and Ms. Akanksha Saxena (Project Fellow)
Funding Agency	: UNDP-GEF
Project Duration	: 2015-16

MStriPES - Monitoring system for tigers - Intensive patrolling and ecological status

Mr. Sougata Sadhukhan, Project Biologist

In conservation science, linking research, field condition and policies has always been a quest. However for abridging this gap, WII in collaboration with NTCA, WWF and ZSL proposed a Program MSTrIPES - 'Monitoring System for Tigers: Intensive Patrolling and Ecological Status (MSTrIPES)' whose foundation is laid on assimilation of Research, Management, Protection and Monitoring; thus, bringing in a cultural change in domain of conservation in India.

The pilot implementation of the program has started in 7 tiger reserves (NSTR, Bhadra, Kanha, Sariska, Anamalai, Corbett and Ranathambore TR).

Implementation of MSTrIPES comprises of 4 stages; a) training and sensitization, b) data collection and compilation, c) analysis and interpretation, d) adaptive management. Training of the forest staff was conducted by the team from WII and NTCA in order to enforce the patrolling protocol and ecological monitoring in 7 tiger reserves of India. Data collected through transect walk, carnivore sign surveys and routine patrolling is compiled at range level. MSTrIPES software involves two components ecological and patrolling that produce spatial and quantitative reports. Forest department, with the assistance of the research team from WII, collected data for patrolling and ecological module from January 2012 to August 2015. Software is updated to version 6, which is compatible to most of the smart devices (e.g. Android, Mac, GPS) and the reports are visible in GIS and Google earth.

Initiation of MSTrIPES in 7 tiger reserves in India has shown considerable changes in forest department's regular activities. The output of total efforts invested throughout the parks by the frontline forest staff represents capacity building followed by the implementation of MSTrIPES. Daily patrol record is compiled systematically in computer similar to log-book maintained at each forest chowky. A database for species distribution and occupancy, human impact intensity, and patrol coverage is being prepared at each site.

The report generated above is a part data on Patrolling Module for more than two years. Program is generating ready reports and maps for management needs so as to assess the park health quantitatively rather than the subjective rating. Changes in field conditions can be integrated in decisions thus channelizing adaptive management.

Keywords: *Monitoring, intensive patrolling, daily log, management, protection*

Project Title	: Monitoring System of Tigers - Intensive Patrolling and Ecological Status - "MSTrIPES".
Principal Investigator(s)	: Dr. Y.V. Jhala and Mr. Qamar Qureshi
Researcher(s)	: Mr. Ashok Kumar (Junior Research Fellow), Mr. Anup Pradhan, Mr. Ninad Mungi, Mr. Srinivas Yellapu, Mr. Ashish Prasad, Mr. Sougato Sadhukhan (Project Biolgists)
Funding Agency	: National Tiger Conservation Authority, Govt. of India
Project Duration	: 2011-2016

Ecological status of leopards in Kalesar National Park and Wildlife Sanctuary - Preliminary results

Ms. Pallavi Ghaskadbi, Volunteer

Kalesar National Park (KNP) and Kalesar Wildlife Sanctuary (KWLS) is the westernmost tip of the Terai Arc Landscape with the Shivalik mountain range cutting across the area. Previously home to tigers, KNP & KWLS is now a haven for leopards and other mammalian species that represent the Shivaliks. The study was aimed at evaluating the population and the density of leopards in the forest of Kalesar.

The study area is Kalesar National Park and Wildlife Sanctuary, Haryana (Northern Tropical Dry Deciduous forest). The forest is primarily a *sal*and *khair* forest interspersed with grasslands and is the westernmost limit of naturally occurring *sal* forest in the country.

To study the spatial and temporal activity of leopards, camera traps were deployed in 1 X 1 sq km grids in 2 blocks for 21 days in an area of 70.6 sq. km. A spatially explicit capture-recapture (SECR) model was used to estimate leopard density. The pattern of temporal and spatial activity of leopards w.r.t. prey was also studied. The data were analysed in R platform (ver. 3.0.1) using the package “secr” and ArcGIS.

The camera trapping exercise recorded a total of 18 mammalian species. The population of leopards was estimated to be 22 ± 1.0 (22.0-25.4). Density was estimated to be15 individuals per 100 sq km (SE=3.54). Leopards show bimodal activity peaks and seem to use the KWLS areas more than the KNP. Temporal data suggests that there was a significant overlap between the temporal activity pattern of the leopard and the wild pig (Δ=0.86), nilgai (Δ=0.83) and sambar (Δ=0.81). The rusty spotted cat was reported for the first time from this area.

The Kalesar National Park and Wildlife Sanctuary have an apparently healthy population of leopards. Further monitoring of this population on a regular basis is key to understanding the population dynamics of leopards in Kalesar.

Keywords: *Kalesar, leopard, SECR, rusty spotted cat, activity, Haryana*

Project Title	: Evaluating Ecological Status of Leopard in Kalesar National Park, Haryana.
Principal Investigator(s)	: Dr. Bilal Habib, Dr. Gautam Talukdar, Dr. Bivash Pandav, Dr. Parag Nigam and Mr. Salvador Lyngdoh
Researcher(s)	: Ms. Pallavi Ghaskadbi (Volunteer)
Funding Agency	: Haryana Forest Department, Govt. of Haryana
Project Duration	: 2014-2015

Preliminary Study on landscape sustainability challenges from mining regimes in West Singhbhum

Mr. Surya Prasad Sharma, Research Biologist

Quantification of the effect of mining on ecosystems is a major issue in sustainable development and resource management. Under the direction of Ministry of Environment, Forest and Climate Change the Wildlife Institute of India is assessing the impact of iron ore mining on wildlife values of Saranda Forest Division (SFD) with special reference to species of conservation significance. As part of the project a preliminary survey was carried out to assess the faunal diversity in the area and possible impact of mining on faunal diversity.

The SFD located in the Southern part of West Singhbhum, falls under Chotanagpur biotic province. The vegetation type includes Northern tropical moist and dry deciduous Forests dominated by *Shorea robusta*. The faunal and floral diversity includes 629 flowering plants, 26 mammals, 43 birds, 10 reptiles, 4 amphibians and 71 species of butterflies. The study was carried out around one active mine in the Koena range of SFD.

Data on the current biological (terrestrial fauna) and environmental parameters were collected through transects of 2-4 km laid in all direction from the breaking boundary of mines. Plots of 10 m radius were laid along transects at every 400 m. Vegetation, anthropogenic disturbance, dust accumulation on leaves and forest surface substrate (boulders and gravels) in the mining areas were recorded in these plots.

Around the mining sites, 8 mammals, 22 birds and 6 herpetofauna species were recorded. *Rhesus macaque, Acridotheres tristis and Python molurus molurus* were sighted on more than one occasion. The maximum numbers of faunal species were recorded between 1600 and 2000m. Among the trees*, Shorea robusta* was the dominated species followed by *Anogeissus latifolia* and *Bridelia retusa.* The anthropogenic disturbance showed variable trend across transects. Dust accumulation on leaves was higher near mines and negligible accumulation was noticed between 1400m and 1800m. Large boulders formed the major forest surface substrate near the breaking boundary.

The preliminary survey carried out at SFD was indicative of negative impact of mining on faunal diversity; however it calls for a detailed assessment encompassing all objectives to characterize critical biodiversity hotspots and quantify the impact of mining on faunal diversity.

Keywords: *Mining, wildlife, survey, impact, Saranda forest, breaking boundary*

Project Title	: Landscape Sustainability Challenges in West Singhbhum Region due to Collective Mining Regimes: Mining - Wildlife Habitat Linkages and Impacts.
Principal Investigator(s)	: Dr. S. A. Hussain, Dr. Parag Nigam and Dr. C. Ramesh
Researcher(s)	: Mr. Narendra Mohan and Mr. Surya Prasad Sharma (Research Biologists)
Funding Agency	: Ministry of Environment, Forests and Climate Change, Govt. of India
Project Duration	: 2015-2016

Human wildlife conflict and incentive based management in and around Rajaji-Corbett Forest Corridor

Mr. Tanveer Ahmad, Technical Assistant

The objectives of the present study were to (a) assess the benefits and costs accrued to local communities from the forest (b) map the spatial distribution of costs and benefits across the corridor (c) identify factors governing the conflict in the area, and (d) to develop an incentive based approach to mitigate the conflict in the area.

The study was conducted around the Rajaji-Corbett Forest Corridor (29° 37′ to 29°53′ N and 78°19′ to 78°41′E), in the districts of Haridwar, Pauri Garhwal (Uttarakhand) and Bijnor (Uttar Pradesh).

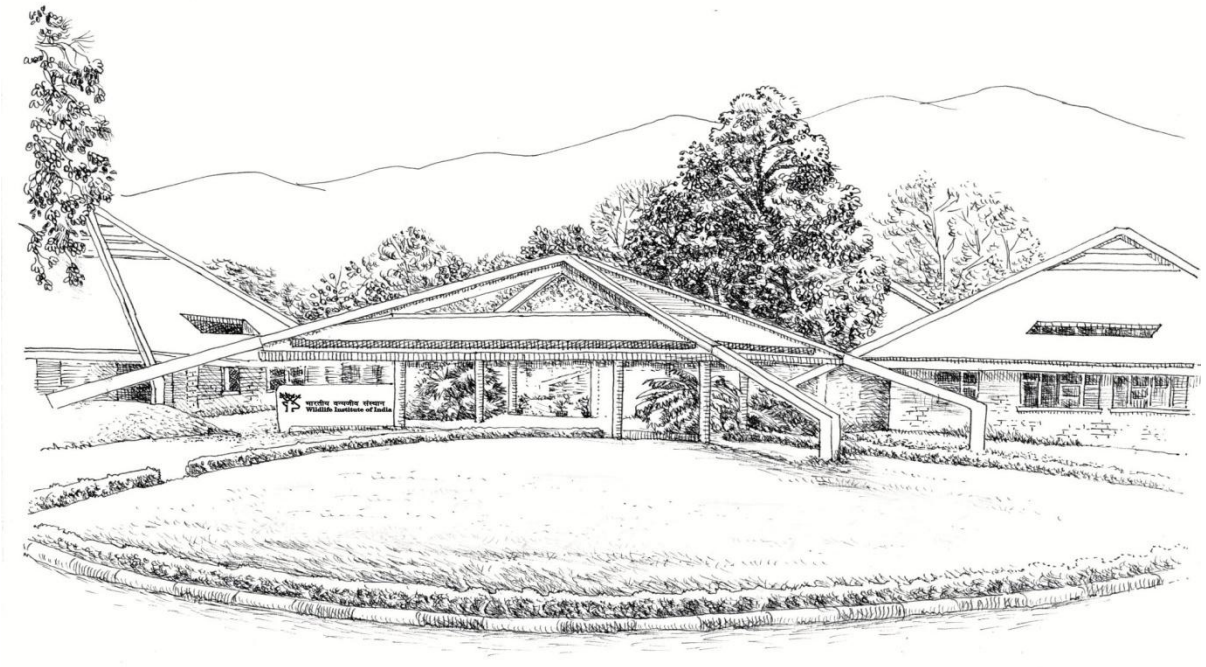
Hierarchical cluster analysis was carried out to get group homogenous villages. 37 representative villages were selected from each group and randomly selected 757 households were surveyed to collect information on benefits derived from forest and crop and livestock damage caused by Human Wildlife Conflict (HWC). Ordinary Kriging was used to determine the conflict hot spots.

Average income of the local people was US$2827 ±380/HH/year. It was higher for the households situated in the plains as compared to hills. Overall 84% of the households were dependent on forest resources that contributed, US$90 ±2.6/HH/year to the income (19%). Forest resources contributed more to income of households in hills (21%) than plains (15%). 71% of the households sampled were involved in agricultural practices of which 69% of households experienced crop damage. A total of 16% of the households experienced livestock depredation of which 63.6% of the incidences occurred in the forest while rest were reported from villages and agriculture fields. Average monetary loss due to crop depredation was high in plain (US$145 ±15.1) than hills (US$43.8 ±6.03) while it was high in plain (US$30.5 ±8.7) than hill (US$17 ±3.8) due to livestock lifting. Cropping pattern, type of cattle and distance from forest were the primary determinants of the HWC. An incentive-based package was designed to compensate the communities for not practicing agriculture in the conflict prone areas. It was US$15644 and US$21533 for hills and plains, respectively, on the basis of Net Present Value of the net profits from agriculture.

Overall cost incurred due to HWC was higher than the benefits accrued from the forest. In both hills and plains the poor households were deriving more benefits from forest than the non poor. The loss from HWC was more for the non poor in the plains while it was similar for both categories in the hills.

Keywords: *Human animal conflict, corridor, Rajaji, Corbett, economics, incentive*

Project Title	: Economics of living in wild: cost benefit analysis of forest corridor linking Rajaji and Corbett National Park, Uttarakhand
Principal Investigator(s)	: Dr. Ruchi Badola, Dr. S.A. Hussain
Researcher(s)	: Ms. Pariva Dobriyal (Senior Research Fellow), Mr. Tanveer Ahmed (Technical Assistant), and Mr. Goura Chandra Das (Technical Assistant)
Funding Agency	: The South Asian Network for Development and Environmental Economics
Project Duration	: 2013-2015



Post Box 18, Chandrabani, Dehradun 248 001, Uttarakhand, India
EPABX: +91 135 2640114, 2640115, 2646100; Fax: +91 135 2640117
Email: wii@wii.gov.in; Website: www.wii.gov.in