



ANNUAL REPORT

2015-16



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ANNUAL REPORT 2015-16

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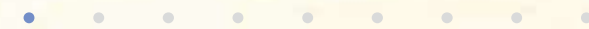
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ROLE & MANDATE

INTRODUCTION

In the early 80s of the last century there was a realization all over the world, including India, that natural resources were diminishing and that the environment was being degraded. At the same time, the understanding of environmental issues was still a little hazy, and the initial remedial responses to complex environmental problems had mixed outcomes of successes and failures.

The limitations of the early initiatives also brought into focus the inadequacy of trained manpower for wildlife management and of wildlife biologists to conduct research and overcome the paucity of researched information for promoting proper conservation planning. A need was felt for establishing an organization that, through multi-disciplinary research at the field level, could help the response to the challenges of biodiversity conservation and develop holistic approaches for managing wildlife and its habitats across the country and the region. This led to the setting up of the Wildlife Institute of India (WII) at Dehra Dun, in 1982.

In 1986, WII was granted the status of an autonomous institution of the Ministry of Environment and Forests, Government of India. WII is a premier training and research institution in the field of wildlife and protected area management in South Asia. Since its inception, WII has had the benefit of collaboration with international organizations such as UNDP, FAO, USFWS, IUCN and UNESCO. These collaborations have helped the institute build a competent faculty and staff through rigorous training and exposure to modern research and analytical techniques.

The institute's wide array of capacity building programmes provides a practical and realistic direction to the concept and practice of wildlife conservation by seeking the involvement and cooperation of local communities. By learning from its own and others' experiences, WII is traversing a path of hope and aspiration, which will help strengthen its inputs and efforts in finding answers in addressing wildlife conservation issues and challenges in the country as well as in the South Asian region.

OUR MISSION

Our mission is to “nurture the development of wildlife science and promote its application in the field in a manner that accords with our economic and socio-cultural milieu”.

AIMS AND OBJECTIVES

- To build up scientific knowledge about wildlife resources.
- To train personnel at various levels for conservation and management of wildlife.
- To carry out research relevant to management, including the development of techniques appropriate to Indian conditions.
- To provide information and advice on specific wildlife management problems.
- To collaborate with international organizations on wildlife research, management and training.
- To develop as a regional centre of international importance for conservation of wildlife and natural resource conservation.



RESEARCH REPORTS

- **Completed Projects**
- **Ongoing Projects**
- **Initiated Projects**

Completed Projects

Diversity of Moth (Lepidoptera: Heterocera) Assemblage and Their Potential Role as a Conservation Tool in Different Protected Areas of Uttarakhand

Objectives: The objectives of the project are to (1) document and prepare a taxonomic inventory of the rich moth fauna of the protected areas of Uttarakhand; (2) assess and analyse the diversity and distribution of moth assemblages along elevation and vegetation gradients and the influence of anthropogenic disturbance factors on moth assemblages in different protected areas of Uttarakhand; and (3) establish moth assemblages as surrogates for the entire insect community and use moths as indicator taxa in rapid habitat quality assessment programmes.

Progress: The study was conducted in the Gangotri Landscape Area, viz., three high-altitude protected areas of Uttarkashi District, Uttarakhand. The elevation varies from 1200 m to over 6500 m. Gangotri National Park has an extent of 2390 km² including Gaumukh Glacier, the origin of the River Ganges, and Govind National Park has an extent of 953.12 km² including the upper catchment of the River Tons. The climate of the area is the typical Western Himalayan climate, with medium to high rainfall during July-August at the lower altitudes. The average rainfall is 1500 mm, and it is extremely cold, with 3-4 months of snowfall in winter, with a permanent snowline in the higher reaches.

Altogether 169 species of geometrid moths belonging to 99 genera of five subfamilies were recorded from different protected areas of Uttarakhand. Detailed species accounts are provided here with the recorded altitudinal range, past altitudinal record and host plant information along with specimen photographs. The research team recorded 20 species from the Askot Landscape, 42 species from the Dehradun-Rajaji Landscape, 112 species from Govind Wildlife Sanctuary, 15 species from Gangotri National Park and 37 species from Nanda Devi Biosphere Reserve. The maximum numbers of species were recorded from Western Mixed Coniferous Forest (55 species), which was

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Department of
Science & Technology,
Government of India

• **Investigator**
Dr. V.P. Uniyal

• **Researcher**
Pritha Dey

• **Date of Initiation**
November 2012

• **Date of Completion**
November 2015



mainly in the mid-elevation area extending from an altitude of 2200 m to 2800 m. Among the other species-rich areas were Pine, *Pinus roxburghii* Mix forests (46 species), extending from 1400 m to 1800 m, and Sub-alpine forest (43 species), between 3200 m and 3600 m. Riverine forest (nine species) and Moru Oak, *Quercus dilatata* forest (12 species) were among the species-poor regions. The alpine scrubland, the semi-arid altitudinal zone above 3600 m, beyond the tree-line yielded 20 species.

Among five subfamilies of the family *Geometridae* sampled across different elevation and forest types, the subfamily *Ennominae* was dominant (92 species), followed by the subfamilies *Larentiinae* (37 species), *Geometrinae* (28 species), *Sterrhinae* (11 species) and *Desmobathrinae* (one species). The altitudinal distribution of the four major subfamilies showed that the subfamily *Larentiinae* was exceptionally distributed towards the higher altitudes while the other three were diverse in the lower and middle elevation zones.

Among 12 tribes of the subfamily *Ennominae* recorded, the tribe *Boarmiini* was dominant (37.5%), followed by the tribe *Hypochrosini* (12.5%). The other main tribes were *Eutoeini*, *Abraxini*, *Gnophini*, *Ourapterygini* and *Macariini* (6.25% each). Nine tribes of the subfamily *Larentiinae* were recorded, with 30% of the species from the tribe *Cidariini*, and the tribes *Larentiini*, *Asthenini* and *Xanthorhoini* having 14.81% each. In the subfamily *Geometrinae*, 43% of the species recorded were from the tribe *Geometrini*, 29% of the species were from the tribe *Pseudoterpnini* and 23% from the tribe *Hemitheini*. In the subfamily *Sterrhinae*, nearly 50% species were from the tribe *Scopulini*. Identification up to the species level was not very successful in this tribe.

Outputs and Outcomes: The research team categorised each species into four biogeographic

components based on their regional and global distribution as determined from a literature survey. Within the Indian sub-region, 65% of the species were endemic to the Himalayan region, while 16% of the species were also common in the Gangetic plains. Around 19% of the species were distributed throughout India. Globally, 60% of the species were of Indo-Malayan origin, while a significant portion (22%) was of Sino-Himalayan origin. There was a minor representation (9%) of the Eastern Palearctic element, while a similar proportion of species that are globally distributed was also recorded. Species of the subfamily *Sterrhinae* are mostly globally distributed. The team compared the maximum altitude record of each species from the literature and was able to document possible range expansions for at least 15 species. Among these species, the team recorded altitudinal range expansions of more than 1000m for 12 species.

Dr. V.P. Uniyal



Promoting Livelihood Security and Community Participation in Forest Conservation in Fringes of Kedarnath Wildlife Sanctuary, Western Himalaya

Objectives: The objectives of the project are to (1) quantify the extraction of forest resources by the local people; (2) quantify the availability of major forest resources along the altitudinal gradient; (3) estimate the contribution of agriculture and forests products traded by local people to their total income; (4) facilitate the establishment of self-help groups in selected study villages; and (5) find ways and possibilities of transforming local goods into value-added products through value chain analysis and market surveys.

Progress: After performing hierarchical cluster analysis, 14 *gram sabha* with 16 villages were identified. The study villages were classified into three elevational categories, viz., high-elevation villages (HEVs, where the villagers often access forests at >2000 m asl), mid-elevation villages (MEVs, where the villagers frequently access forests at 1500- 2000 m asl) and low-elevation villages (LEVs, where villagers frequently access forest ≤ 1500 m asl). A total of 413 households (20-25% of each study village) were surveyed from the study area from November 2013 to October 2014 using a semi-structured questionnaire. Sampling was done in two kinds of systems, viz., natural forests and agroforestry systems (AFS), to estimate the availability of key phyto-resources in and around the villages and the surrounding forests,.

Spatio-temporal variations were seen in the resource use in the study area along the elevational and seasonal gradients. The fuelwood consumption per year per household was highest in the HEVs. There were primarily three sources of fodder, viz., forest, AFS in villages and fodder bought from other households or *gram panchayats*. In LEVs, almost 50% of the fodder demand was met from AFS. The fodder obtained from these systems included agricultural byproducts and tree species planted along farm boundaries or on non-cultivated land.

- **Funding Source**
Department State of
Council for Science
& Technology
- **Investigators**
Dr. Ruchi Badola and
Dr. Syed Ainul Hussain
- **Researcher**
Upma Manral
- **Date of Initiation**
May 2013
- **Date of Completion**
December 2015



The fuelwood consumption per household per year correlated positively with elevation, while the fodder extraction from forests correlated positively with elevation and location of the village inside the sanctuary.

A total of 16 tree species in the forests were exploited for fuelwood in HEVs and MEVs, while the corresponding number in LEVs was 11. HEVs had the highest density of trees in the forest; however, there was no significant difference in the total above-ground biomass per unit area along the elevational gradient. In AFS, the highest number of fodder tree species was recorded in LEVs (18) followed by MEVs (15). LEVs had the highest density of trees and highest fodder biomass per hectare, and these values were significantly different from those of HEVs.

As part of the project, meetings were held with villagers and IRRRRFM representatives to discuss alternatives for livelihood diversification and income generation. A total of 65 kg of *Rajma* was bought from 25 households. This was sold as a chemical-free produce from the region. Later, a small workshop was conducted in which women were encouraged to make local produce such as *Badi* and *Chatnee*. They shared their views on the possibility of improving their income and conserving natural resources.

Outputs and Outcomes: The results indicate that the forest resources provide subsistence income to the majority of the households in the study area, thus, acting as a significant contributor towards the livelihood security of local communities. Easy access to the forests in the surroundings, resource constraints and poor economic conditions resulted in a greater dependence of HEVs on natural forests, which may not be sustainable in the long run. Thus, the research team recommended plantation of multipurpose tree species in the agro-forestry

landscape to remove the burden from the sanctuary forests. Information about the status and availability of the major phyto-resources across the elevational gradients in the region could be used to suggest multi-purpose tree species for plantation according to the local community's requirements.

Milestones: A paper titled 'Banj, Beasts and People-Life in the Fringes of the Kedarnath Wildlife Sanctuary, Western Himalaya' was published in *Sanctuary Asia* during the reporting period.

A poster titled 'Forest, Farm and People-A Study on Park-People Interface from Kedarnath Protected Area Landscape, Western Himalaya' was presented at a workshop, 'Forest within Landscape Connecting Forest with Farming System', held at Udaipur, Rajasthan between 17 and 22 February 2016.

Upma Manral



Economics of Living in Wild: Cost Benefit Analysis of Forest Corridor Linking Rajaji and Corbett National Parks, Uttarakhand

Objectives: The objectives of the project are to (1) assess the use values and the benefits of the corridor forests accruing to the local communities residing in these forests; (2) assess the cost incurred by the local community due to the presence of wildlife in the corridor forests; and (3) determine the spatial distribution of costs and benefits, across different stakeholder groups.

Progress: The study was conducted in 37 representative villages and 757 randomly selected households in and around the forest corridor linking Rajaji and Corbett national parks to assess the benefits and costs accruing to local communities from forests, to identify factors governing human-wildlife conflict (HWC) and to design an incentive-based approach to mitigate HWC. An interview-based questionnaire survey was conducted in selected households to understand the socio-ecological setup and status of HWC in the selected households in representative villages. Ordinary kriging was used to determine the conflict hotspots. An incentive-based package was designed on the basis of the net present value (NPV) of the net profits from agriculture to compensate the communities for not practicing agriculture in the conflict-prone areas. The qualitative and quantitative data generated from participant-observation, in-depth interviews and focus group discussions were fully transcribed and coded, and each relevant unit of the data was assigned tentative codes to describe the process. Following the Government of India (2014), all the households were divided into two categories: poor (below poverty line) and non-poor (above poverty line). Rural and urban poverty indices were used for the hill and plain households, respectively.

Outputs and Outcomes: Overall 84% of the households were dependent on forest resources. The contribution to the income of the households was

- **Funding Source**
The South Asian Network for Development and Environmental Economics

- **Investigators**
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- **Researchers**
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- **Date of Initiation**
May 2013

- **Date of Completion**
May 2015



greater in the hills (21%) than in the plains (15%). 71% of the households practiced agriculture, of which 69% experienced crop damage. 16% of the households experienced livestock depredation. The cost incurred due to HWC was higher than the benefits accruing from the forest. In both the hills and plains, the poor households derived more benefits from the forest compared with the non-poor. At a 12% discount rate, the NPV for the hills and plains is US\$4282/household/ha and US\$16,789/household/ha, respectively. These measures should be combined with other mitigation measures and policy actions in other sectors.

Milestone: A paper titled "Economics of Living in Wild" was presented at a workshop on forests within landscapes and connecting forests with farming systems held between 18 and 21 February 2016 at Udaipur, Rajasthan. This paper was published in the proceedings of the XIV World Forestry Congress, held at Durban, South Africa between 7 and 11 September 2015. The final report, titled "Human-Wildlife Conflict and Incentive Based Mitigation Strategies in and around Rajaji-Corbett Forest Corridor, India" was submitted to the funding agency, *i.e.*, South Asian Network for Development and Environmental, Kathmandu, Nepal.

Enhancing Capacities at Wildlife Institute of India in Wild Animal Capture



Objective: Enhancing the capacities of the Department of Wildlife Health Management, WII in the area of wild animal capture through provisioning of various drug delivery systems for animal capture.

Progress: The activities initiated towards fulfilling the objectives of the project involved procurement of a range of animal capture equipment. Various drug delivery systems (syringe projectors, jab sticks, blow pipes, *etc.*) were procured for demonstration in regular and short-term teaching/training courses organised by the institute; providing hands-on experience to officer trainees, frontline staff members and veterinarians; and animal capture in various ecological studies.

Outputs and Outcomes: An important outcome of the project was enhancement of the capabilities of the Department of Wildlife Health Management of WII in terms of equipment for capture and restraint of wild animals. These have helped enhance the capacities of wildlife professionals in terms of the use of current techniques for wild animal capture.

- **Funding Source**
National Tiger Conservation
Authority, New Delhi

- **Investigators**
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- **Date of Initiation**
March 2014

- **Date of Completion**
March 2016

Assessment of Conservation Value of Mangroves of Gujarat



Objectives: The project has the following objectives: (1) identification of contiguous patches of mangroves along the coastal region of Gujarat; (2) drawing the boundaries of all such mangrove patches that lie outside marine protected areas; (3) collection of biological data with respect to each of the mangrove patches identified; (4) organisation of a stakeholders' consultation for determining the threshold conservation value for delineation of "highly sensitive areas" (on the basis of criteria to be developed by NCSCM).

Progress: The project was envisaged to identify contiguous patches within the identified ecosystems falling outside protected areas and to collate secondary and field data to assess the ecosystem health from each of such patches. A total length of 1650 km of the coast was surveyed within the short duration of 45 days. A total of 53 patches (19 in Kachchh, 14 on the Saurashtra coast, eight in the Gulf of Khambhat and 12 on the south Gujarat coast) were identified and delineated. There are very good, dense mangrove forests along the creek systems in the western part of Kachchh District, and there are unique mudflats with mangrove forests at the tail end of the Gulf of Kachchh. There is only a patchy distribution of scrubby mangrove forests in Saurashtra between stretches of sandy coast. There are good patches of scrubby forest in the intertidal mudflats the Gulf of Khambhat. In south Gujarat, particularly in the Purna and Ambika estuaries, very good, diverse mangrove forests were documented.

Outputs and Outcomes: Currently the ownership of the mangrove areas is distributed among various stakeholders such as the BSF, GMB, FD and Government as well as private port authorities in Kachchh and Amreli districts, where there are dense mangroves. An extent of 581.80 km² of mangroves has been notified as mangrove forests (reserved forests) in Abdasa, Lakhpat and Mundra talukas, in Kachchh District, by the state government (vide notifications of 1969 and 1975), and an extent of 77.70 km² in Madiya-Miyana Taluka, in Morbi District, was notified as mangrove forests under the Indian Forest Act (IFA), 1927. There are no mangrove forests notified under IFA, 1927 in nine coastal districts that have very patchy scrubby forests under anthropogenic and industrial pressure. Industrialisation, port and jetty construction and other development pressures were observed near the mangrove forests.

Milestone: The data collected and collated under this project have been uploaded into the ESA Knowledge System, developed by NCSCM. This will help assess the conservation value on the basis of the broad criteria drawn up for the purpose through stakeholder/expert consultation.

• **Funding Source**
National Centre for Sustainable Coastal Management (NCSCM)

• **Investigators**
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• **Researchers**
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• **Date of Initiation**
October 2014

• **Date of Completion**
March 2015

Evaluation of Ecosystem Services of Munnar High Range Mountain Landscape: Review of Available Literature on Protocols Used for Assessment of Ecosystem Functions

- **Funding Source**
UNDP

- **Investigators**
Dr. Ruchi Badola and
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- **Researchers**
Chongpi Tuboi, Pariva Dobriyal,
Shruti Sengupta, Goura Chandra
Das, Aditi Dev and Amanat Gill

- **Date of Initiation**
January 2015

- **Date of Completion**
January 2016

Objectives: The objectives of the project are to (1) identify the major ecosystem services provided by the Munnar High Range Mountain Landscape (HRML), southern Western Ghats; (2) carry out an extensive literature survey to assess the state of the documented information; (3) identify the most appropriate method available for estimating the functional and economic values of key ecosystem services in HRML; and (4) derive the numerical values of selected services.

Progress: An extensive literature review was conducted to understand the important services provided by HRML. There were a total of 3,49,410 hits on online scientific databases such as Google Scholar, JSTOR, ResearchGate and Science Direct for different ecosystem services and their assessment protocols, of which 660 were selected. Six ecosystem services were selected, viz., timber, carbon stock (storage and sequestration), water provisioning (soil moisture retention and water yield), soil nutrient content, recreation and non-timber forest products, keeping in mind the vast landscape and the short duration of the project. To assess the functional and economic value of these services, methods were selected on the basis of resource efficiency, accuracy of results and spatial coverage. For timber and carbon in above-ground biomass, the forest yield method was found to be most appropriate, while the biomass expansion factor was found to be suitable for quantifying the carbon in the below-ground biomass. The dry biomass weight and Walkley-Black methods are suitable, respectively, for the carbon in the leaf litter and soil. Time domain reflectometry and the timed volume method were found to be appropriate for assessing soil moisture and water yield, respectively. The Kjeldahl method, UV spectrophotometry and flame photometry were found to be appropriate for determining the nitrogen, phosphorus and



potassium content in the soil, respectively. The travel cost method was found to be apt for assessing the recreational value of the landscape. Since the valuation process requires a spatial analytical domain for proper estimation, a base land cover and land use map was prepared to aid further assessment. A spatial sampling method with a grid-based approach was also designed for systematic evaluation.

Later, due to logistic issues, primary data collection was not feasible. Hence, the simple benefit transfer method was used to develop preliminary order-of-magnitude estimates for the selected ecosystem services of the HRML.

Outputs and Outcomes: Only studies conducted in the Western Ghats were selected since intra-region transfers have lower transmission errors *vis-à-vis* inter-region transfers. Among the different forest types, evergreen forests, with $234.5 \text{ m}^3\text{ha}^{-1}$, have the highest estimated quantity of timber, while dry deciduous forests, with $134.2 \text{ m}^3\text{ha}^{-1}$, have the least. A carbon stock of close to 37.67 million tonnes is stored in the forests of the HRML, with approximately $1.62 \text{ t C ha}^{-1} \text{ yr}^{-1}$ sequestered annually in the forests and plantations. The total amount of additional water recharge that can be attributed to the forests in the HRML is approximately equal to 71.81 million m^3 , with an economic value of about US\$20.45 million. Approximately 121.8 thousand Mt and 119.5 thousand Mt of major nutrients (NPK), worth around US\$15.43 million and US\$ 15.02 million, is available for the different forest types of the HRML pre-monsoon and post-monsoon, respectively. The economic value of the NTFPs of the HRML is roughly $\text{US\$}461.7 \text{ ha}^{-1} \text{ yr}^{-1}$. The economic value of the recreational services provided by the Periyar Tiger Reserve is approximately equal to US\$7.43 million. The estimates generated are conservative

and should be treated as an indicator of the economic value of the six selected ecosystem services provided by the HRML.

Milestones: The study report of the project was submitted in January 2016. A paper titled "Recycling Data: Benefit Transfer Approach to Valuation" was presented at the workshop "Forest within Landscapes: Connecting Forests with Farming Systems", organised at Udaipur, Rajasthan from 18 to 21 February 2016.

Dr. S.A. Hussain



Assessment of Conservation Value of Mangroves of Goa



• **Funding Source**
National Centre for Sustainable Coastal Management (NCSCM)

• **Investigators**
Dr. Gopi G.V.,
Dr. K. Sivakumar
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• **Researchers**
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• **Date of Initiation**
April 2015

• **Date of Completion**
October 2015

Objectives: The project has the following objectives: (1) identification of contiguous patches of mangroves along the coastal region of Goa; (2) Preparation of boundaries of all such mangrove patches which lie outside the marine protected areas; (3) collection of biological data with respect to each of the above identified mangrove patches; and (4) organization of a stakeholders' consultation for determining the threshold conservation value for delineation of "highly sensitive areas" (based on the criteria to be developed by NCSCM).

Progress: The project envisaged identifying contiguous patches within the identified ecosystems falling outside protected areas and collating secondary and field data to assess the ecosystem health from each of these patches. A total length of 101 km of the coast was surveyed. A total of 24 patches (four in Pernam, four in Bardez, six in Tiswadi, two in Bicholim, one in Mormugoa, three in Salcete and four in Canacona) were identified and delineated.

Outputs and Outcomes: The largest patch (4.61 km²) was found on David Island (North Goa), and the smallest patch (0.08 km²) was found on Bicholim (North Goa). The extent of the mangrove cover outside marine protected areas in Goa was found to be 33 km². Eleven species of mangrove were recorded, with most of the patches having heterogeneous habitats of two or more species. Twenty out of the 24 patches in Goa were found to be high conservation value areas according to the matrix developed. This study will help declare ecologically sensitive areas along Goa.

Milestones: The data collected and collated under this project have been uploaded into the ESA Knowledge System, developed by NCSCM. They will help assess the conservation value on the basis of broad criteria developed for the purpose through stakeholder/expert consultations.

Ongoing Projects

Monitoring Source Population of Tigers in Ranthambhore Tiger Reserve, India



Objectives: The objectives of the project are to (1) monitor the source population of tigers in Ranthambhore Tiger Reserve by estimating the population of the source (using capture-mark-recapture framework); (2) estimate the survival and mortality rates of the tigers; and (3) understand and monitor the tiger dispersal patterns and land tenure systems through radio telemetry.

Progress: A camera trapping survey was carried out in a systematic manner by placing a pair of camera traps in each 2 km² grid in the tiger-occupied area of Ranthambhore Tiger Reserve to estimate the population parameters of the tigers. The GPS locations of the camera traps (n=182) were plotted into the GIS domain to ensure that there were no sampling holes. The camera traps were placed on dirt roads, trails, fire lines and dry river beds to maximise the probability of capturing tigers. The program Extract-Compare was used to identify tigers. Unique IDs (e.g., T1, T2) were given to prepare a capture history matrix for individual tigers. The spatially explicit capture recapture (SECR) framework (the SECR package in the R platform) was used to estimate the tiger density. The best-fit model was selected on the basis of AICc (Akaike Information Criterion, with correction for small sample size). The research team obtained long-term data on demographic parameters from 97 individually known tigers in Ranthambhore Tiger Reserve using camera traps, radio-telemetry, photo-album documentation and intensive monitoring. Life history events were recorded to get an account of the litter size and sex ratio (the sex of an individual was recorded once it was >12 months old), inter-birth interval, female age at first reproduction, survival rates of cubs with known fate, and natal dispersal. The team used a known-fate model with staggered entry design to compute survival rates in the program MARK. Line transects (n=95) were walked in the morning between 0600 and 0800

● **Funding Source**
National Tiger Conservation Authority

● **Investigators**
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● **Researcher**
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● **Date of Initiation**
2006

● **Date of Completion**
2017

hours to estimate the prey density (major prey species chital, sambar, nilgai, wild pig, chinkara, langur, peafowl) in the study area. The total effort was 190.38 km. GPS locations for the beginning points and end points of the transects were recorded along with the bearing of the line, GPS location, angular distance, animal bearing and habitat type of each sighting. The data collected from the line transects were analysed using the program DISTANCE (ver. 6.0).

Outputs and Outcomes: In all, 39 adult tigers were photo-captured during the session, and the density (\hat{D}) was estimated at 6.11 (± 1.0) tigers/100 km². The male:female ratio was 0.76 (SE 0.07), and the cub: adult tigress ratio was 0.48 (SE 0.12). The average litter size at 2 months' age was 2.24 (SE 0.14). The age at first reproduction in tigresses was 54.5 months (SE 3.7). The inter-birth interval was 29.6 months (SE 3.1). The male recruitment as sub-adults (77.8%, SE 2.2) was higher than that of females (62.5%, SE 2.4). In contrast, the male recruitment as territorial adults (76.2%, SE 2.0) was lower than that of females (86.7%, SE 1.3). The survival rates of cubs (82.4%, SE 5.0) and juveniles (82.4%, SE 5.6) were lower than those of sub-adult (97.6%, SE 2.3) and adult (96.3%, SE 1.01) tigers. Among the cub mortality events, 21% were natural and 42% were caused by humans, whereas in adult tigers the corresponding figures were 31% and 23%, respectively. The individual density, as well as

group density, was estimated for each dominant herbivore species such as chital, sambar, nilgai, wild pig and chinkara and for other prey species such as langur and peafowl.

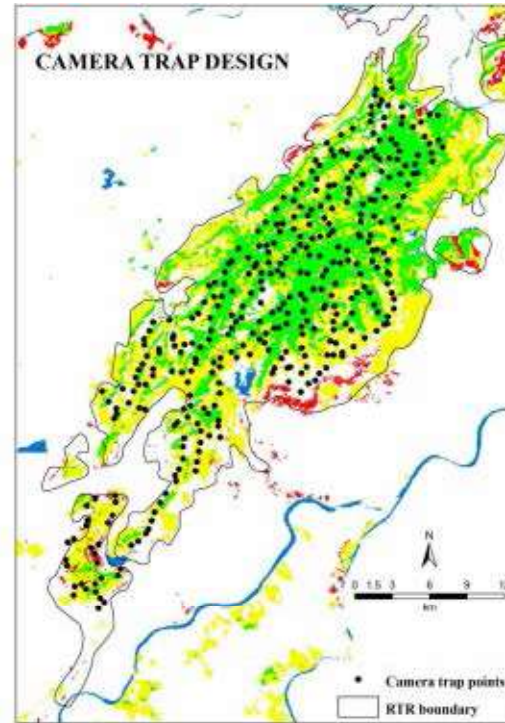


Figure 1: Distribution of camera traps ($n=182$) in Ranthambhore Tiger Reserve

Ayan Sadhu



Monitoring Source Population of Tigers in Kanha Tiger Reserve



Objectives: Intensive monitoring of tigers should address the population status, trends, demography and ecological aspects that are relevant for the long-term persistence and source value of the tiger population. The objectives of the project are to (1) monitor the source population of tigers in Kanha Tiger Reserve, including (a) estimating the tiger populations within selected areas of the reserve and (b) obtaining survival and mortality information through a mark-recapture study; (2) monitor prey and co-predator populations and the condition of the habitat in the tiger reserve; and (3) gain an understanding of tiger dispersal patterns.

Progress: Breeding tiger populations form the source from which tigers disperse throughout connected forests to maintain the tiger occupancy of entire landscapes. Protecting and managing these source populations is the crux of tiger conservation. This project aims to understand the population dynamics of a source tiger population. The research team camera trapped an area of 777 km² in the core area of the tiger reserve with an effort of 11,191 camera trap nights and gathered 1906 tiger photographs and 602 leopard photographs of 63 adult tiger individuals and 85 individual leopards. The maximum likelihood spatially explicit capture-recapture (MLSECR) approach was used to estimate the tiger and leopard densities. Three tigers were radio-collared in February 2014, and data on the home range, movements and habitat use were collected till June 2015.

Outputs and Outcomes: The tiger density was computed to be 5.0 (SE 0.64)/100 km², while the leopard density was 9.79 (SE 1.03)/100 km². A total of 5698 independent locations were obtained by tracking the collared tigers. The weights of the collared tigers ranged from 117 kg (sub-adult female) to over 220 (adult male) and lengths from 2.51 m to 2.97 m. (Table 1).

● **Funding Source**
National Tiger Conservation Authority

● **Investigators**
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● **Researchers**
Ujjwal Kumar and Neha Awasthi

● **Date of Initiation**
June 2009

● **Date of Completion**
December 2017

Table 1. Body weight and home range of collared tigers in Kanha Tiger Reserve, 2015

Tiger Id	Sex	Age	Weight (kg)	Home range (MCP 95%) (km ²)	No. of locations
Sub-adult	Female	2.2	117	13.44	2159
Prime resident	Male	10	208	76	80
Dispersal sub-adult	Male	2.5	220	20	3459

The prey status was estimated through distance sampling on line transects. A total effort of 1344 km was invested in sampling 224 spatial transect

replicates and 672 temporal replicates. Amongst ungulates, chital had the highest density, 31.68 (7.07 SE) per km² (Table 2).

Table 2. Abundance estimates of ungulates in Kanha Tiger Reserve, 2015

Temporal replicates: 672 Total effort: 1344				
Group density (number per km ²)			Density (number per km ²)	
Species	Core	Buffer	Core	Buffer
Chital	03.69 SE 0.51	1.24 SE 0.35	31.68 SE 7.07	6.94 SE 2.15
Sambar	03.56 SE 0.41	1.08 SE 0.32	9.80 SE 1.25	2.49 SE 0.91
Gaur	01.37 SE 0.25	0.06 SE 0.03	5.42 SE 1.24	0.32 SE 0.21
Wild pig	01.23 SE 0.20	1.27 SE 0.27	7.90 SE 1.55	5.92 SE 1.67

SE = Standard Error

Milestones: Three tigers were radio-collared.

The project now has continuous data from 7 years of camera trapping, which will be one of the long-term data sets for understanding the dynamics of source populations.

Camera Trap

Population Estimation and Ecology of the Tiger in Sunderbans Tiger Reserve



● **Funding Source**
National Tiger Conservation Authority

● **Investigators**
Dr. Y.V. Jhala and Shri Qamar Qureshi

● **Researchers**
Manjari Roy and Dipanjan Naha

● **Date of Initiation**
October 2009

● **Date of Completion**
December 2016

Objectives: The main objectives of the project are to (1) assess the home ranges of tigers; (2) estimate the tiger abundance and density; (3) assess the population and density of prey species; (4) develop a methodology for monitoring tigers, co-predators and their prey in the mangrove swamps; and (5) suggest management recommendations for effective conservation of tigers in Sunderbans Tiger Reserve.

Progress: The research team achieved 80% of the objectives, namely, assessing tiger home ranges and estimating the tiger abundance and density during the 2015-2016 field work. A khal survey was carried out across the entire Sunderbans using a standardised sampling protocol established for the Sunderbans. This exercise was conducted along with a camera trapping study. During the khal survey, direct sightings and signs of the tiger, fishing cat, otters, estuarine crocodile, monitor lizard, wild pig, spotted deer and human disturbance were noted along with vegetation covariates. The GPS coordinates, type of mangrove, slope of the bank and widths of the upper and lower banks were noted for each sighting/sign encountered.

The camera trap blocks selected were such that they were surrounded by wide water channels > 1 km on most sides as there is evidence that tigers avoid the same. This was done to ensure geographic closure. Suitable camera trap locations were selected near brackish water holes, in elevated places, at river bends and at regular channel-crossing paths frequented by tigers on the basis of the local knowledge of the frontline forest staff and sign surveys to maximise photo captures and minimise the chances of lethal encounters.

One female tigress was captured and tranquillized using ketamine and xylazene administered intra-muscularly using a dart gun. The radio-collar (Vectronics IRIDIUM) weighed less than 1% of the body weight of the tiger. The tigress was collared on 1 February 2016.

Outputs and Outcomes: This is the first ever effort to quantify tiger abundance in Bangladesh as well as the entire Sunderbans based on a robust scientific protocol using camera traps in an SECR framework and double sampling approach. The current assessment covers a reasonably large area (2912.15 km²) of the Sunderbans using camera traps.

The biggest peril to this landscape, given the comparatively low risk of direct habitat destruction by humans, is the rising sea level due to climate change, which threatens to submerge 96% of the landmass. Enhanced protection of the remaining natural forests, afforestation with salt-tolerant mangrove species and social forestry and use of natural and human-made levees should be undertaken to prevent further loss of land.

Another threat to this landscape is the use of water channels inside this forest as conduits for commercial boat traffic. Over 200 vessels ply every day through the Sela River and Passur River, located in and near the Chandpai-Sarankhola Range of the Bangladesh Sunderbans, respectively. Development is inevitable in this economically backward region; however, appropriate mitigation measures need to be planned and implemented simultaneously. This would buffer the adverse impacts of development projects to some extent. Development in consonance with conservation objectives in mind should be the norm of this very sensitive ecosystem.

Pollution is also one of the major threats faced by this landscape. The vessels plying inside the Sunderbans often carry cargo like oil, fly ash, cement and fertilisers. In all likelihood, the only solution to this problem is massive awareness programmes along with regional collaboration between the two countries to clean the river system of sewage and industrial waste.

Last but not the least, poaching of tigers and their prey is a major concern for tiger conservation globally, the Sunderbans being no exception. Strict law enforcement, enhanced community participation, strengthening of the Forest Department and efficient tiger-human conflict management in the Sunderbans would help reverse this trend.

Camera Trap



MSTrIPES—Monitoring System for Tigers: Intensive Patrolling and Ecological Status

Objectives: The objectives of the project are to (1) implement MSTrIPES (Monitoring System for Tigers Intensive Patrolling and Ecological Status) and orient the field staff to modern field techniques and patrolling protocols that will be useful for wildlife conservation; and (2) design a new version of the software to include spatial hierarchy, online data transfer and live visualisation.

Progress: The programme consisted of two modules: (1) technology-aided patrols; and (2) ecological assessment. The patrol component of MSTrIPES provides (a) information on spatial coverage; (b) information on the patrol intensity and efforts; (c) a spatial map and data on the intensity of illegal activities. The ecological component provides information on the status and changes in status of the major mammalian species, human impacts and habitat status.

Implementation of MSTrIPES comprised four stages: (1) training and sensitisation; (2) data collection and compilation; (3) analysis and interpretation; and (4) adaptive management. Training of the forest staff was conducted by a team from WII and NTCA to implement the patrolling protocol and ecological monitoring in seven tiger reserves of India. Data collected through transect walks, carnivore sign surveys and routine patrolling are compiled at the range level and park level. Forest departments, with assistance from WII, collected data for the patrolling and ecological module from January 2012 to June 2016.

Outputs and Outcomes: Initiation of MSTrIPES in seven tiger reserves (Nagarjunsagar Srisailem, Bhadra, Corbett, Kanha, Sariska, Ranathambore and Anamalai) has resulted in enhancing transparency and permitted the use of digital information to guide law enforcement and conservation management.

MSTrIPES was partially successful in Kanha, Srisailem, Anamalai, Sariska and Corbett, where the

- **Funding Source**
National Tiger Conservation Authority
- **Collaborating Agency**
Zoological Society of London, World Wildlife Fund for Nature-India
- **Investigators**
Dr. Y.V. Jhala and Shri Qamar Qureshi
- **Researchers**
Ashok Kumar, Anup Kumar Pradhan, Ashish Prasad and Ninad Mungi
- **Date of Initiation**
March 2012 (Phase I)
- **Date of Completion**
July 2016 (Phase I)

patrolling module was effectively implemented. For example, an annual patrol effort of 1,27,970 km was recorded from Bhaisanghat Range of Kanha Tiger Reserve. Owing to the implementation of GPS-aided surveys, the patrol effort and the number of patrol days almost doubled in 2015-2016, with a total of 7548 patrol records and 46,032 km of patrol walk,



compared with the previous year, 2014-2015. There were a total of 3211 records and a 24,613 km effort of walk in Nagarjunsagar Srisaillam Tiger Reserve in 2015-2016.

Ranathambore has yet to commence MSTRIPES. However, Bhadra Tiger Reserve has implemented MSTRIPES with all its components (patrolling and ecological monitoring) and is entirely independent of WII, with regular monthly reports being generated.

The programme is generating reports and maps for management needs so as to assess the park status quantitatively rather than through subjective ratings. Changes in field conditions can be integrated into decisions, resulting in adaptive management. Objective data can now be used as input for management effectiveness.

The transparency and accountability allow recognition of good performance by forest staff members. At the same time, non-performing staff members are identified. This has enhanced the protection status of the tiger reserves.

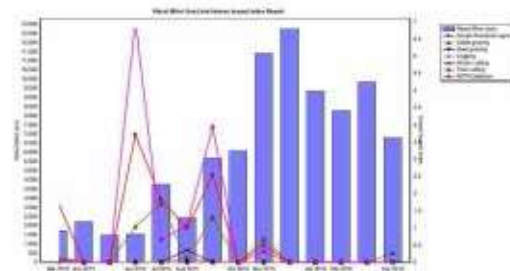


Figure 1: (a) Patrolling (blue points) done by the frontline staff of Bhadra Tiger Reserve (pink boundary) during given period. Human impact signs (red points) and tiger signs (green points) are recorded on the same patrol tracks. (b) Patrolling effort versus human impact in Nagarjunsagar Srisaillam Tiger Reserve from March 2015 to April 2016

Milestone: If implemented as designed, the system reduces the time of response to detrimental events like poaching and habitat degradation and becomes a comprehensive tool to keep the pulse of tiger reserves. It enhances the transparency and accountability of the wildlife management agency and assists informed decision making and policy formulation.

Evaluation of MHC Heterozygosity in Isolated Tiger Population



Objectives: The objectives of the project are to (1) evaluate the level of MHC Class-I polymorphism in tiger populations; (2) evaluate the MHC heterozygosity level in isolated and connected tiger populations; and (3) compare the difference in heterozygosity level between microsatellite and MHC markers.

Progress: The Bengal tiger, *Panthera tigris tigris* populations in India have been exposed to various anthropogenic influences that potentially affect their genetic structure. A small and isolated population faces an uncertain future from the impact of a variety of potential threats, including climate change, human encroachment (habitat degradation) and infectious diseases. This project aims to standardise the protocols for successful amplification of the MHC class I gene from tiger scat samples. A total of 138 samples were collected from various tiger reserves of India (Ranthambore, Bandhavgarh, Bandipur and Wayanad tiger reserves) for MHC gene standardisation. In this study, the research team examined the genetic variations of isolated and connected tiger populations using microsatellite loci and part of exon 2 of the MHC class I gene, which includes amino acid residues contained within the antigen-binding sites (ABS) of the MHC class I molecule.

Outputs and Outcomes: The results indicate that 30-50 ng/μl DNA extracted from scats with an OD260/OD280 ratio between 1.75 and 1.90 could significantly increase the PCR success rate. A panel of nine microsatellite loci and about 250 bp of exons 2 and 3 of the MHC class I gene were assessed to estimate the genetic variability in the populations. The results obtained from the microsatellite loci revealed that the genetic diversity in these tiger populations is moderate. The genetic diversity of the Ranthambore (RTR) tiger population was found to be slightly lower than that of the Bandhavgarh (BTR) and Bandipur-Wayanad (BdTR) populations in terms

● **Funding Source**
Grant-in-Aid

● **Investigator**
Dr. S.K. Gupta

● **Researcher**
Ajit Kumar

● **Date of Initiation**
February 2012

● **Date of Completion**
May 2016

of the number of alleles as well as heterozygosity level. This might be due to the loss or weakness of connectivity of Ranthambore with the other tiger reserves. Structure analysis clearly assigned the RTR, BTR and BdTR populations to three distinct clusters. The amplified PCR product of the MHC gene was cloned before sequencing to obtain unambiguous nucleotide sequences. Removal of putatively false and spurious nucleotides from the sequences provided a clear estimation of the MHC gene diversity among the tiger populations. After the MHC gene had been cloned, a maximum of eight alleles were identified in single individuals, suggesting the presence of at least four MHC class I loci.

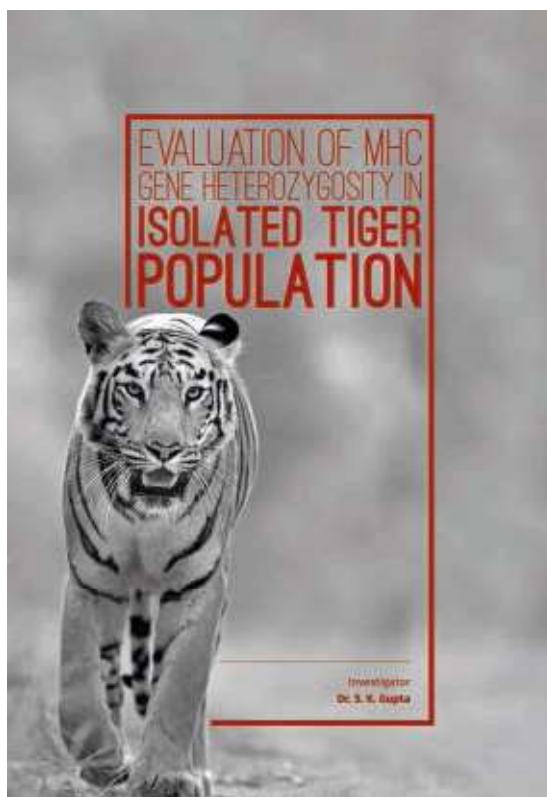
Interestingly, a high level of polymorphism (hotspot region) was observed between 179 and 240 bp of exon 2, which had a high polymorphic amino acid residue content, which is responsible for the specificity of recognition of antigens. The sequence of the exon 2 regions is more polymorphic compared with exon 3. The corresponding amino acid sequence consisted of 89 residues in the α -1 domain and 82 residues in the α -2 domain. A high level of MHC variation was found in all the tiger populations, with 30 alleles in exon 2 and 24 alleles in exon 3 from 30 and 18 individuals, respectively. No significant difference in MHC diversity was detected between the isolated population of RTR and the connected tiger populations of BTR and BdTR.

The MHC gene of the RTR and BTR populations exhibited almost the same level of nucleotide diversity. However, a relatively high nucleotide diversity was observed in Bandipur (BdTR). Twenty polymorphic sites were observed in both the MHC α -1 (exon 2) domain and the α -2 (exon 3) domain. Such high polymorphism in the MHC gene is linked with the resistance of individuals as well as populations to disease. The high rate of non-synonymous substitutions provided clear evidence of positive selection and shaping of the genetic variation in the tiger populations. Phylogenetic analysis of the MHC gene sequences of the domestic cat, tiger, Asiatic lion and cheetah

revealed trans-species polymorphism (TSP). The current investigation of MHC polymorphism indicated that the tigers of RTR, BTR and BdTR have comparable immunological fitness. The results do not suggest that the small and isolated population of RTR is genetically compromised at the MHC gene locus.

Milestone: (1) Successful establishment of infrastructure for molecular cloning at WII. (2) This study will help long-term conservation and tiger reintroduction plans by identifying immunologically fit populations from which individuals may be selected.

Dr. S.K. Gupta



Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI) Project: Implementation Programme in India



- **Funding Source**
ICIMOD, Nepal

- **Investigators**
Dr. G.S. Rawat (Nodal Person, ICIMOD activities), Dr. B.S. Adhikari, Dr. S. Sathyakumar, Dr. V.P. Uniyal, Dr. K. Sivakumar, Dr. Gopi G.V.

- **Research Associate**
Arti Kala

- **Project Biologists**
Ajaz Hussain, Sumit K. Arya, Alka Chowdhary, Deep Shah, Mona Chauhan, Zareen Syed

- **Date of Initiation**
March 2012

- **Date of Completion**
December 2016

Objectives: The major objective of the project is the conservation and development of the Kailash Sacred Landscape (KSL), India part.

Progress: The WII signed a Letter of Agreement (LoA) with the International Centre for Integrated Mountain Development (ICIMOD) in March 2013 for implementation of specific programme components under the Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI) in India. These components are (1) Management of Ecosystems for Sustaining Services (Component 2), (2) Biodiversity Conservation and Long-Term Ecological and Socio-economic Monitoring, in part (Component 4), and (3) Promotion of Regional Cooperation, Enabling Policies and Knowledge Management, in part (Component 5). The third year of implementation of this ongoing project was successfully completed. A large team comprising six participating scientists/faculty members and seven research personnel at any given time has made significant progress, contributions and accomplishments in the past 36 months of execution of this collaborative project across three countries.

During the reporting period, several activities related to the project were accomplished, such as ecosystem vulnerability analysis at the landscape level, valuation of key ecosystem services at pilot sites, training local community institutions in participatory natural resource management (PNRM) planning and plan implementation, preparation and implementation of ecosystem management plans (ESM) for pilot sites, preparation of restoration plans for degraded ecosystems at pilot sites and preparation and implementation of mitigation plans for human-wildlife conflicts for pilot sites under component 2.

Outputs and Outcomes: Protocols for long-term monitoring of ecosystem services, threatened species of fauna and their habitats prepared and baseline information collected. Ecologically sensitive sites and critical interface areas identified. Transboundary cooperation between Askot Wildlife Sanctuary and Api Nampa Conservation Area (ANCA) enhanced under Component 4. Lessons learned from implementing Integrated Ecosystem Management Plans, mitigation of human-wildlife conflicts and trans-boundary cooperation for management of Askot-ANCA shared with policy makers and integrated into state/national policies.

Study of the Ecology and Migration of the Lesser Florican, *Sypheotides indica* Through Satellite Telemetry



Objectives: The objectives of the project are to (1) study the migration and movement patterns of the lesser florican and to identify its non-breeding habitats using satellite tracking techniques; (2) assess the current status and distribution of breeding lesser floricans in north-western India and Andhra Pradesh; (3) study the habitat and breeding ecology of the lesser florican in north-western India; (4) assess the status of the non-breeding habitat of the lesser florican; and (5) prepare a comprehensive conservation plan covering both the breeding and non-breeding ranges and the migration pathways of the lesser florican.

Progress: The lesser florican, *Sypheotides indica* a species endemic to the Indian sub-continent, is seen during the monsoon season in north-western India, where it breeds. Its population and range are continuously decreasing at an alarming rate due to loss of the breeding habitat and certain threats prevailing in the non-breeding habitats, which are believed to be in south and south-east India. In this context, two male floricans were tagged with PTTs in agriculture fields of the Sonkhaliya landscape near the Nasirabad area of Ajmer District, Rajasthan.

Florikin-I: *Florikin-I*, tagged with an Agros PPT-100 (18 g PTT, Platform No. 125812), spent 112 days and left the breeding ground on 11 November 2014. The bird flew 94 km towards the south and settled down in grasslands to the north of Bhilwara, Rajasthan. *Florikin-I* crossed this distance in 5 days and 8 hours with four stopovers. Each stopover lasted 1-2 days. All the stopovers were in croplands and grasslands. *Florikin-I* stayed for a year near Bhilwara and started moving towards the north in the first week of March 2015 but failed to transmit signals later on. *Florikin-I* flew at a speed of 0.73 km/hr, including the stopover time.

• **Funding Source**
Grant-in-Aid

• **Investigators**
Dr. K. Sivakumar,
Dr. Y.V. Jhala and
Dr. G.S. Bhardwaj

• **Researchers**
Omkar Dhavale
and A. Mohan

• **Date of Initiation**
March 2012

• **Date of Completion**
June 2016

Florikin-II: *Florikin-II* was tagged with a 22 g GPS/Argos PTT that failed after 35 days, but it provided much more precise insights into the lekking behaviour of this species. It was found that a florican could shift the displaying territory within an arena during a breeding season. This bird shifted its territory three times and spent considerable time in each territory, where it displayed. All these three territories of *Florikin-II* were within a home range of 6.8 km² (MCP 100%).

Outputs and Outcomes: A total of 58 transects were laid, covering a total length of 91.9 km at seven sites in three states (Gujarat, Rajasthan and Madhya Pradesh). A total of 57

floricans were observed during the transects. Data analysis showed that uniform co-sign functions best fitted the data. (Uniform cosine function $\chi^2 p=80.8$, AIC=659.6) and estimation the ESW at 213.7 m ranging 185.3-246.4. Detection probability=0.56 (0.48-0.65). The global density estimated was 1.19 floricans per km² of contiguous area (0.75-1.88) and the estimated abundance was 1091 floricans (689-1729) in the contiguous habitat of floricans in these three states. Shokaliya was monitored intensively in 2014 and 2015. A total of 47 transects were laid, and 56 lesser floricans were sighted on transect walks.

WII Photo Library



Distribution Pattern, Habitat Use and Movements of Breeding Waterbirds with Respect to Black-Necked Cranes and Bar-Headed Geese Using Telemetry in Changthang Cold Desert Sanctuary, Ladakh and Gharana Wetland Conservation Reserve, Jammu, Jammu & Kashmir



Objectives: The objectives of the project are to (1) quantify the current status of waterbirds with special reference to the blacknecked crane and barheaded goose; (2) examine the habitat use and movement patterns of the blacknecked crane and barheaded goose; and (3) use this information to devise an effective management strategy for wetlands.

Progress: *Flight Initiation Distance (FID).* (1) The FID was measured to quantify the perceived disturbance. (2) Wetlands were visited on different days of the week and at different times of the day between 0700 and 1800 hours. (3) One observer walked towards a target bird at a steady pace (0.5-1.0 m/s) till the bird was flushed from its location and used a range finder to record the FID. A second observer monitored the activity of the bird. (4) To avoid repeated sampling, the sampling location and the individual bird were changed.

Waterbird abundance. (1) The total count method was used within small blocks between late January and early February in 2016. (2) Counts were conducted in the morning (between 0700 and 1100 hours).

Outputs and Outcomes: *FID.* (1) Species-wise FIDs were not calculated for Changthang Wildlife Sanctuary because of the small sample size. (2) The team recorded FIDs for tourists visiting the wetlands, viz., Tso Kar, Statsapuk and Tso Moriri. (3) Species-wise FIDs were not calculated because of the small sample size (Table 1).

• **Funding Source**
Department of Wildlife
Protection, J&K

• **Investigators**
Dr. S.A. Hussain, Dr. Bilal Habib
and Dr. Gopi G.V. (WII) and
Shri Jigmet Takpa and
Shri Tahir Shawl (Department
of Wildlife Protection, J&K)

• **Researcher**
Neeraj Mahar

• **Date of Initiation**
July 2012

• **Date of Completion**
August 2016

Table 1: Number of observations in different wetlands of Changthang

	Name of Wetland	No. of Observations	FID (m)
1	Tso Kar	13	172
2	Statsapuk	24	155
3	Puga	10	82
4	Tso Moriri	14	197
5	Staklung	3	172
6	Kyon Tso I	5	116
	Total	69	

Gharana Wetland. The FID range was 24–66.5 m. Hence, visitors should not be allowed inside this range (Table 2).

Table 2. Species-wise FID observations in Gharana Wetland, Jammu

Species	No. of Observations	FID (m)
Common coot	3	24
Common moorhen	3	29
Common teal	10	42.5
Intermediate egret	5	48
Little cormorant	8	49
Northern shoveler	4	66.5
Purple swampen	7	56
Ruff	3	60

1. Waterbird abundance in Gharana

- Most abundant species: common teal (505.33 ± 52), ruff (181 ± 19.14), northern shoveler (40.33 ± 7.80), common moorhen (34.67 ± 4.91), coot (28.33 ± 3.18), pond heron (22 ± 3.61), little cormorant (15 ± 4.16) and gadwall (11.33 ± 6.01).
- The least abundant species were the intermediate egret (9.67 ± 2.91), little egret

(8.33 ± 2.91), cattle egret (3.33 ± 2.40), whitebreasted waterhen (3.33 ± 2.03) and common sandpiper (3 ± 1.53).

- The team compared the abundance values of 2015 and 2016 and found that there was a significant difference (CI=95%) in the abundances of the common teal and little cormorant whereas no significant difference was observed in the abundances of the other species (Fig. 4).

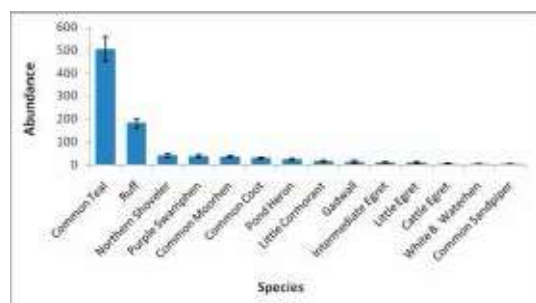


Fig.3 Abundance of waterbirds in Gharana

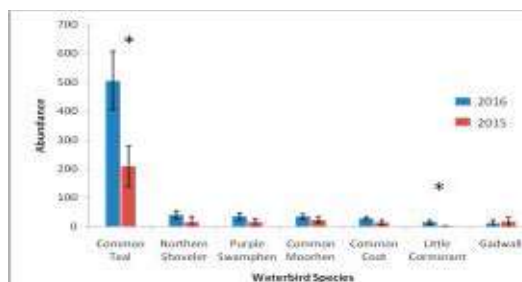


Fig 4. Year-wise comparison of abundance of the key species in Gharana Wetland (.Significant confidence interval (CI)=95%)

Development and Maintenance of Studbooks of Selected Endangered Faunal Types in Indian Zoos

Objectives: The project was initiated with the objective of maintaining a centralised database for providing a decision support system for scientific management of species identified for *ex-situ* conservation in Indian zoos. The project involves development and maintenance of studbooks of 34 species threatened with extinction and held in captivity across the country. It involves the development of population management plans for managing the species in captivity.

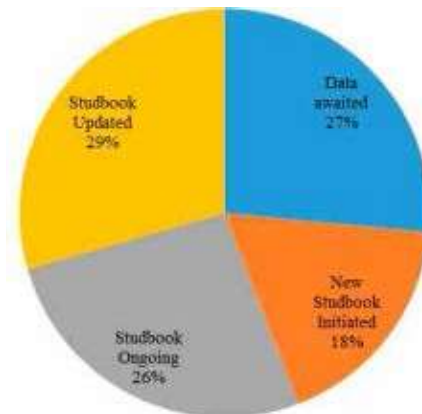


Figure 1: Quantum of work accomplished

• **Funding Source**
Central Zoo Authority

• **Investigators**
Dr. Parag Nigam
and Shri P.C. Tyagi

• **Researcher**
Nilofer Begum

• **Project Consultant**
Dr. Anupam Srivastav

• **Date of Initiation**
July 2012

• **Date of Completion**
July 2017

Progress: During the reporting period, new studbooks were developed for the Indian pangolin, *Manis crassicaudata* and western tragopan, *Tragopan melanocephalus* and the studbooks of the gaur (Indian bison), *Bos gaurus*, liontailed macaque, *Macaca silenus* and Tibetan wolf, *Canis lupus chanco* updated.

The development of the studbooks for the following species involved collection of pedigree data from holding institutions, the CZA inventory and the database maintained by ZIMS (ISIS); data entry and validation; and subsequent analysis: grey peacock pheasant, Indian wild ass, cheer pheasant, Himalayan monal, Himalayan serow, one-horned rhinoceros, Asiatic wild dog, swamp deer, whiterumped vulture, slenderbilled vulture, longbilled vulture and tiger.

Outputs and Outcomes: The major output of the project included the updating and initiation of studbooks for the five identified species held in Indian zoos. These studbooks include reviews of the literature relevant to managing the species in captivity and the pedigree information of the species in Indian zoos. The pedigree information forms the basis for detailed demographic and genetic analyses. Support to *ex-situ* conservation initiative in India through the development of population management plan for identified species that include breeding recommendations and population targets for the species.



Dr. K. Ramesh



Patterns of Spatial and Temporal Habitat Occupancy in Relation to Crop Raiding Behaviour and Genetic Variation of Free-Ranging Asian Elephants, *Elephas maximus* in North-West India Using Non-invasive Genetic Sampling

Objectives: The project has the following objectives: (1) estimation and modelling the spatial and temporal habitat occupancy of elephants; (2) providing baseline genetic structural information using mtDNA and nuclear microsatellite variations across different populations; (3) identification of any patterns in dispersal in terms of age and sex of individual elephants; (4) documenting and testing for population genetic differentiation and recent bottlenecks, if any; (5) examining the existence of any age/sex-based patterns of crop depredation and incidences of habitual raiding in relation to cropping patterns; and (6) investigating social organization in Asian elephants.

Progress: During 2015-2016, the research team adopted an occupancy survey design to understand heterogeneity in habitat use by elephants in summer in Rajaji Tiger Reserve. A "detection-non-detection" survey of fresh elephant signs (dung boluses, debarking, feeding signs, footprints and direct sightings) was carried out during June 2016 under an occupancy survey design. The study area was divided into 61 grid cells (sites) of 16 km² each, of which 55 grids (90.1%) were surveyed. Forest trails of 6 km (six spatial replicates of 1 km each; 274 kilometers in total) were walked per site having 100% elephant habitat, while for sites with less habitat coverage, the number of replicates were scaled and reduced accordingly. Site and survey co-variate data were collected from one habitat plot per replicate. The intensity of habitat use (psi) was estimated using a statistical model that explicitly addressed variable detectability across space and spatially dependent non-closure of occupancy across sampling replicates.

For individual identification of elephants, the team screened 12 potentially co-amplifiable microsatellite markers for Asian elephants and three markers designed for African elephants. A panel of eight markers was chosen on the basis of amplification success rate, data quality and the number of alleles. The team also included a Y chromosome-linked marker for molecular sexing of elephants in the designed panel. The alleles in the population for each locus were characterised by amplifying them with tissue samples (n=97) collected from all over the range of the north-west Indian elephant population. These markers were then amplified in faecal samples (n=95) using two multiplex reactions (set 1 and set 2) containing five and three loci each. All the markers chosen could be separated on the basis of their respective dye labels and fragment lengths. Thus, the team pooled together

- **Funding Source**
Project Elephant, MoEFCC, Government of India; Asian Rhino and Elephant Action Strategy-WWF International; University Grants Commission; Operation Eye of the Tiger, India
- **Investigators**
Dr. Parag Nigam, Dr. S.P. Goyal, Shri Qamar Qureshi and Dr. A.C. Williams
- **Researcher**
Rahul De
- **Date of Initiation**
October 2012
- **Date of Completion**
March 2017



the polymerase chain reaction (PCR) products from both sets of reactions for fragment analyses.

Outputs and Outcomes: Fresh elephant signs were detected at 47.2% of the sites. It was observed that the combined effect of the preferred food plant, *Mallotus philippensis*, distance from crop field boundary, and forest cover influenced the use of the habitat by the elephants. Sites adjacent to crop fields ($n=13$) were more intensely used (mean $\psi=0.84$) compared with the other grid cells at the reserve boundary (mean $\psi=0.44$) or inside the forest (mean $\psi=0.75$). The sites in the vicinity of frequently raided crop fields along the southern boundary had a mean ψ value of 0.82.

To test the efficacy of individual identification and molecular sexing, the faecal samples ($n=95$) were genotyped, with a 74.2% success rate, with two PCR reactions and only one fragment analysis per sample. When the poorly performing samples (20%) were removed from the analyses, the success rate of the panel went up to 87%, which is notable considering the non-invasive origin of the samples.

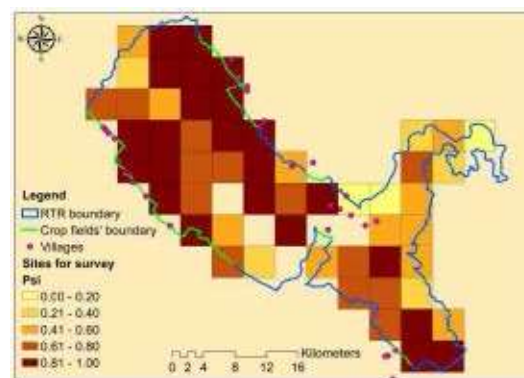


Figure 1: Probabilities of habitat use intensities (ψ) by elephants in Rajaji Tiger Reserve in June 2016

Milestone: The team determined the spatial patterns of habitat use of elephants in summer. Habitat near crop fields was used more, increasing the possibilities of crop depredation. The team also standardised and evaluated a panel for individual identification along with molecular sexing of elephants, which would be useful in identifying crop-raiding elephants.

Rahul De



Pattern of Biomass Production by Wetlands and Its Use by Wild Ungulates in Kaziranga Landscape

Objectives: The objectives of the project are to (1) map the wetlands of Kaziranga Tiger Reserve in terms of location, area, and seasonality; (2) determine the biomass productivity of selected wetlands across various seasons; (3) derive the use of these wetlands by large herbivores in terms of biomass consumed and area utilised, and (4) quantify the amount of biomass extracted by the local people and its impact on wetlands productivity.

Progress: A map of the area of inundation in the reserve was prepared using remote sensing data. A total of 140 plant species were recorded during the sampling period. Thirty-two families have been identified so far. Two years' (2014 and 2015) data have already been collected. The initial results indicated that the highest silt deposition occurred in the Eastern Range, followed by the Central Range. The site with the highest siltation was in Agrotoli Range (Eastern), *i.e.*, Rangamutia. A total of 270 soil samples have been collected for a period of 1 year from different depths in different inundation regimes inside the reserve. Analysis of 57 of these 270 samples for nitrogen has been completed. Laboratory analysis of the soil samples is in progress at the WII Research Laboratory.

During the first phase of the study, 63 species were identified by micro-histological analysis of rhino dung samples. In the second phase, the rhinos were found to have fed on 64 plant species. *Saccharum* sp. was the major forage species. It was consumed in the highest proportions in both the first and second phases of the study. During the first phase, the diet of the Asian elephants was dominated by dicots, while monocots dominated the second phase. During both phases, the wild buffalo diet was dominated by monocots, with the mean percentage

- **Funding Source**
Department of Science and Technology, Government of India

- **Investigators**
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- **Date of Initiation**
January 2013

- **Date of Completion**
July 2016



of monocot and dicots consumed by wild buffalo. During the first phase of the study, the wild buffalos fed on 61 plant species. In the second phase, they fed on 56 plant species. *Saccharum* sp. was the major forage species in both the first and second phases of the study.

The diet of the swamp deer was dominated by monocots in both phases. During the first phase the swamp deer fed on 59 plant species. In the second phase the swamp deer fed on 45 plant species. *Hemarthria compressa* was the major forage species in both phases.

During both the first and second phases, the diet of the hog deer was dominated by monocots. During the first phase, the diet of the sambar was dominated by dicots, while in the second phase, monocots dominated. During the first phase of the study, the sambar fed on 57 plant species, and in the second phase they fed on 55 plant species. *Saccharum* sp. was consumed in the highest proportions in both both phases.

A comparison of the diets of all the study species was carried out for both phases. This showed that in the first phase the diet overlap between the wild buffalo and hog deer (0.971) was highest, while the least diet overlap was between the elephant and hog deer. During the second phase, the maximum diet overlap was between the swamp deer and hog deer (0.961), while the least diet overlap was between the elephant and swamp deer (0.766).

Nutrient analysis of the major forage species is in progress.

Outputs and Outcomes: The Kaziranga landscape is in the Brahmaputra floodplains. Its high primary productivity makes it the foraging ground for both wild animals and domestic animals. Animal husbandry is an important source of income in the study area. The majority of the families (87.23%) from the fringe villages had livestock, including cattle, buffalos, poultry, goats and pigs. These are reared for various domestic needs such as dairy produce and ploughing the land. Only 26.05% of the households surveyed collected fodder for their livestock.

Firewood was the most common and primary source of energy in all the villages used for cooking and space heating. In fringe villages, the average firewood consumption per household per day was 44.48 ± 1.64 kg. Firewood was collected from both outside and inside the protected area.

Milestones: for the first time based on inundation regime a remote sensing map of Kaziranga Tiger Reserve was prepared. This will help monitor the changes in the wetland area and size over time. Data on the biomass productivity of the wet grassland-wetland habitats of Kaziranga Tiger Reserve are being collected for the first time. Information on the resource partitioning among the large herbivores of the Brahmaputra floodplains is also being collected systematically for the first time to understand better the ecosystem level processes operating in the Brahmaputra floodplains.

Effects of Climate Change on Riverine Forests and Indicator Species along the River Ganga in Uttarakhand: A Multi-scale Approach

Objectives: The objectives of the project are to (1) study the distribution pattern, range shift and population response of indicator species along the Ganga in Uttarakhand, from the foothills to the snout of the Gangotri glacier; (2) quantify the structure and functional attributes of the vegetation along selected climatic ecotones; and (3) detect major drivers of the composition and configuration of the landscape in space and time, and develop spatially explicit predictive models.

Progress: Vegetation assemblages were identified to qualitatively describe the vegetation types in the different sub-basins, which represent different eco-climatic zones. Also, an attempt was made to categorise the vegetation. Landsat data for three years (1993, 2003 and 2013) were used to study the vegetation changes in the basin in a spatio-temporal framework. Decadal change detection analysis was undertaken to look at the loss of forest cover using ArcGis10 and ERDAS 2013 software. Markov analysis and Change Vector Analysis (CVA) were performed using the IDRISI Andes software for predicting the direction and magnitude of probabilities of change in the land cover/land use types across two decades (1993–2003 and 2003–2013). In this study, baseline data relating to the major specialist riverine bird species, which are often indicators of the climatic and habitat regimes, and their patterns of distribution and abundance were documented during the pre-monsoon (March–May) and post-monsoon (September–November) seasons.

Outputs and Outcomes: Across the river basin, over 20 riverine forest assemblages were recorded, with the diversity being higher in the lower sub-basin. The catchment is undergoing substantial

• **Funding Source**
Department of Science
and Technology

• **Investigators**
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• **Researcher**
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• **Date of Initiation**
March 2013

• **Date of Completion**
March 2016



changes in the land-use and land-cover patterns owing to several natural calamities as well as rapidly intensifying anthropogenic activities. There has been a decline in the dense forest category over decades in the catchment, and the trend was similar for the riverine patches along the river as well. Over 13 species of riverine bird were found in the Bhagirathi basin. The obligate riverine species included the plumbeous water redstart, *Phoenicurus fuliginosus*, white-capped redstart, *Phoenicurus leucocephalus*, brown dipper, *Cinclus pallasi*, little forktail, *Enicurus scouleri*, spotted forktail, *Enicurus maculatus*, crested kingfisher, *Megaceryle lugubris*, pied kingfisher, *Ceryle rudis* and ibisbill, *Ibidorhyncha struthersii* (a rare record). Among the non-obligates encountered were the white-browed wagtail, *Motacilla maderaspatensis*, white wagtail, *Motacilla alba*, grey wagtail, *Motacilla cinerea*, blue whistling thrush, *Myophonus caeruleus*, common kingfisher, *Alcedo atthis* and white-throated kingfisher, *Halcyon smyrnensis*. The plumbeous water Redstart, *Phoenicurus fuliginosus* and white-capped redstart, *Phoenicurus leucocephalus* appeared to be the most abundant and widely distributed birds, followed by the blue whistling thrush. The distribution ranges of the riverine birds showed clear responses to the season.

Milestone: The mountainous region of the Ganga, like those of other river system, has been extensively harnessed for hydropower. Anthropogenic pressure seems to be a very dominant process causing loss of forest cover in the basin. This study highlights the fact that unplanned and intensified anthropogenic activities in the form of dam construction, sand mining, settlement, fishing, deforestation, leading to severe soil erosion, and road-cutting activities pose a serious threat to these biodiversity-rich mountain

river systems. The obligate riverine birds present an ideal candidate for understanding and managing the terrestrial–aquatic continuum in riverine systems, including climatic effects. The baseline established by this study and the indicator species analysis would be useful in recognising the priority areas for devising an adaptive strategy with sound scientific evidence. Using a multi-scale approach, the study developed a predictive model for species response at the local, regional and landscape levels and for the related impact on the configuration of the riverine landscape.

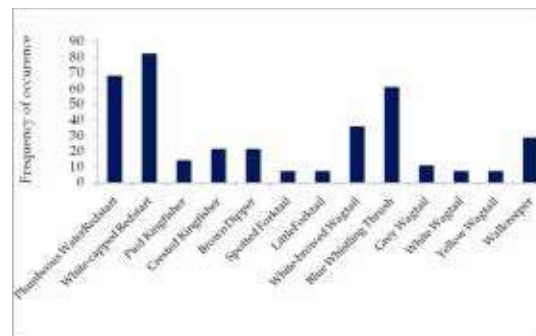


Figure 1: Encounter rates of different riverine bird species found in the Bhagirathi basin

Ecology of the Endangered Asiatic Lion Using Satellite and GPS Telemetry

• **Funding Source**
Department of Science &
Technology (DST),
Government of India
and WII Grant-in-Aid

• **Investigator**
Dr. Y.V. Jhala

• **Researchers**
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• **Date of Initiation**
June 2013

• **Date of Completion**
June 2016

Objectives: The project has the following objectives: (1) studying range use, movements, habitat needs and dispersal of lions; (2) studying the lion demography in the Gir landscape; (3) estimating the lion-prey population in parts of the Gir landscape; (4) assessment of lion food habits; and (5) quantification of the magnitude and nature of human-lion conflicts.

Progress and Outcomes: *Lion ranging pattern estimation.* The lion ranging pattern was estimated using radio telemetry. The average home range size of males outside the Gir protected area (PA) was 333 km². Females outside the PA had smaller home ranges than those of males, averaging 106.5 km². The average male core area was estimated at 214 km². However, the average core area of breeding lionesses outside the PA was estimated at 51.5 km². Within Girnar Wildlife Sanctuary (WLS), males had an average home range of 280.5 km² and females 130.5 km² (Fig. 1).

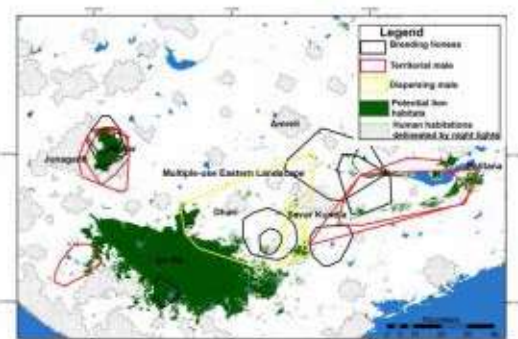


Fig.1: Distribution of lion home ranges in human-dominated eastern Gir landscape, Gir and Girnar WLS

Lion population estimation. A new innovative approach specially designed for lions was tested in the Western Gir, wherein 29 grids of 25 km² were

sampled via 10 visits (occasions) to each grid to locate and identify individual lions. The search resulted in 360 lion sightings of 67 adult lions (28 males and 39 females). This spatially explicit sampling design was adopted to infer the spatial densities of lions in the Western Gir. The overall adult lion density in the Western Gir was 8.78 per 100 km², with that of males being 3.12 per 100 km² and females 5.66 per 100 km². The spatial lion density was not correlated with either the chital or sambar distribution but was highly correlated with tourism "hotspots", water availability and elevation. The results show the positive influence tourism management practice has on the lion distribution and density.

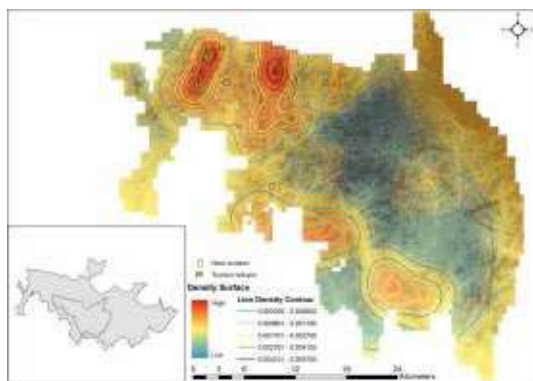


Fig. 2. Lion density surface map in Western Gir PA showing locations of nesses and tourism hotspots

Prey estimation in Gir. Distance sampling based on line transects (n=91) was used in the Gir PA (the national park and the sanctuary), over an area of 1880 km², to estimate the prey population. This exercise comprised a total effort of 315 km within a span of 60 days. Chital and buffalo were the most abundant prey in Gir PA in terms of individual

density and biomass. Chital contributed about 75% to the lion prey density, while domestic livestock (buffalo and cattle) contributed about 18% to the lion prey density inside the Gir PA. Domestic livestock contributed about 48% to the prey biomass, followed by chital (about 45%).

Assessment of lion diet. Extensive feeding experiments (n=68) conducted on a wide size range (4.4-130 kg) of obligate carnivores (lion, leopard, jungle cat and domestic cat) at Sakkarbaug Zoological Park, Gujarat, India showed that the patterns of consumption and scat production in relation to prey size were similar across obligate carnivores only after accounting for the effect of carnivore size. Allometric measurements allowed us to develop a common biomass model to compute the prey biomass consumed from the scats of the obligate carnivores.

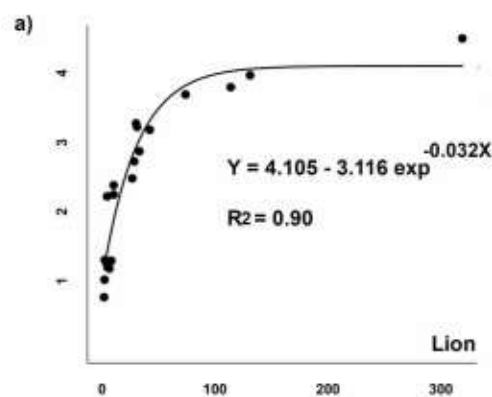


Fig 2(a) Common biomass model for tropical felids developed by regressing biomass consumed per collectable scat/predator weight (Y axis, scaled biomass consumed per collectable scat) with prey weight/predator weight (X axis, scaled prey weight) using data from 68 feeding trials on lions, leopards, jungle cats and domestic cats

Ecological and social assessment of Barda WLS, Gujarat for lion reintroduction. The research team has assessed the ecological and social potential of Barda Sanctuary (situated in Porbandar District, 150 km from Gir PA) for developing strategies for lion reintroduction. The team used spatially explicit capture-recapture ($n=1856$ camera trap nights) and distance sampling ($n=27$ line transects) frameworks to estimate the abundances of predators and prey, respectively. Potential habitat corridors between Gir and Barda were delineated using lion habitat-suitability models and Circuitscape. The team surveyed 25 nesses in Barda WLS to quantify their livestock holdings and understand the people's perceptions of lion reintroduction. It was estimated that the Barda landscape (410 km^2) could support 26-35 lions. Currently, the sanctuary supports a sizeable population of leopards. The wild prey density of Barda WLS was low, nilgai (0.3 km^{-2}) and wild pig (3.4 km^{-2}) being the only wild ungulates recorded on transects. Currently, the reintroduced lions cannot sustain themselves exclusively on wild prey, as a result of which there is predation on livestock at Barda.

Milestones: (1) *Finding a new home for lions.*

The research findings regarding the reintroduction of lions in Barda WLS were communicated to the Gujarat Forest Department in September 2014 through a technical report. These were accepted and the following actions were carried out on the basis of the research recommendations: (a) Four lions were shifted to Barda WLS for a soft release programme. (b) The sambar and chital restocking

and release programme was initiated afresh. (c) A blueprint for voluntary Maldhari resettlement from inside Barda WLS has been prepared.

(2) *Revisiting optimal foraging theory in carnivores.* Feeding trials on tropical felids add to a holistic understanding of the carnivore diet and optimal diet choices of tropical carnivores. Constraints on predation by gut fill, digestibility and carcass utilisation had not been incorporated in optimal foraging theory; we provide data to parameterise these costs. These would have immense scientific and conservation significance since they would help us understand biological and social carrying capacities for lions in the Gir landscape (and other carnivores elsewhere).

(3) *Seeing conflict in new light.* Review of published diet studies on large felids with models developed from feeding trials conducted in this study has wide implications on understanding human-carnivore conflict as depredation of large domestic livestock would likely to be lower in reality than reported in literature.

(4) *Fingerprinting lions.* The team also developed a novel method to estimate lion populations using a spatially explicit capture-recapture technique specially designed for lions, by identifying individual lions using their vibrissae patterns and permanent body marks. Also, the software LION Version 2 is being tested. It will support a computer-generated observer bias-free interface to identify unique lions and maintain a database of the lions in Gir, essential for keeping track of the life histories of individuals and demographic parameters of the population.

Stotra Chakrabarti



Development of Knowledge Management System for Conservation of Coastal and Marine Biodiversity in the East Godavari River Estuarine Ecosystem (EGREE), India with respect to Climate Change and Payment of Ecosystem Services



Objectives: The main objective is to establish a knowledge management system (KMS) for the East Godavari River Estuarine Ecosystem (EGREE), in Andhra Pradesh. The objectives include (1) assess and predict the impact of climate change on the biodiversity, community structure and ecosystem functioning in EGREE; (2) assessing and predicting the impact of climate change on the distribution pattern and community structure of primary producers, mangroves, reptiles, birds and mammals with special reference to the threatened species in EGREE; (3) assess and predict the impact of climate change on the socio-economic and demographic profile of coastal communities in EGREE; and (4) prepare a long-term conservation and preparedness plan to safeguard the marine biodiversity and coastal communities of EGREE from the adverse impacts of climate change.

Progress: Influence of salinity on structural components of the mangrove (i.e., density, Complexity Index, Importance Value Index, above-ground biomass, carbon content) revealed a significant negative relationship. It was estimated that there is a stock of 148 mt carbon/ha in the mangroves of EGREE. Therefore, the economic value of the mangroves with respect to their carbon sink potential was estimated as approximately 2,54,208/ha.

The resource selection of the smooth-coated otter, *Lutrogale perspicillata* was studied in Coringa Wildlife Sanctuary, where there is a two-dimensional interface between fishermen and otters. This is resulting in conflict between otters and humans in the region. The fishermen's traditional ecological knowledge of otters in and around Coringa Wildlife

● **Funding Source**
UNDP-GEF Marine Programme

● **Investigators**
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Dr. P.S. Raja Sekhar (AU)

● **Researchers**
Paromita Ray, Giridhar Malla
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● **Date of Initiation**
August 2013

● **Date of Completion**
August 2013



K. Sivakumar

Sanctuary also confirmed that otters largely feed in the wild but visit aquafarms occasionally for food or to play. Further, about 79% of the people in the region felt that otters visit their farms at night. This confirms the nocturnal behaviour of otters around human habitation and is supported by previous studies.

Outputs and Outcomes: This study found that fishermen suffering from poverty could not bear even the meagre losses caused by otters to them. Further, the study found that less educated people are against the otters in the region. Therefore these poor fishermen need to be provided additional livelihood options and their awareness needs to be improved for the long-term conservation of otters in the region. EGREE Foundation, of Andhra Pradesh, a foundation established with the support of a GoI-UNDP-GEF project to sustainably manage the Godavari estuarine system, has already initiated some programmes in this regard. However, these programmes should focus more on fishermen, who have low incomes. It is proposed to install otter-proof fencing around aqua farms, especially

those farms located along the Ramanapallam creeks. Developing eco-tourism in the sanctuary with the involvement of fishermen and small-scale farm owners can also change their attitudes towards the otters.

Causes of Avian Diversity Gradients along the Himalaya



Objectives: The objectives of the project are to (1) understand the distributions, densities, and habitat associations of a select group of closely related birds in the western and eastern parts of the Himalayan range; (2) study the genetic differentiation across the range of species shared between the east and west; and (3) combine the results in an evaluation of ecological and historical hypotheses to explain the diversity gradients in the Himalaya.

Progress: A complete inventory was made of the woody vegetation in several sample plots along elevational gradients in north Bengal and Sikkim, in the East Himalaya, and Jammu & Kashmir, in the West Himalaya, this year. Extensive efforts were made to capture the target flycatcher species, and blood samples were collected. The research team also made several recordings of the songs of flycatchers to understand the differences between populations in the East Himalaya and West Himalaya.

Outputs and Outcomes: The results of our vegetation sampling along the elevational gradients showed the maximum species diversity to be at the foothills and the diversity declining with increasing elevation in both the East Himalaya and West Himalaya. Vegetation sampling was conducted to test the species diversity and/or food resource hypotheses driving the diversity of flycatchers along the elevational gradients. The species diversity patterns of the woody plants and flycatchers, as well as other passerine birds, are different as the avifauna exhibits the maximum diversity at the mid-elevations. However, the vegetation sampling results support the food resource hypothesis, showing the maximum foliage density as well as biomass

● **Funding Source**
Department of Science and Technology, Government of India

● **Investigators**
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● **Researchers**
Ashutosh Singh and Suresh Kumar Rana

● **Date of Initiation**
August 2013

● **Date of Completion**
August 2016



Suresh Rana



Suresh Rana

quantity at the mid-elevations, where the diversity of flycatchers is greatest.

Comparison of the songs of the ultramarine flycatcher, *Ficedula supercilialis* showed significant differences between the populations of the East Himalaya and the West Himalaya. Notably, these populations differ in the supercilium, which is wide in the West Himalaya, and very fine to non-existent in the East Himalaya. Molecular comparison, which is currently in progress, will ascertain whether these differences are correlated with genetic differences. Other species showing significant variations in song type are the verditer flycatcher, *Eumyias thalassinus* and the blue-throated blue flycatcher, *Cyornis rubeculoides*. The birds in the East Himalaya sing with higher frequencies than do those in the West Himalaya.

Milestones: This is the first time that a detailed and fine-scale sampling of vegetation across an elevational gradient and across the East Himalaya and West Himalaya has been carried out. This has provided new insights into the vegetation diversity across the Himalaya. Intensive efforts

were also made to study the population-level genetic and vocalisation differences between the cryptic species of flycatchers occurring across the wide range from the East Himalaya to the West Himalaya.



Pratap Singh

Long-term Monitoring of Antarctic Wildlife and Their Habitats in Antarctica



Anant Pande

- **Funding Source**
National Centre for Antarctic & Ocean Research (NCAOR), Goa, Ministry of Earth Sciences and WII Grant-in-Aid

- **Investigators**
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- **Researcher**
Anant Pande

- **Date of Initiation**
September 2013

- **Date of Completion**
May 2017

Objectives: The main aim of this programme is to carry out long-term monitoring of selected animal species that are indicators of the Antarctic and Southern Ocean ecosystems in connection with climate change and, thereby, strengthen the biological database of the NCAOR. The objectives of this programme are to (1) monitor indicator species such as penguins and birds in the Indian sector of operation in Antarctica using satellite telemetry; (2) understand the movement of birds in and around the Indian sector of operation in Antarctica; (3) assess habitat use by the tagged individuals and determine key habitats for the species; and (4) monitor any changes in the movement patterns over the years and correlate them with climate change.

Progress: WII had participated in the XIV, XV and XVI Indian Scientific Expeditions to Antarctica (InSEA; 1994-1995 to 1996-1997) to initiate and implement the monitoring programme titled "Developing a Long-Term Monitoring Programme for Birds and Mammals in the Indian Ocean and Antarctica". During these 3 years' participation, WII could collect baseline data on the status and distribution of mammals and birds of India Bay, Antarctica and standardised the methodology for long-term wildlife monitoring.

Outputs and Outcomes: During the 28th, 29th, 33rd and 34th In SEA, WII could collect baseline data on the status and distribution patterns of birds and mammals in the Larsemann Hills area and continued the wildlife survey along Princess Astrid Coast. During the 35th InSEA, the nesting ecology, behaviour and habitat of certain birds were studied in the Larsemann Hills. Genetic samples of birds (feathers) were collected during the last expedition. These will be analysed for the determining site fidelity and for population genetics.

WII is also monitoring the changes in the abundance and distribution of wildlife in the Southern Oceans, both Indian and Atlantic.

Milestones: WII, in its last seven expeditions, could collect very valuable data on birds and mammals in the Indian Southern Ocean. These could be used as baseline data to detect changes in the wildlife populations in this region in relation to climate change. Some of the research findings have been published as a paper and a chapter in a book.

Ecology, Taxonomy and Conservation of Fish Diversity in Subansiri River Basin of Arunachal Pradesh, North-East India



- **Funding Source**
Department of Science and Technology, New Delhi

- **Investigator**
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and Dr. Gopi G.V.

- **Researcher**
Sutanu Satpathy

- **Date of Initiation**
October 2013

- **Date of Completion**
March 2017

Objectives: The objectives of the project are to (1) investigate the fish species distribution and abundance in different types of streams, rivers and river basins along the altitudinal gradient; (2) inventory the existing aquatic habitats and fish communities in headwater streams; (3) assess the habitat condition and macro and microhabitat utilisation patterns of fishes in streams of the Subansiri River Basin; (4) identify the human-induced perturbations in the resource availability and trend of resource usage by the fish assemblages in different streams and rivers; and (5) identify the rare, endangered and economically important cultivable species in the rivers and provide options for conservation of threatened species.

Progress: During the study period, 32 streams/rivers in the upper Subansiri River Basin in the catchment area from Dopeji to Natcho were surveyed for fish diversity. A total of 34 species of primary freshwater fish belonging to 16 genera, six families and two orders were recorded from the study area. The maximum species richness was found in the Sippi stream, near the confluence of the stream with the Subansiri River. The snow trout, *Schizothorax richarsonii* was dominant (distributed in nine streams), followed by *Barilius bendelisi*, *Garra gotyla*, *Neolissochilus hexagonolepis* and *Schizothorax progastus*. Two of the 34 species recorded, namely, *Psilorhynchus arunachalensis* and *Schistura arunachalensis*, are strictly endemic to Arunachal Pradesh, and many species are endemic to the north-eastern Himalaya. Four species need confirmation, including one species of *Schistura*, one species of *Glyptothorax*, one species of *Exostoma* and one species of *Botia*.

Information on the habitat variables revealed that the altitude of the study streams ranged between 240 m and 910 m above mean sea level. The present study shows that altitude is a surrogate for ambient temperature. Sites at lower elevations are warmer than those in the high-elevation region, and the water temperature in the streams ranged from 9°C to 24°C. Similarly, the riparian forest cover in the upstream areas is in good shape and less disturbed, covering 90% to 100%. In contrast, in the lower valley, the forest was completely modified into agricultural land and converted to other land use.

Outputs and Outcomes: Fishes species associated with stream/ river habitat was generated for Upper Subansiri River Basin and ecology of some of the threatened species of Subansiri River also have been documented.

Milestones: In the forthcoming year, the human-induced perturbations in the resource availability and trend of usage of resources by the fish assemblages in different streams and rivers will be documented. Analysis of the data and preparation of the final report will also be completed during the year.

Evaluation of Prey Availability and Habitat Suitability for the Tiger and Its Ranging Patterns in Sanjay Tiger Reserve, Madhya Pradesh



● **Funding Source**
Madhya Pradesh
Forest Department

● **Investigators**
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● **Researchers**
R. Rajasekar and
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● **Date of Initiation**
June 2014

● **Date of Completion**
June 2017

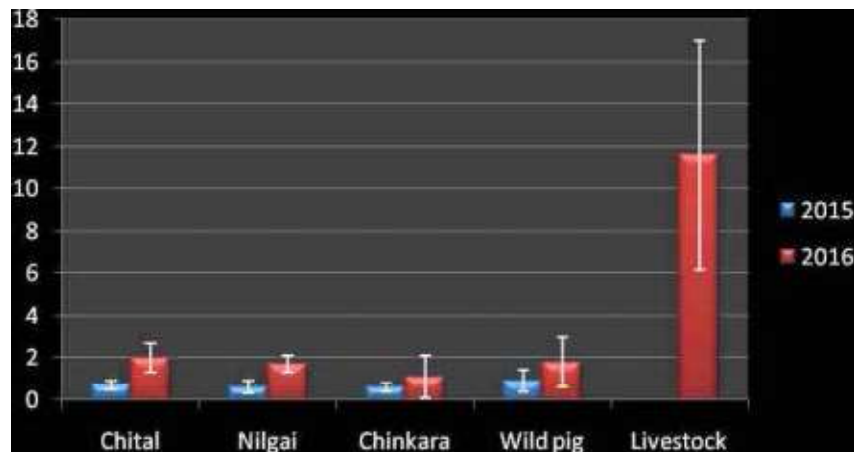
Objectives: The objectives of the project are to (1) evaluate the current status of the prey base in Sanjay Tiger Reserve (STR), Madhya Pradesh; (2) assess the suitability of the habitat for tigers in STR; (3) study the ranging and dispersal patterns of tigers using radio-telemetry; and (4) equip the forest department staff at the ground level with enough knowledge and resources so as to continue the monitoring of the tigers in the park after the project is completed.

Progress: Line transects (n=45) were walked once in the morning (6:00 am to 8:00 am) and once in the evening (4:00 pm to 6:00 pm) during winter and summer throughout the core area of STR to estimate the status of the prey population. A carnivore sign survey was carried out in selected beats (n=45) during winter and summer to establish the presence/absence of tigers and other carnivores. Camera traps were deployed in 161 grids to obtain abundance estimates for tigers. On 6 May 2015, one adult male tiger (P212 or T-002) was radio-collared (VHF) by WII and the Forest Department team. Unfortunately, this tiger (T-002) died to a territorial fight on 19 July 2015. During the interim period, a total of 273 spotted deer were translocated from Bandavgarh Tiger Reserve (BTR) to STR to improve the prey base. Also, one sub-adult tigress (semi-wild), named T-11, was translocated from the Magdhi enclosure, BTR to the Kanjira enclosure, STR on 11 March 2016. The behaviour of the tigress (T-11) was observed through CCTV cameras throughout the period.

Outputs and Outcomes: The overall density of prey was estimated to be (39.7 ± 5.8) . There were considerable variations in the densities of individual species. Among the wild ungulates, chital

(2.0 ± 0.7) was most abundant, followed by the wild pig (1.8 ± 1.2), nilgai (1.7 ± 0.4) and chinkara (1.1 ± 1.0). The density of the langur was 17.6 ± 3.7 and that of the rhesus macaque was 4.5 ± 2.6 , while the density of livestock was estimated to be 11.6 ± 5.4 . The detection of sambar was too low to estimate the density. The encounter rates of carnivore species were calculated for two seasons. The encounter rate of tigers was lower (0.03) than those of leopards

(0.07), hyaenas (0.12) and sloth bears (0.61). A total of eight tiger individuals were identified through camera trapping, of which one was an adult male (T-005), two were adult females (T-001 and T-003) and four were sub-adults (T-006, T-007, T-008 and T-009). One adult male was found dead (T-002). The home range of (T-002) before it died was calculated using the minimum convex polygon method to be 209.07 km².



Milestone: STR is a low-density tiger area, but concerted efforts, in the form of prey augmentation and translocation of tigers, have resulted in a positive outcome, with tigers breeding and the population growing. The efforts

made through the project have been an important step towards a comprehensive tiger recovery programme, which will be jointly executed by the Madhya Pradesh Forest Department and WII.

R. Rajasekar



Assessment and Monitoring of Climate Change Effects on Wildlife Species and Ecosystems for Developing Adaptation and Mitigation Strategies in the Indian Himalayan Region



- **Project Assistants**
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- **Date of Initiation**
August 2014

- **Date of Completion**
July 2019

- **Funding Source**
Department of Science & Technology under the National Mission on Sustaining the Himalayan Ecosystem (NMSHE) Programme

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Objectives: The main goal of the project is to develop strategies to mitigate the effects of climate change on wild animal species and ecosystems in the Indian Himalayan Region (IHR). To achieve this goal, the following research/task components have been put forth under the theme "Fauna and Ecosystems": (a) Identify the drivers of landscape change (climatic and anthropogenic) in the IHR (Ganges River Basin) and their effects on the ecological and social systems. (b) Conduct focussed research on wildlife (terrestrial and aquatic fauna, micro flora and their habitats) and human dimensions in the IHR (Ganges River Basin) for framing evidence-based policy measures. (c) Develop monitoring systems and Decision Support Systems (DSS) for indicator species in the IHR (Ganges River Basin). (d) Undertake climate change scenario analyses and visualisation for predicting potential effects on the fauna and ecosystems as a strategy to communicate with stakeholders and to influence policy and decision making. (e) Develop spatial and inter-operable databases to facilitate and

policy and decision making. (f) Build capacities within WII and other stakeholders for sensitisation and development of action plans for climate change impact mitigation and to enhance capabilities for negotiations at national and international forums.

Progress: WII has developed the organisational, conceptual and methodological frameworks for achieving the proposed objectives. WII has set up the Project Management Unit to execute the programme under the joint supervision of the identified faculty members, project scientists, researchers and assistants. The programme has identified four major themes: terrestrial ecology, aquatic ecology, spatial ecology and human ecology. An inception workshop was conducted to discuss the process of networking for research and data sharing to finalise the research plan. This was followed by collation of the existing information on faunal species/taxa/communities in the IHR, identification of gaps and initiation of interoperable spatial databases.

A literature survey covering all the research components in different themes is being carried out to collate secondary information and identify the gap areas. The focus is on searching the existing database of journals, reports, gazetteers and other such documents related to species descriptions and distribution range. This secondary data collection also includes collation of all the available information on the micro flora, micro fauna and wildlife in the IHR and preparation of a theme-specific database of the

historical and present distributions of important species.

Primary data collection for all research components is being carried out at the selected study sites (Bhagirathi basin, in Uttarakhand). It also includes a range of protection (National Park, Reserve Forest, and Community Forest) and human use levels (livestock grazing, forest produce collection, eco-tourism, pilgrimage and agriculture). The sampling design follows a hierarchical framework within the selected catchment such that the data on different components will be generated in the same spatial/ecological sampling units for integration and appropriate inference. Currently, for the purpose of generation of baseline data on species richness, the Bhagirathi basin has been subdivided into 38 cells of extent 256 km² (16 km × 16 km) each, considering the average home range of the largest mammal found in the area, the Himalayan brown bear, *Ursus arctos isabellinus*. Each of these cells has been further subdivided into 4 km × 4 km grids, and sampling is in progress in 3 to 4 such subdivided grids.

Outputs and Outcomes: The baseline status of the faunal groups and the micro flora was established during the reporting period. The sampling efforts together confirm the presence of 30 mammalian species in the Bhagirathi basin. To date, the presence of 14 carnivore species, seven ungulates, two primates, five rodents, one lagomorphs, one chiropteran and two unidentified rodents and bats has been recorded.

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Eight species of amphibian and 10 species of reptile were encountered during the survey. *Nanorana minica*, *Duttaphrynus himalayanus*, *Japalura kumaonensis*, *Asymblepharus himalayanus*, *Gloydus himalayanus* and *Amphiesma platyceps* are endemic to the Himalaya. *Nanorana minica* and *Asymblepharus* have been selected as indicator species for climate change for further study. *Nanorana minica* is the smallest species of its genus *Nanorana*, or *Paa*. It was recorded calling from March to December. *Nanorana minica*, categorised as Vulnerable, is the only threatened species observed in this area. The reptile genus *Asymblepharus* is distributed from 1000 m to 4800 m, providing an opportunity to understand body size changes along the elevation gradient.

A total of 18 (4 km × 4 km) grids were covered during the initial reconnaissance survey. A total of 25 streams were covered during the reconnaissance period. All the streams were surveyed opportunistically for macro-invertebrates during the reconnaissance, and capable fishermen were chosen for each sub-basin. Surveys were carried out from an altitude of 436 m (Nayar River) to 3912 m.

A total of 38 species have been recorded in the study area, but only 27 species belonging to 20 genera and nine families have been identified. Out of a total of 14 *anisopteran* species, 13 species belong to the family *Libellulidae* and one species belongs to the family *Aeshnidae*. A total of 13 *zygopteran* species were identified. Five of these species belong to the family *Coenagrionidae*. Three species each from the families *Cholorocyphidae* and *Euphaeidae* and only one species each from the

families *Synlestidae* and *Platycnemididae* were recorded.

Collection of soil samples analysis for soil micro-flora and soil nematodes are in progress. From this analysis, a list of 135 villages belonging to different clusters was prepared. These villages are located in Uttarkashi and Tehri Garhwal districts. A preliminary survey and village resource mapping were carried out in these 135 villages from October 2015 to March 2016. The survey was conducted in 55 villages in Uttarkashi and 78 villages in Tehri Garhwal. Information on each village's location, the forest resources used by the villagers, the distance to the forest from the village, natural disasters, the distance to basic facilities (medical facilities, water sources, education, markets and transport), wildlife conflicts, pollinator services, crop yield and agricultural patterns was collected. Data entry is in progress, and it will be followed by further cluster analysis of the preliminary data.

Work on the spatial ecology has made substantial progress, including the development of the Landscape Ecology and Visualization Laboratory at WII.

Milestones: From the camera traps monitored till December 2015, the presence of at least five individual snow leopards in Nelong Valley, including two cubs, has been confirmed. The first photographic evidence of the presence of the Himalayan brown bear, wild dog and stone marten in the Uttarakhand Himalaya (Harsil-Kyarkoti area) was obtained. The ranges of a few species have been extended.

Capacity Building for Participatory Management of Coastal and Marine Protected Areas in India with Special Reference to Forests Sectors

Objectives: The objectives of the project are to customise the existing Capacity Needs Assessment (CNA) tool and to carry out a conceptual and situation analysis of the capacity development systems, structures and tools relevant to marine protected areas (MPAs) in India, with special reference to forest sectors, and building capacity for participatory management of coastal and marine protected areas in India.

Progress: The field assessment studies indicate that the significant gaps in the capacities of the forest sectors of all the coastal states are inadequacy of the baseline biodiversity data, infrastructure and leadership qualities to involve all the stakeholders in policy making; a lack of inter-sectoral coordination and adequate skills for effective management of MPAs; and a lack of the necessary infrastructure and equipment to carry out applied research and to develop a research framework for improved conservation of coastal and marine protected areas in all the four coastal states.

The major possible interventions of the HCD measures of the forest sectors and the youth of the local populations of all the project states have been identified as they require a conducive environment to consult, debate, understand and mutually agree on common goals; conservation of marine protected areas with the involvement of identified stakeholders including the participation of local communities; intervention in existing policies to enhance participatory approaches in protected area management; capacity building of resource organisations towards emerging issues such as climate change, endangered species and invasive species with better linkage and understanding; issues related to a lack of funds and manpower for the applied research; and training for leadership

- **Funding Source**
GIZ Indo-German
Biodiversity Programme

- **Investigators**
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- **Date of Initiation**
September 2014

- **Date of Completion**
December 2017



development and establishment of a knowledge-based system with participatory approaches for effective management of MPAs.

Further, the "Special Certificate Course on Coastal and Marine Biodiversity and Protected Area Management" for field-level staff of the forest departments was organized in December 2015 at Havelock Island and Port Blair jointly by WII and *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) GmbH. This course was intended to enable the participants to have a sound understanding of the concepts and issues related to managing coastal and marine biodiversity, coastal and marine protected areas, the ecological and socio-political context, conservation approaches and legal-policy framework between terrestrial and

coastal marine PAs. The course was also enabled to acquire the necessary skills to assess and monitor coastal and marine habitats and species and prepare field reports and to develop under supervision an operational plan for MPAs based on management effectiveness guidelines. A one-week training course for IFS officers titled "Integrated Management of Coastal and Marine Biodiversity in India" was also organised at Port Blair with the help of MoEFCC and GIZ. The Forest Department of Andaman and Nicobar Islands provided all logistic and technical help in organising this course as a partner.

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Population Genetic Structure, Gene Flow in Brown Bear, *Ursus arctos isabellinus* in India (Jammu & Kashmir, Himachal Pradesh and Uttarakhand) and Assess Extent of Gene Flow Between Populations of India and Pakistan: Conservation and Forensic Implications

Objectives: The objectives of the project are to (1) determine the spatial distribution and occupancy model for the brown bear in Jammu & Kashmir, Himachal Pradesh and Uttarakhand; (2) determine the genetic diversity and genetic differentiation within and between populations, if any, in the brown bear populations in Jammu & Kashmir, Himachal Pradesh and Uttarakhand; (3) determine the level of gene flow between brown bear populations in India and Pakistan by utilising the genotyping data of Bellemain *et al.* (2007); (4) estimate the genetic drift, genetic assignment, number of first generation migrants, effective population size (N_e) and gene flow (N_m) of the brown bear populations in Jammu & Kashmir, Himachal Pradesh and Uttarakhand and between brown bear's populations from India and Pakistan; (5) identify the geographical barriers to the gene flow between the brown bear populations in India and Pakistan; and (5) determine the populations involved in poaching cases.

Progress: The research team surveyed the distribution range of the Himalayan brown bear in Jammu & Kashmir and Himachal Pradesh. The presence of many species of wild animal including mammals, birds and reptiles, was recorded during the survey. In Kugti (KWLS) and Tundah (TWLS) wildlife sanctuaries, in Himachal Pradesh, the team found altitudinal differences in the distributions of the Asiatic black bear and Himalayan brown bear. The research team observed differential use of altitude, up to 2800 m and >2800 m by the Asiatic black bear and Himalayan brown bear, respectively. They recorded high encounter rates of the Himalayan brown bear in KWLS (1.805/km) and TWLS (1.494/km), Himachal Pradesh, compared with Overa-Aru Wildlife Sanctuaries (OAWLS) (0.23/km), in Jammu & Kashmir.

The team collected adequate numbers of scat samples ($n=150$) from KWLS and TWLS after a considerable sampling effort (September 2015 to November 2015), whereas very few number scat samples ($n=12$) were found in OAWLS. Initially, to check the level of genetic diversity and the phylogenetic status of the Himalayan brown bear, we extracted DNA and generated mitochondrial control region data from 42 samples ($n=41$ scats and $n=1$ tissue). The success in PCR amplification of the mitochondrial control region in the 41 scat

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Department of Science
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• **Investigators**
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• **Date of Initiation**
November 2014

• **Date of Completion**
October 2017



samples was 70% ($n=31$). However, we could not get any amplification with the remaining ($n=10$) scat samples. After rigorous checking of the sequence data, the team utilised a 259 bp control region of the mitochondrial genome using faecal samples ($n=25$) collected from three locations each in Jammu & Kashmir (J&K) and Himachal Pradesh (HP) respectively. These locations were separated by 25–350 km.

Table 1. Genetic diversity indices of the Himalayan brown bear in India on the basis of partial mtDNA control region (259 bp). *N*, number of samples; *s*, segregation site; *h*, haplotype diversity; π , nucleotide diversity.

Population	N	No. of haplotypes	S	h	π
OAWLS (J&K)	7	1	0	0.000	0.000
KWLS and TWLS (HP)	7	2	1	0.286	0.0010
Ladakh and Pin	11	2	1	0.509	0.0019
Average	8.3	1.66	4	0.265	0.0009

The nucleotide (π) and haplotype (*h*) diversities ranged from 0.00 to 0.0019 and from 0.00 to 0.509, respectively. The average nucleotide ($\pi=0.0009$) and haplotype ($h=0.265$) diversities are moderate in the Himalayan brown bear in India compared with other global populations. The phylogenetic analysis revealed the presence of five haplotypes in three different lineages, and all these lineages were within the Gobi–Pakistan clade, with a higher posterior probability value of 0.99. Only one of these haplotypes was shared between Ladakh, J&K and Pin Valley National Park, HP, which are separated at least by 250 km. Median-joining network analysis and the mtDNA haplotypes observed (Gobi–Pakistan–India) indicate the presence of the core haplotype of Ladakh (J&K)–PNP (HP).

Outputs and Outcomes: The preliminary findings of the present study highlighted the need for extra effort to collect biological samples from the low-density areas (OAWLS) compared with the high-density area (KWPS and TWLS). This will be helpful

in planning the sampling strategies in other areas. The relatively high mitochondrial genetic diversity observed in the Himalayan brown bear population compared with small or isolated brown bear populations in East Europe/West Asia might be due to a larger number of founder individuals in the past or a good gene flow between the populations. The team needs to sample other populations in the western Himalaya. The presence of specific regional haplotypes (HP: KWLS, TWLS; J&K: OAWLS) might be due to strong female philopatry or the presence of geographical barriers between the populations, and verification using biparental markers is required.

Milestones: The present study is the first attempt to assess the genetic status of the Himalayan brown bear in India and to report area-specific regional haplotypes from J&K and HP. The core-haplotypes for the Himalayan brown bear populations of India, Pakistan and Gobi were in Ladakh, J&K and Pin Vally National Park, HP in the western Himalaya.

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

Objectives: The objectives of the project are 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 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 a conservation strategy.

Progress: Dibang Wildlife Sanctuary and the adjoining landscapes were monitored for tigers, co-predators and their prey through sign surveys, camera trapping and questionnaire-based surveys from October 2015 to June 2016. Three different monitoring blocks of extent 144 km², 129 km² and 69 km² were surveyed during this year (2015–2016) in three sessions respectively. Single-sided camera traps were deployed in 3 km² grids for a minimum of 60 days each, with an average distance between two camera trap points of 500–1500 m. A total of 10 sign surveys were conducted in Dri Valley, Angi Pani, Mathun Valley and Maliney, with efforts of 34.53 km, 5.3 km, 21.9 km and 14 km, respectively. A questionnaire survey was carried out at 14 households of three villages, namely, Maroli, Emuli and Mihondo. So far, 69 carnivores' scats have been collected, of which 22 are tiger scats and the others are scats of leopards, dholes and small carnivores.

During the reporting period, the key areas for the tiger and its co-predators and prey species were documented and identified. The relative abundance

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National Tiger Conservation Authority, New Delhi
- **Investigators**
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- **Date of Initiation**
November 2014
- **Date of Completion**
November 2017



and occupancy of carnivores will be estimated using the camera trap data. The relative abundance index (RAI) will be used to derive the prey densities.

Outputs and Outcomes: In all (inside and outside the protected area), 6264 trap nights were operated. The research team has so far obtained 28 photographs of tigers. From these photographs, the team has identified four individuals (one adult male, one adult female and two cubs), which were captured at different grids and altitudes. One tiger was photo-captured inside the protected area, while the other three were photo-captured in community-managed lands. The highest occupied areas were at heights of 1923 m (determined using camera traps) and 2593 m (from signs).

Milestone: The sign survey encounter rates were highest for the tigers in Dri, followed by Angi Pani, Malinye and Mathun Valley. The takin, the major prey species of tigers, was captured frequently in Dri and Mathun Valley, where tigers were also photo-captured frequently. The preliminary results of the questionnaire survey suggested that all the respondents were positive about tiger conservation; however, they all expressed concerns about mithun depredation by tigers and dholes, which they reported to be a major problem.

Genetic Assessment of Sambar, *Rusa unicolor* Population in North-East India

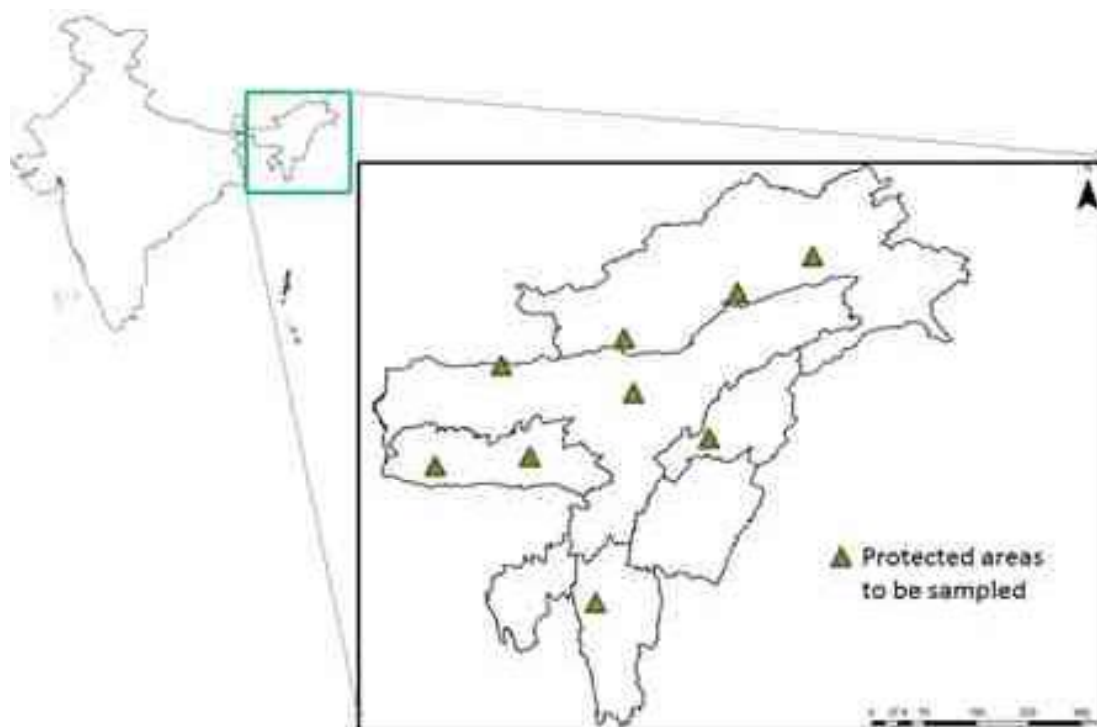


Objectives: The objectives of the project are to (1) study the phylogenetic relatedness among the sambar populations across the various biogeographic zones of India and (2) assess the mitochondrial genetic structure of the north-eastern sambar populations using mitochondrial markers.

Progress: The sambar, *Rusa unicolor* is the largest cervid species in Southeast Asia. In India, it is widely distributed from the Himalayan foothills to the southern limits. Seven subspecies of sambar are recognised, with *R.u. unicolor* occurring in India and Sri Lanka. Despite a large distribution range, very limited information is available on the genetic variations of this species. In the present study, the research team investigated the genetic variations in the sambar populations of south, central, north and north-east India using two mitochondrial (control region (CR) and cytochrome b (Cyt b)) and nuclear genes. The biological samples were collected from different protected areas of north-east India, such as Pakke Tiger Reserve and Itanagar Biological Park, in Arunachal Pradesh, and Nagaland Zoological Garden, Nagaland.

A total of 112 samples from all the major sambar populations of India were used. The samples from north-east India were from Pakke Tiger Reserve (n=35), Biological Garden, Itanagar (n=7), Nokrek National Park (n=4), Meghalaya, and Nagaland Biological Park (n=4) were collected. Samples from north and central India (n=36) and south India (n=26) were also included in the analysis to identify the phylogenetic structure of the sambar populations. Partial fragments of mtDNA Cyt b (674 bp) and the CR gene (474 bp) were used to construct the phylogenetic relationships among all the observed haplotypes using Bayesian analysis. To assess the population genetic structure of the

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SERB, Department of Science & Technology
- **Investigators**
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- **Date of Initiation**
November 2014
- **Date of Completion**
November 2017



sambar populations across India, a panel of 14 polymorphic loci was also selected and successfully standardised.

Outputs and Outcomes: Preliminary analysis of the mtDNA CR and Cyt b gene reveals high variability among the sambar populations. A total of 26 haplotypes were observed among all the sambar populations of India. Out of these 26 haplotypes, seven were unique to the north-eastern Sambar. Bayesian phylogenetic analysis revealed that these seven haplotypes were clustered in a distinct clade. In the previous study, a 40 bp insertion-deletion (INDEL) was observed in the sambar population of southern India. This 40 bp INDEL was also observed in the sambar of north-eastern India.

Milestones: In several studies, INDEL markers have been used in population genetics and forensics. Sequence information from the mtDNA control region (CR), which documents variations within and among human populations, has been widely used to infer certain aspects of human populations and demographic history. In the present study, INDEL was used to describe a 40 bp insertion in the mtDNA control region. In the previous study, this 40 bp insertion was also reported in the south

Indian sambar population. This unique molecular feature differentiated the north-eastern population as well as the southern population, suggesting that a further detailed investigation is required. This INDEL, which was observed in the Kaziranga population, is a rapid marker for genetic screening and identification of these populations using simple PCR and sequencing-based analysis. Also, the mtDNA control region is being investigated along with other mitochondrial and micro-satellite markers to get a better idea of the population structure of the sambar and its adaptive radiation in India.

Preparation of Marine Turtle Recovery Plan for Puducherry



- **Funding Source**
Puducherry Forest Department

- **Investigators**
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- **Researcher**
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- **Date of Initiation**
January 2015

- **Date of Completion**
August 2016

Objectives: The project has the following objectives: (1) mapping existing and potential turtle nesting areas along the Puducherry coast; (2) identification of existing threats to marine turtles and their habitats, and measures to mitigate the same; (3) preparation of a community-based species recovery programme for the next 5 years; and (4) capacity building of the Department of Forests and Wildlife towards implementation of the proposed Marine Species Recovery Plan.

Progress and Outcomes: Five of the seven species of sea turtle found worldwide are reported to occur in the Indian sub-continent, including the olive ridley, *Lepidochelys olivacea*; green turtle, *Chelonia mydas*; leatherback, *Dermochelys coriacea*; hawksbill, *Eretmochelys imbricata*; and loggerhead turtle, *Caretta caretta*. Except for the loggerhead, all the species are known to nest along the Indian coastline. Olive ridleys nest along both the east and west coasts of India, with globally significant nesting sites at Gahirmatha and Rushikulya, in Odisha. Olive ridleys and green sea turtles are known to nest along the coast of Puducherry sporadically. Their sporadic nesting peaks during November–February along Puducherry. However, turtle populations and their habitats are under threat due to fisheries and other anthropogenic activities along the coast, including Puducherry.

Milestones: WII and MoEFCC, Government of India have prepared guidelines and frameworks for the Marine Species Recovery Plan, which will be used for preparing the Marine Turtle Recovery Plan of Puducherry. Two years' data on sea turtles nesting along the Puducherry coast were used to prepare this plan. Further, various stakeholders were consulted while drafting the plan. Moreover, the land-use and land-cover changes of the past 3 decades along the Puducherry coast were detected and incorporated in the plan with recommendations to recover the turtle population and habitats in Puducherry.

Dr. K. Sivakumar



Meta-population Dynamics of Tigers in the Terai-Arc Landscape, India



Objectives: The objectives of the project are to (1) understand the extent to which tigers occupy unprotected areas within the Terai-Arc landscape; (2) investigate what the source and sink populations are; (3) assess the population connectivity by estimating the rates and directions of tiger dispersals at the meta-population scale; and (4) evaluate what landscape features, if any, affect the connectivity in this landscape.

Progress: During this year, the research team worked on both field and laboratory components towards achieving the project goals. From November 2015 to April 2016, the team collected 538 large-carnivore scats across a number of tiger reserves (Rajaji, parts of Corbett and Dudhwa) and forest divisions (Lansdowne, Haridwar and Ramnagar) within this landscape. The team extracted DNA from each of the faecal samples twice and performed PCR-based species identification tests to understand the tiger distribution across our sampling areas. Subsequently, the team standardised tiger individual identification from 40 field-collected faecal samples from Rajaji Tiger Reserve using a panel of 13 microsatellite markers. Finally, the molecular sex determination protocols for both the tiger and leopard were standardised.

Outputs and Outcomes: From the field-collected faeces, 255 tiger and 249 leopard samples were identified in the laboratory, with a success rate of 94.68% in species identification. Fifteen unique tiger individuals were identified from the initial 40 test samples from Rajaji Tiger Reserve and Lansdowne Forest Division, with 25 recaptures among these samples. Currently, the research team is working on individual identification from the remaining samples and molecular sexing. These data will be further used for large-scale meta-population dynamics analyses.

Milestone: The team standardised a comprehensive protocol for faecal sample collection and storage and a DNA extraction method for a range of wild animals and validated a set of 13 microsatellite loci for unambiguous individual identification of tigers. One manuscript from this work has been communicated.



Camera Trap

● **Funding Source**
Wildlife Conservation Trust and Panthera Global Cat Alliance Fund

● **Investigators**
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● **Researcher**
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● **Date of Initiation**
January 2015

● **Date of Completion**
December 2018

Reintroduction and Recovery of Tigers in Panna Tiger Reserve and Landscape Complex: Phase II



● **Funding Source**
Madhya Pradesh
Forest Department

● **Investigators**
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● **Researchers**
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● **Date of Initiation**
February 2015

● **Date of Completion**
March 2020

Objectives: The objectives of the project are to (1) monitor and study the population growth of the translocated/re-established tiger population in Panna Tiger Reserve (PTR), including the genetic variations and physiological profile; (2) understand the dynamics of the co-predator and prey populations in relation to the tiger occupancy pattern, food habits, habitat association and other management interventions; (3) study the landscape ecology of the tiger and its ranging patterns, incorporating human interface issues such as human use of the core and buffer zones, poaching pressure and ecological correlates linked to the economics and system services, including the water sources and stream ecology; and (4) upgrade the skills of the PTR staff to independently execute Phase IV of the tiger monitoring programme in the next two years.

Progress: Reintroduced tigers and their offspring were regularly monitored using radio-telemetry and camera trapping. Phase IV activities, *i.e.*, prey population abundance estimation using line transects and carnivore abundance estimation using camera traps, were carried out within Panna National Park. The wildlife use and status of regeneration of the main floral communities of the relocated villages within PTR were studied using camera traps and circular vegetation plots, respectively. The staff of the forest department were trained in Phase IV activities, *i.e.*, camera trapping and line transect laying.

Outputs and Outcomes: Home range maps of all the radio-collared tigers were generated, and it was observed that T7 has the largest home range (262 km²) as it is still exploring and has not been allowed to settle by other established males. The prey density (including livestock) within the reserve was estimated using the program Distance 6.2. Among the major tiger prey species, the density of sambar was the highest. The camera trap data were analysed using an R interface wherein the best-fit model estimated the tiger density to be 3.18/100 km² and the leopard density to be 17.91/100 km². The camera trap results from the relocated villages suggest that wild herbivores used Surajpura most (51.67/km), followed by Pipartola (43.33/km), while the least used village was Bhadar (1.4/km). A large number of seedlings and saplings were recorded in the vegetation plots, suggesting that there was more regeneration of trees in Pipartola and Chaneri compared with the other villages. In the relocated villages, the maximum grass cover recorded was that of *Cynodon dactylon* in Surajpura village (59%), followed by Talgoan (55.81%).

Milestones: The Panna Reintroduction and Recovery Project has reached a significant milestone with the completion of Phase I and initiation of Phase II. The population growth has been rapid, and the demography reflects healthy growth of the population. Given the fast population recovery, dispersal events are taking place, indicating the need for a landscape-level approach to tiger population management.

Landscape Sustainability Challenges in West Singhbhum Region Due to Collective Mining Regimes: Mining–Wildlife Habitat Linkages and Impacts



Objectives: The main objectives of the study were to (1) assess the current status of spatial biological and environmental parameters, that includes the terrestrial and aquatic flora and fauna of Saranda Forest; (2) characterisation of critical biodiversity hotspots/agriculture/natural resources for quantification of impacts and (3) effect of mining on the wildlife of the Saranda and South Chaibasa forest divisions, in West Singhbhum District, Jharkhand.

Progress: This study was carried out to examine the impact of mining activities on the wildlife values, initially in Saranda Forest, in West Singhbhum District, Jharkhand. Subsequently, Chaibasa Forest Division is to be included in the study.

Intensive field studies were carried out in the Gua, Koina, Sasangda and Noamundi ranges, of Saranda and Chaibasa forest divisions. Data on direct and indirect animal signs, habitat conditions and

Surya P. Sharma



- **Funding Source**
Ministry of Environment, Forest and Climate Change, New Delhi

- **Collaborating Agency**
Indian Council of Forestry Research and Education, Dehradun

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- **Researchers**
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- **Date of Initiation**
March 2015

- **Date of Completion**
July 2016

disturbance parameters were collected. Nineteen species of mammal, 116 bird species, eight species of reptile and amphibian and 66 butterfly species were recorded in the area. The elephant is the flagship species of West Singhbhum District. The elephant population of the district forms an integral part of the central Indian elephant population. The distribution and abundance of mammals and birds varied significantly across the different ranges, depending upon the mining intensity, as did their habitat conditions. The impact of a mine up to a distance of 3 km was recorded from the broken boundary, on the basis of which the impact area was calculated. Any increase in mining area may further restrict the use by elephants of the forests and their movements and exacerbate the human–elephant conflicts in the area. Apart from mining, the other factors affecting the integrity of the forests in the region are poaching, linear development activities, biomass extraction and weed infestation. The negative impacts of these on wildlife values need to be addressed.

An Integrated Wildlife Management Plan (IWMP) for West Singhbhum District, Jharkhand has been prepared. The draft IWMP has been reviewed by the MoEFCC-constituted Multi-disciplinary Expert

Committee (MDEC). The research team endorsed the recommendations of the MDEC regarding the IWMP in general and specifically reiterated the following:

The Government of Jharkhand should establish a high power body, [the] West Singhbhum Integrated Environmental, Forest and Wildlife Management Authority, headed by the State Chief Secretary and having representation from a range of stakeholders.

The network of Joint Forest Management (JFM) committees should be strengthened, and the network should be expanded for ensuring community participation for the protection of forest and wildlife. The Elephant Conservation Area Development Initiative and Regional Elephant Plan as proposed in IWMP and endorsed by MDEC should be expanded beyond West Singhbhum District to cover the entire Eastern Central Elephant Landscape and be adequately funded and implemented so as to inter-alia address the human–elephant conflict issues in an efficient manner.

The constitution of [the] proposed Conservation Reserve in the IWMP should be revisited in terms of (a) areas to be included and (b) the appropriate legal instrument to be used for designating the Conservation Reserve.

Narendra Mohan



Initiated Projects

Monitoring of Re-introduced Tigers in Sariska Tiger Reserve, Rajasthan: Phase II



● **Funding Source**
Central Zoo Authority

● **Investigators**
Dr. Parag Nigam,
Dr. P.K. Malik and
Dr. K. Sankar

● **Researchers**
Dibyendu Mandal and
Debaprasad Sengupta

● **Date of Initiation**
April 2015

● **Date of Completion**
March 2016

Objectives: The objectives of the project are to (1) study the home range and dispersal patterns of the re-introduced tigers and cubs with respect to the relocated villages; (2) assess the habitat use by the re-introduced tigers and cubs with respect to the relocated villages; (3) study the food habits of the re-introduced tigers; (4) estimate the populations of the prey species; and (5) suggest management recommendations for effective conservation of tigers in the tiger reserve.

Progress: All the tigers were monitored periodically in Sariska Tiger Reserve (STR) through ground tracking (using the “homing in” and “triangulation” techniques), camera trapping, direct sightings and pugmarks. The minimum convex polygon (100% MCP) technique was used for calculating the home range. To evaluate the habitat use patterns, habitat variables such as terrain, broad vegetation type and distances to nearest water body, road and human settlement were recorded on each radio-collared location. A total of 3658 locations were recorded for all the individuals during the reporting period using a hand-held global positioning system (GPS). The diet and food preference of the tigers were determined through analysis of scats and kills. A total of 119 scat samples were collected during the year and analysed at the WII lab. A total of 171 tiger kills were also recorded during the year. A total of 38 transects were walked thrice each season to estimate the prey population.

Outputs and Outcomes: All the re-introduced tigers were monitored periodically. A total of 494, 346, 501, 458, 498, 445, 267, 271 and 378 locations were recorded, respectively, for ST2, ST3, ST4, ST5, ST6, ST7, ST8, ST9 and ST10 between March 2015 and March 2016. The annual home ranges were estimated, respectively, to be 47.24, 103.07, 322.75, 67.52, 213.70, 30.82, 40.15,

76.39 and 80.29 km² for the nine adult tigers ST2–ST10. The average annual home range of an adult male tiger was 268 ± 56 (SD) km² and that of an adult female tiger was 64 ± 24 (SD) km². The average home range of a sub-adult male was 20.32 km² and that of a sub-adult female was 19.79 km². ST7 and ST8 (first litter of ST2), adult tigresses, extensively utilised inviolate areas created by village relocation. ST2 raised her first litter (ST7 and ST8) in the Slopka-Kundli area, close to the relocated village Umri. The second litter of ST2 (ST13 and ST14) was raised in the Kundli area near Kiraska village, which is partially relocated, and effectively utilising the area. Although no villages have been relocated from within the home range of ST10 (breeding tigress), the grazing pressure has been reduced remarkably in the area. This might be due to efficient enforcement by the forest department after the tiger re-introduction.

Remains of sambar, chital, nilgai, rodents and livestock were recorded in tiger scats. Of these, sambar contributed the maximum to the tiger's diet (43.97%), followed by chital (29.08%) and livestock (14.89%); nilgai (6.38%) and rodents (5.67%) contributed only in small proportions. The sambar has been re-established as the main prey species of the tiger in the study area, as throughout the study period 2008–2012 (Sankar *et al.*, 2013).

A total of 171 kills of seven prey species, including 112 livestock kills, by all the tigers were recorded during 2015–2016. Remains of livestock (buffalo and cattle) were the most commonly found (65.50%), followed by sambar (19.96%), nilgai (7.02%) and chital (5.26%). Occasionally, remains of wild pig (4.68%) and langur (0.58%) were found. Almost all livestock kills are reported because of the compensation scheme.

The density of chital was found to be the highest amongst all the ungulate prey species ($24.33 \pm 7.85/\text{km}^2$) followed by sambar ($16.1 \pm 4.49/\text{km}^2$), nilgai ($13.69 \pm 2.00/\text{km}^2$) and wild pig ($8.12 \pm 3.18/\text{km}^2$). In total, the wild ungulate density of Sariska during the study period was 64.2 animals/km². A 40% increase in the wild ungulate density in Sariska over the past 3 years was recorded. The wild ungulate density increased from 46.8 ungulates/km² in 2013–14 to 64.2 ungulates/km² in 2015–2016. The proportion of fawns of both sambar and chital increased over 3 years. The livestock density in the study area remained fairly stable over 3 years.

The carrying capacity of tigers of the reserve was assessed during the study period. The combined density of preferred prey species was 35.6 ± 10.6 (SE) animals/km², which is capable of sustaining 7.01 ± 2.13 (SE) tigers/100 km², corresponding to a population of 42.08 ± 12.75 (SE) tigers in 600 km².

Milestones: All the tigers were monitored regularly during the last year, and a total of 3,658 locations were recorded for all the tigers. A total of 119 scat samples were collected, and 171 tiger kills were recorded.

One tigress (ST9) gave birth to one cub, which was photographed during the year. The tigresses and her cub are being monitored using pugmarks, camera traps and direct sightings.

Present study recorded a 40% increase in the wild ungulate density in Sariska over the past three years. The wild ungulate density increased from 46.8 ungulates/km² in 2013–2014 to 64.2 ungulates/km² in 2015–2016. The proportion of fawns of both sambar and chital increased over 3 years. The livestock density in the study area remained fairly stable across 3 years.

The carrying capacity was assessed on the basis of the prey availability. Sariska is capable of sustaining 7.01 ± 2.13 (SE) tigers/100 km², corresponding to a population of 42.08 ± 12.75 (SE) tigers across 600 km² of this tiger-occupied landscape.

Four tigers (ST3, ST4, ST5 and ST6) have been re-collared successfully during the study period. ST6, ST4 and ST5 were re-collared in May, November and December 2015, while ST3 was re-collared in February 2016.



Re-collaring of ST5 (Female) on 1 December 2015

Documentation of Traditional Ecological Knowledge among Indigenous Ethnic Communities of Pithoragarh District, Uttarakhand



Objectives: The objectives of the project are to (1) document the traditional ecological knowledge (TEK) among the indigenous ethnic communities (IEC) of Pithoragarh District especially with respect to the coping strategies adopted by them in response to recent changes in the environment and climate; (2) assess the TEK pertaining to the resource use pattern and conservation of natural resources (especially the flora and fauna); (3) study the traditional farming practices along with their benefits and drawbacks; and (4) study the patterns of TEK among various age and gender classes and extent of knowledge transfer from older to younger generations.

Progress: Two IEC were selected for documentation TEK in the state of Uttarakhand. These are the *Van Rajis* and *Barpatiyas*. Both the communities are confined to the Kumaon region. The Van Rajis are among the least known tribal community of Uttarakhand and are described in the literature as *Van Rauts* (kings of the forest) or *Rajis* (royal people of the forest). Until a few decades ago, the Rajis lived a life typical of the Neolithic age, as cave dwellers and food gatherers subsisting on hunting, fishing and other forest products. However, the present-day *Rajis* are scattered across nine villages of two districts, namely Pithoragarh and Champawat districts, in Uttarakhand. On the other hand, Barpatiyas or Jetharas are among the earliest settlers in the interior valleys of Gori and Ramganga, confined to 12 villages of Munsyari Block, of Pithoragarh District. The word “*Barpatiya*” is derived from the 12 villages (barah=twelve, patti= cluster of villages) that they occupy. On the basis of a preliminary socio-economic survey of a few *Van Raji* and Barpatiya villages, the research team has prepared basic community profiles and documented key features of their traditional knowledge. Further studies on their knowledge of natural resource use, housing and mechanisms of coping with extreme climatic conditions are being investigated.

Outputs and Outcomes: Two chapters of an edited volume on the IEC of the Indian Himalayan Region (IHR), one each on *Van Rajis* and *Barpatiyas*, have been prepared and submitted for publication to the nodal institute (JNU). Besides, a standard protocol for documenting TEK has been developed for further analysis.

● **Funding Source**
Department of Science & Technology, Government of India through Department of Environmental Sciences, JNU, New Delhi

● **Investigators**
Dr. G.S. Rawat and
Dr. S. Sathyakumar

● **Researcher**
Naveen Chandra Joshi

● **Date of Initiation**
June 2015

● **Date of Completion**
May 2019

Detailed Abundance Estimates of Key Wildlife Species of Madhya Pradesh

Objectives: The objectives of the project are to (1) provide abundance/relative abundance estimates of the major carnivores and ungulates in the state of Madhya Pradesh; and (2) provide species distribution and occupancy maps of the major carnivores and major ungulates in the State.

Progress: The annual progress report was submitted to the Madhya Pradesh Forest Department in April 2016. The abundances of tigers and leopards have been estimated at both the forest division and civil (tehsil/district) scales. Habitat suitability occupancy maps of the major carnivore species of the state have been prepared. The density and abundance estimates of the major prey species have been made at the landscape level. Relative abundance maps for the major mammalian species have also been prepared. The final report is in press and is about to be submitted to the Madhya Pradesh Forest Department.

The research team followed the double sampling approach to estimate the distribution of tigers and leopards. The first component of double sampling consists of ground surveys (Phase I), wherein the data are collected by the state forest department personnel. To model the tiger abundance and occupancy, remotely sensed data (Phase II) of different variables (human footprint, landscape characteristics, etc) were used. The second component of double sampling consists of scientifically rigorous abundance estimation in selected sampling units.

- **Funding Source**
Madhya Pradesh
Forest Department

- **Investigators**
Dr. Y.V. Jhala and
Shri Qamar Qureshi

- **Researchers**
Jayanta Kr Bora,
Shravana Goswami and
Deb Ranjan Laha

- **Date of Initiation**
June 2015

- **Date of Completion**
October 2016

Species	Habitat	Encounter rate (per km ²)	Effort (km)	Density ((±SE)/km ²)
Chital	Sal and Sal Mixed	0.73	1119	7.71 (0.78)
	Teak and Teak Mixed	0.78	2215	9.98 (0.77)
	Miscellaneous	0.39	9443	3.18 (0.08)
Sambar	Sal and Sal Mixed	0.28	287	3.71 (0.71)
	Teak and Teak Mixed	0.24	1485	2.68 (0.26)
	Miscellaneous	0.33	6410	3.93 (0.15)
Gaur	Miscellaneous	0.24	659	2.27 (0.31)

For occupancy analysis of the major carnivore species, data from the ground surveys (Phase I) were transferred to 25 km² grids in a geographic information system. The tiger and leopard densities were estimated using the joint likelihood covariate model in SECR. The team used distance sampling methods to estimate the densities of the prey of the tiger in Madhya Pradesh. The data were analysed in a two-step process. Initially, the density and effective strip width (ESW) were calculated for each species in different habitats (Sal, Teak and Miscellaneous) using the data collected in Phase III by the researchers. To calculate the final densities of the ungulates, the encounter rate (ER) data from Phase I were converted into individual densities.

Outputs and Outcomes: The tiger population was estimated to be 308 (standard error (SE) range 264-352), and the leopard population in Madhya Pradesh was estimated to be 1848 (SE range 1,643-2,053).

Habitat-wise abundance estimates of major prey species obtained from Phase I surveyed areas of Madhya Pradesh derived from the species-specific encounter rate and habitat-wise effective strip width from Distance sampling of some protected areas. These density estimates do not include the sampled protected areas.

Population Genetic Structure of Nilgiri Tahr, *Nilgiritragus hylocrius* in Western Ghats, India: Conservation and Forensic Implications

Objectives: The objectives of the project are to (1) determine the distribution pattern in relation to sex and estimate the minimum number of individuals of Nilgiri tahr, *Hemitragus hylocrius* in the Western Ghats, India; (2) estimation of the genetic diversity in the Nilgiri tahr populations; (3) estimation of the genetic differentiation and subdivision within and between populations; (4) estimate the genetic drift, gene flow (Nm), genetic assignment, first generation migrants and effective population size (Ne); (5) Identification of geographical barriers and their effect on the gene flow; and (6) assignment of poaching cases to the respective populations.

Progress: The present distribution of the Nilgiri tahr, *Nilgiritragus hylocrius* is limited to the Kerala and Tamil Nadu portions of the Western Ghats, India. The recent study estimated the population to be around 3,122 across the present distributional range, which is confined to five conservation blocks.

The research team surveyed Mukurthi National Park and Nilgiri South Forest Division in Block I. Anamalai and Parambikulam tiger reserves were surveyed in Block III, and the Grizzled Giant Squirrel Wildlife Sanctuary was surveyed in Block IV, from February to August 2016. The research team used the direct count method to assess the populations, and each sighted animal was classified in different age and sex classes from the field and further from photographs in the lab whenever these were available. The team classified adult males into three classes, viz., saddleback male (SBM), dark brown male (DBM) and light brown male (LBM), and female as adults (AF), whereas yearlings (YL) and young ones (Y) were not classified for sex.

• **Funding Source**
Department of Biotechnology,
Government of India

• **Investigators**
Dr. Bivash Pandav,
Dr. S.P. Goyal and
Dr. Parag Nigam

• **Researchers**
Predit M.A. and
Dr. Rakesh Matura

• **Date of Initiation**
September 2015

• **Date of Completion**
September 2018

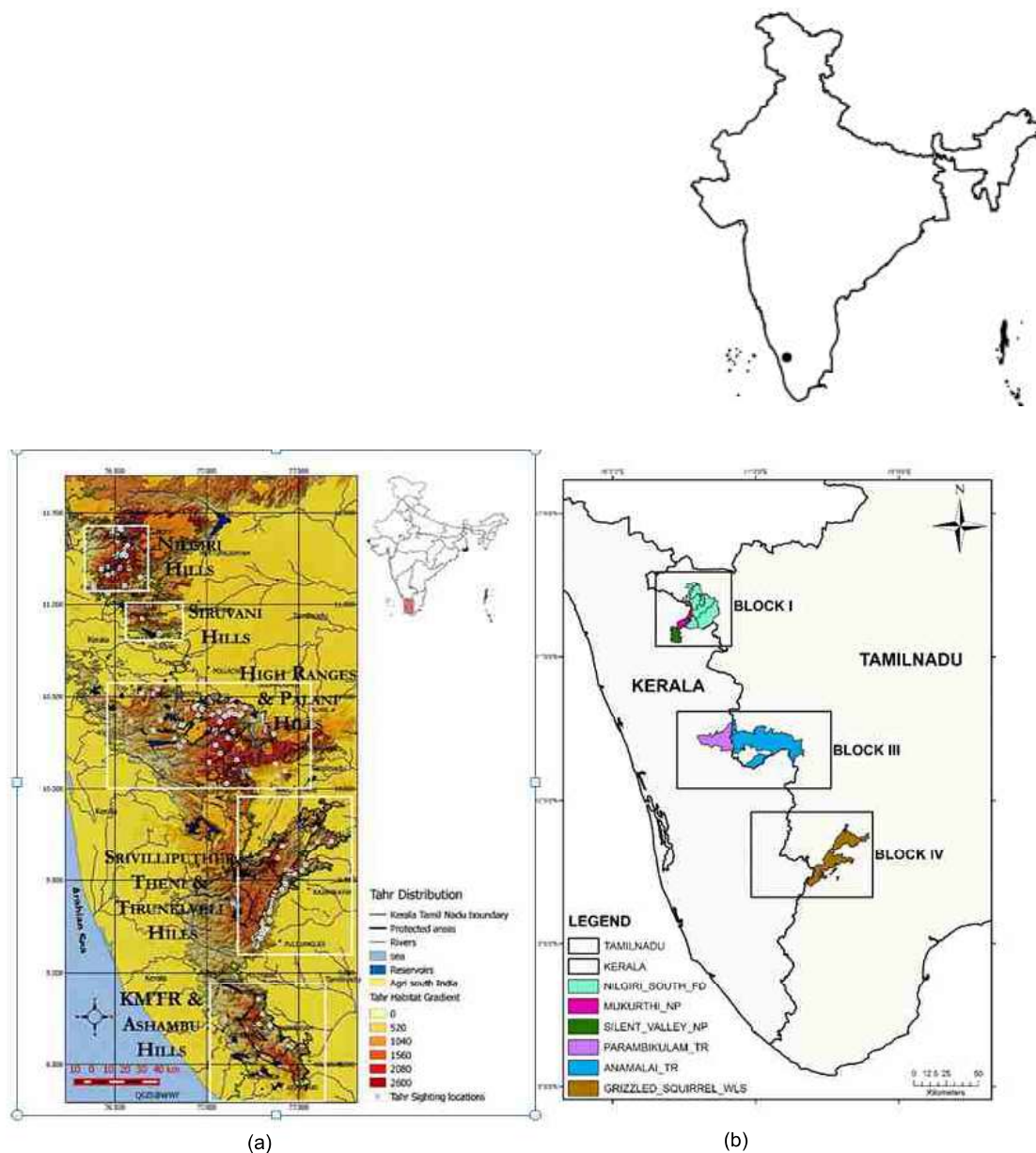


Figure 1. (a) Reported distribution of the Nilgiri tahr in five conservation blocks from previous studies and (b) distribution in selected study areas at different locations during the studied period

Information on the anthropogenic pressures (livestock grazing, non-timber forest produce collection) was collected through signs observed during the survey. The team collected faecal pellets from the surveyed blocks and dry preserved them for genetic studies.

Block I: The team has surveyed 16 areas in Mukurthi National Park between February and March 2016, during the calving season. They observed 75 Nilgiri tahr from seven sightings, ranging from 3 to 31 individuals/herd, with the mean herd size being 10.4 individuals. The direct sightings and population counts were few since the

Nilgiri tahr were tightly restricted to inaccessible cliffs during this season. A collaborative census was carried out with the Tamilnadu Forest Department during the post-calving season, in May 2016, and a total of 418 individuals were recorded. There were tahr sightings from 16 locations, from 2 to 170 individuals/herd, with a mean herd size of 22 individuals. The largest herd recorded involved the congregation of animals from three areas in a recently burnt grassland. There were more Nilgiri tahr sightings during the post-calving season, and the ratios of adult female to young ones and yearlings doubled during the post-calving season

compared with the calving season. This may have been because the Nilgiri tahr started moving out in the open grassland areas with the young ones and yearlings in the post-calving season.

Block III: Eleven areas were surveyed in Anamalai Tiger Reserve and two areas in Parambikulam Tiger Reserve. There were sightings of 33 animals from four areas in the Anamalais, with a mean herd size of 8.25 individuals and the group size ranging from 1 to 17 individuals/herd. The team found the individuals distributed in all age classes ranging from 5 to 36.

Block IV: Ten areas were surveyed for tahr in the Grizzled Giant Squirrel Wildlife Sanctuary. A total of 35 individuals were observed from four areas, with the herd size ranging from 1 to 15 individuals, with an average of 8.75. Three areas had young ones of the current season.

Assessing age and sex classes using faecal pellet measurements:

A considerable percentage of animals could not be classified for age and sex from all the blocks due to various field difficulties. Faecal pellet size measurements have been commonly used in classifying moose, caribou, mountain goats and Nilgiri tahr into different age and sex categories. Nilgiri tahr faecal pellet measurements (length,

width1 and width2) were obtained from pellets from animals of known age and sex classes. width2 had higher discriminating power and could be grouped into four broad categories. Additional pellet measurements will be made to get more discrimination power.

Genetic assessment: A total of 835 faecal pellet samples were collected from three blocks of the study area. In all, 132 samples have so far been used to extract DNA with modified protocols. DNA was successfully extracted from 93% (124) of the analysed samples. mtDNA (Cyt b and control region) and nuclear markers (n=7) were optimised. Identifying males from faecal DNA was optimised using the SRY gene from two known male samples.

Outputs and Outcomes: Assessment of the sex and age categories across different areas within the Nilgiri tahr habitat reveals variations in the group size and age categories. The Anamalai and Parambikulam tiger reserves had all classes of Nilgiri tahr, whereas a few adult male classes (SBM and DBM) were missing in the Grizzled Giant Squirrel Wildlife Sanctuary.

Milestones: The present study has highlighted the variations in group size as well as the sex and age structures across the studied blocks. Moreover, the Nilgiri tahr has male-biased dispersal. Therefore, information obtained on the group size and sex and age categories across blocks will enable us to determine how these population demography attributes influence the extent of gene flow among the populations.



Figure 2. The number of faecal samples collected across different blocks of the study area for the genetic assessment

Population Estimation and Home Site Selection by Wolves in Human-Dominated Landscapes of Maharashtra, India



● **Funding Source**
Maharashtra Forest Department

● **Investigators**
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● **Researcher**
Sougata Sadhukhan

● **Date of Initiation**
September 2015

● **Date of Completion**
September 2016

Objectives: (1) *Population estimation using howl surveys.*

The objectives of this study are three-fold:

(i) to examine individual variations in acoustic structure to identify individual wolves, (ii) to examine the group-specific howl acoustic structure and (iii) to analyse differences in howl acoustic structure between different wolf subspecies.

(2) *Home site selection by wolves in and around Nagpur District.*

The aim of the study is to gain insights into the underlying mechanism driving home site selection by wolves during the breeding period in tropical wet and dry climatic zones.

(3) *Home site selection by wolves in and around Pune District.*

The aim of the study is to gain insights into the underlying mechanism driving home site selection by wolves during the breeding period in a semi-arid climatic zone.

Progress: Known wolf locations and unreported data were compiled with the help of local NGOs and naturalists.

Data have been collected from 11 ranges in and around Pune District, *i.e.*, Rahuri, Ahmednagar, Parner, Chakan, Pune, Saswad, Baramati, Karjat, Mohol, Nanaj and Osmanabad, and two ranges from Nagpur District, *i.e.*, Hingna and North Umred. In those areas, a total number of 160 howl surveys were carried out. Simultaneously, wolf home sites were searched by walking through probable wolf habitats. Different disturbances and natural parameters that may act as driving forces for home site selection of wolves were recorded along with GPS locations. During the surveys, scat samples were collected for analysing the diet.

Captive wolves from Jaipur Zoo were also studied and their howls recorded to understand howling behaviour and bioacoustics better.

Outputs and Outcomes: Around 20 howls from 10 different packs (expected) have been recorded using a H4n recorder and Blue Yeti microphone. More than 250 scat samples have

been collected from the sampling areas for diet analysis. Nine active dens and rendezvous sites have been identified, and data from 29 old or inactive home sites have been collected.

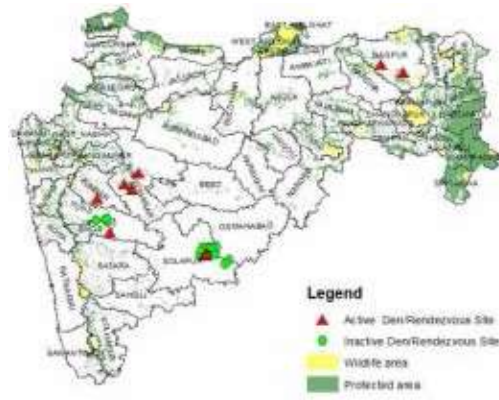


Fig.1: Home sites (den/rendezvous)

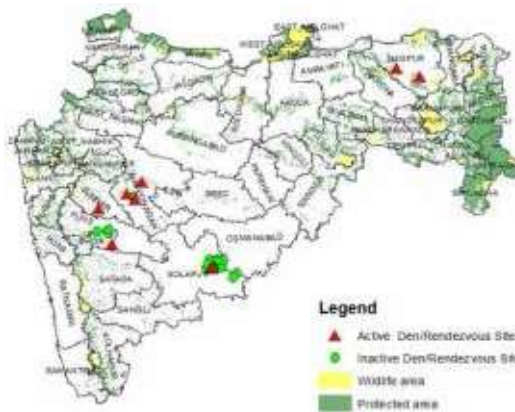


Fig.2: Howling survey locations

Milestones: As wolves' habitats are being destroyed by anthropogenic developmental activities, there is a real scarcity of breeding grounds (rendezvous sites), which in turn is leading to a population decline. Although data analysis has yet to be done, it is pretty clear from published papers and our field observations that drought is one of the main reasons why wolves sometimes do not breed for an entire season. Data from the eight active dens and rendezvous sites will help us characterise the driving force of home site selection, whereas data from the old, inactive home sites might lead to understand the reason why wolves left their old home sites.



WII Photo Library

Space Use and Dispersal of Tigers in Corbett Landscape



- **Funding Source**
National Tiger Conservation Authority
- **Collaborating Agencies**
Wildlife Institute of India, Uttarakhand Forest Department
- **Investigators**
Dr. Y.V. Jhala, Shri Qamar Qureshi and Dr. Bivash Pandav
- **Researchers**
Shikha Bisht and Sudip Banerjee
- **Date of Initiation**
November 2015
- **Date of Completion**
October 2016

Objectives: The proposed study aims at gaining a robust understanding of tiger ecology—the land-tenure system, dispersal patterns, which will aid park management, and the population dynamics that are characteristic of a high-density source population. The objectives of this study are to (1) understand the land-tenure system of adult tigers; (2) characterise the dispersal patterns of sub-adult and old adult tigers; (3) obtain robust estimates of vital rates (emigration versus mortality) by combining telemetry and mark-recapture-based inferences.

Progress: To meet the objectives of the current study (an extension of the long-term monitoring exercise of tigers in Corbett Tiger Reserve (CTR) since 2010), camera trapping-based mark-recapture sampling was done in the entire tiger reserve to obtain estimates of the population and density of tigers as well as a preliminary idea of the home ranges (camera trap based) of different individuals of both the sexes of different age classes. This long-term idea of the spatial distribution of different individuals gathered via camera trapping will help determine which ones are to be radio-collared (permission awaited) and will also enable us to attain a robust estimate of vital rates by combining telemetry and mark-recapture inferences. Beside camera trapping for tigers and other carnivores, line transect sampling was also conducted in the entire area as a part of the monitoring process. Training was imparted to the forest department staff to execute the camera trapping and line-transect exercises. Since permission for radio-collaring is yet to be sanctioned by the PCCF, no work has commenced in that respect. Hence the research team is providing the results of camera trapping-based mark-recapture

and line transect-based distance sampling in the following report.

Training of ground staff to carry out and assist with executing Phase IV. During the sampling session of 2015–2016, rangers and beat guards from 11 ranges were efficiently trained in handling different digital camera traps and deploying them. Training was also provided on data collection from line transects and in handling equipment such as GPS, compass and range finders as well as carrying out human disturbance and ungulate dung surveys. The training programmes included both theoretical lectures and field practicals. After the training, a schedule was fixed to carry out the data collection exercise across the entire tiger reserve in a systematic manner, and camera traps were also deployed subsequently by the forest staff and the WII team.

Population and density estimation of tigers

Sampling method: Camera trapping was conducted for 30–45 days to ensure population closure. A handheld GPS unit was used to record coordinates, which were then plotted in a GIS domain to reach a good trapping design with the least “sampling holes”. Each beat was taken as a

unit of sampling where, depending on the size of the beat, three or four camera trap stations were identified and sampled. A total of 348 camera trapping stations were identified in the entire tiger reserve. These trapping stations were selected so as to maximise the capture probabilities of tigers. The camera trapping was done in two blocks. The Kalagarh, Jhirna, Dhela, Sarpdhuli, Bijrani, Dhikala, Mandal, Maidavan and Adnala ranges of the tiger reserve were sampled in the first block, from 22 April 2015 to 30 May 2015, while the Palain and Sonanadi ranges were sampled in the second block, from 23 May 2015 to 23 June 2015.

The research team used Cuddeback Attack, Cuddeback Ambush, Reconyx IR and Panthera Digital cameras, which are passive infrared cameras, for the present camera trapping session.

Tiger individual identification was done using the software EXTRACTCOMPARE, which is a database that provides automated photo-ids for tiger individuals.

Sampling effort: A total of 348 camera trap stations were deployed in the entire ~1400 km² of CTR during April–June 2015–2016. Details of the effort are tabulated in Table 1.

Table 1: Details of camera trapping session in Corbett Tiger Reserve, April–June 2015–2016

No. of camera traps	Trap nights	No. of photographs	Mt+1
348	9540	3200	163

Outputs and Outcomes: The tiger density was estimated under a likelihood-based spatial capture-recapture (SECR) framework using the SECR (2.10.2) package in an R (3.2.1) platform. Population estimates were derived using closed

population estimators in the program MARK. The overall density in the tiger reserve is 11 tigers per 100 km² (Table 2), while the density in the national park alone is 16 tigers per 100 km².

Table 2: Details of population estimates and density of tigers in Corbett Tiger Reserve, April–June 2015–2016

Total area (km ²)	Area after masking (km ²)	Tiger individuals photographed (Mt+1)	Density (SE)/100 km ²	Population estimate (SE) (Mbh model)
1257.2	1174.8	163	11.43 (1.94)	171 (5.47)

Estimation of densities of prey species: Sampling method. A total of 68 line transects were sampled across 11 ranges in 68 beats during May–June 2015. Each transect was replicated thrice, amounting to an effort of 390 km of total walk.

Results: The density was estimated using the program DISTANCE 7. The best fit model was selected on the basis of the Akaike information

criterion (AIC). Using the selected model, estimates of the group density and animal density were derived.

Table 3: Density of chital, sambar, wild pig, barking deer and langur along 68 transects (total replicates=204) walked (total of 390 km) using the program DISTANCE 7.0 in Corbett Tiger Reserve, 2015

Species	Observations (no. of clusters detected)	Best fit model	Chi square value	Effective strip width (SE)	Mean Group size (SE)	Detection probability (SE)	Group density per km ² (SE)	Density (no. of individuals per km ² (SE)
Chital	166	Hazard/ Hermite	0.92	43.95 (3.32)	14.64 (0.9)	0.24 (0.02)	4.84 (0.6)	70.9 (10.2)
Sambar	119	Uniform/ cosine	0.86	43.36 (3.15)	2.84 (0.1)	0.42 (0.03)	3.52 (0.4)	10.7 (1.4)
Wild pig	46	Hazard/ Hermite	0.78	38.51 (6.83)	7.9 (1.1)	0.35 (0.06)	1.53 (0.3)	12.2 (3.4)
Barking deer	69	Uniform/ cosine	0.65	47.30 (3.6)	1.4 (0.06)	0.59 (0.04)	1.87 (0.2)	2.8 (0.4)
Langur	32	Uniform/ cosine	0.92	37.69 (5.6)	15.43 (1.8)	0.68 (0.1)	1.08 (0.2)	22.3 (7.1)

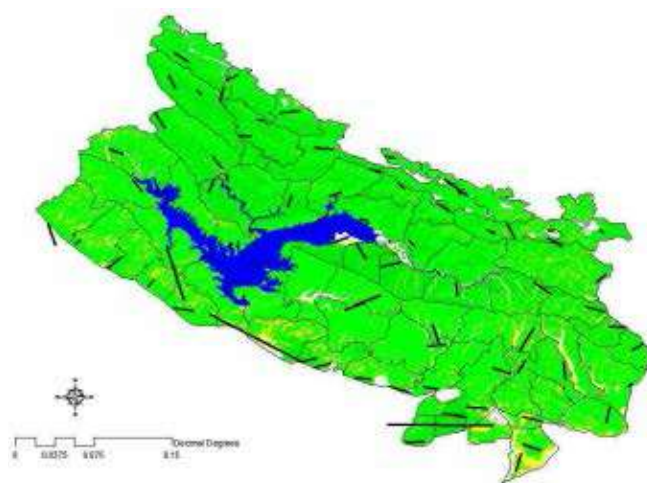


Figure 1. Map showing distribution of transects (n=68) in 11 ranges of Corbett Tiger Reserve during Phase IV sampling, April–June 2015–2016

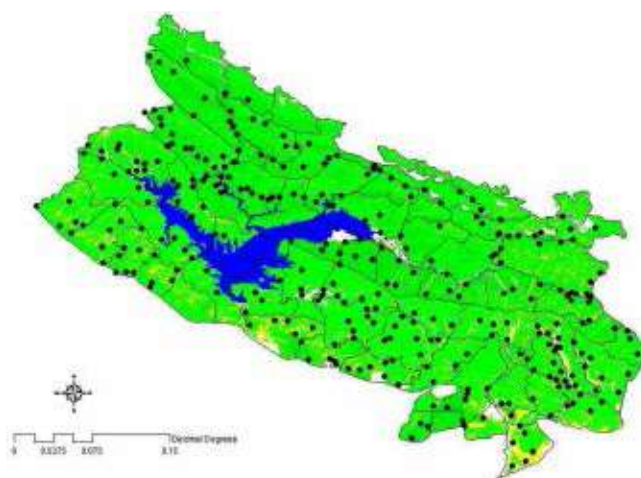


Figure 2. Map showing spatial distribution of camera traps (n=348) in Corbett Tiger Reserve during Phase IV sampling, April–June 2015–16

Studying Dispersal of Tigers across the Eastern Vidarbha Landscape (EVL), Maharashtra, India



- **Funding Source**
Maharashtra Forest Department

- **Investigators**
Dr. Bilal Habib and
Dr. Parag Nigam

- **Researchers**
Pallavi Ghaskadbi
and Zehidul Hussai

- **Date of Initiation**
December 2015

- **Date of Completion**
December 2015

Objectives: The objectives of the project are to (1) study the dispersal patterns of sub-adult tigers in the landscape; (2) study the densities of the prey and predators in the landscape; (3) study the behavioral cues that lead to dispersal; and (4) ground-truth corridors mapped previously using variables such as forest cover.

Progress: Initially, a recce survey was carried out in four protected areas, viz., Umred Karhandla Wildlife Sanctuary, Pench Tiger Reserve, Nawegaon-Nagzira Tiger Reserve and Bor Tiger Reserve, and one non-protected area, Brahmapuri Forest Division. During this period, information about the presence of sub-adult tigers was collected as they would be most likely to disperse. The scats were also collected during this period for the purpose of diet and genetic analysis.

After this initial survey, two sub-adult tigers were collared in March 2016, and their movements are being tracked intensively. One adult tiger that roams extensively through the human-dominated landscape and forest matrix has also been re-collared and tracked.

Outputs and Outcomes: The research team is helping the forest department with the annual camera trapping exercise. A training session in the methodology for camera trapping was conducted for the field staff of Umred-Karhandla Wildlife Sanctuary, Bor Tiger Reserve and Navegaon-Nagzira. As of April 2016, the team is helping with setting up cameras in these protected areas.

Milestones: Two more individuals were subsequently collared in early June 2016. One male and one female sub-adult tiger were collared in Brahmapuri Wildlife Division. Since this study area is not a protected area, there were different challenges in working in a landscape of extensive land use by humans.

Mapping Land Use Land Cover Patterns in Aravallis, Haryana with Reference to Status of Key Wildlife Species



Objectives: The project has the following objectives (1) Map the Landuse Landcover pattern of the Aravallis in Haryana State; and (2) Conduct Occupancy based survey for leopard and other key species in Aravallis of Haryana State.

Progress and Outcomes: The study area is the Aravalli hills of Haryana, situated in the south-eastern part of the state. In all, 51 grids have been surveyed under the five forest divisions.

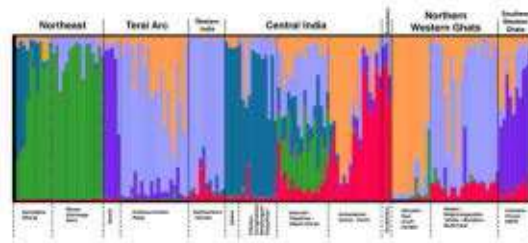
Land use/land cover (LULC) mapping. Reference maps (focusing on forest type) have been prepared from existing thematic maps and other essential data. The next step will be the creation of final maps by incorporating new information through ground verification and satellite data in the reference maps. It is proposed to use moderate-resolution satellite data mapping in LULC. The remotely sensed data will be geometrically and radio-metrically corrected if required. With the help of sufficient ground truthing, the LULC patterns will be delineated using suitable classification techniques.

Occupancy analysis. The fraction of sampling units in a landscape where a target species is present (occupancy) is a very widely used concept in ecology. The study area was divided into logical units on the basis of beat boundaries. The walks were conducted on trails passing through these units, ensuring coverage in each unit in proportion to its area. Wildlife signs, such as direct sightings, calls, droppings, tracks and scrapes, and threats, such as tree cutting, cattle grazing, forest fires and human presence, were recorded. Occupancy analyses were carried out for leopards and other key wildlife species using the software PRESENCE.

Milestones: The observations are being analysed.

- **Funding Source**
Haryana Forest Department
- **Investigators**
Dr. Bilal Habib and
Dr. Gautam Talukdar
- **Researchers**
Paridhi Jain and Anchal Bhasin
- **Date of Initiation**
December 2015
- **Date of Completion**
December 2015

Genetic Connectivity at Landscape Scales for Large Carnivore Populations in Tiger Habitats



Objectives: The objectives of the project are to (1) carry out genetic identification of the leopard, *Panthera pardus*; dhole, *Cuon alpinus*; and sloth bear, *Melursus ursinus* in the study area, from DNA extracted from their scats; (2) investigate the meta-population structure of large carnivores in the country using microsatellite loci genotypic data; (3) investigate the level of genetic structuring between local populations and across the country; and (4) to identify any ESUs or isolated populations that merit special conservation attention.

Progress: A total of 4,300 potential carnivore scats were collected opportunistically from tiger reserves across the country during this country-wide tiger monitoring project. As part of the project, a leopard-specific primer based on the variable region of the cytochrome b region was designed to amplify a region of 277 bp, and the results were subsequently published. A total of 1,147 putative leopard/tiger scats were chosen for extraction of DNA. Out of these, 718 scats were successfully amplified with tiger- and leopard-specific primers. These yielded a total of 432 leopard-positive scats. On the basis of the distribution of the leopard-positive samples and the quantity of DNA present in the extracts, 178 of the 430 leopard-positive samples were chosen for genotyping with a set of 11 microsatellite loci. These samples were chosen on the basis of their amplification success and distribution so as to avoid too many samples from the same region, thereby increasing our chances of capturing different individuals. Genotyping of these leopard samples is currently going on. A wild dog-specific marker was designed (SS2) on the basis of the cytochrome b region and a sequence of 307 bp was amplified. Extraction of wild dog and sloth bear samples and genotyping are going on.

Outputs and Outcomes: The paper "Schrodinger's Scat: A Critical Review of the Currently Available Tiger, *Panthera tigris* and Leopard, *Panthera pardus*-Specific Primers in India, and a Novel Leopard-Specific Primer", published in BMC Genetics, is the outcome of the project.

● **Funding Source**
National Tiger Conservation
Authority, New Delhi

● **Investigators**
Dr. Y.V. Jhala and
Shri Qamar Qureshi

● **Researcher**
Shweta Singh

● **Date of Initiation**
January 2016

● **Date of Completion**
January 2016

Phylogeography and Population Structure of Whale Shark, *Rhincodon typus*, Smith, 1828 in Gujarat Coast in India



- **Funding Source**
Wildlife Trust of India, Noida

- **Investigators**
Dr. S.P. Goyal,
Dr. K. Sivakumar and
Dr. J.A. Johnson

- **Collaborators:**
Shri B.C. Choudhury and
Shri Sajan John,
Wildlife Trust of India, Noida

- **Researcher**
Bheem Dutt Joshi

- **Date of Initiation**
February 2016

- **Date of Completion**
February 2017

Objectives: The objective of the project is to generate the DNA profile of the whale shark from the Gujarat coast using mitochondrial and nuclear markers and compare these data with other parts of the world populations.

Progress: DNA was extracted from the 18 samples collected from whale sharks (n=16) and Bryde's whales (n=2). Seven of these samples were of good quality; three moderate-quality DNA; three samples had low visibility; and five samples were not visible on 0.8% agarose gel. Five primers of the overlapped control region gene were designed to obtain an amplicon of 1250 bp for use with degraded samples. Finally, 11 samples of total length 1090 bp were analysed. Seventeen microsatellite loci were selected and run into a multiplex manager, and four sets of different marker combinations were selected. A total of 12 microsatellite markers were amplified in the whale shark samples. DNA sequencing of the rest of the samples and genotyping are in progress.

Outputs and Outcomes: Among the 11 samples analysed so far, six haplotypes were observed, and five were new for the Indo-Pacific Ocean. Only one sample (5,321) matched with Haplotype No. 44 of Castro et al. (2007) which was sampled from the Western Indian Sea. MJ network spanned with 51 haplotypes with many of median vectors, which shows that there are many missing haplotypes that are un-sampled in the distribution range. A similar trend was observed in the phylogenetic tree.

Milestones: The team determined the presence of five new haplotypes that have so far not been reported from the Gujarat coast. The findings will prove whether the Indo-Pacific Ocean whale shark population is a separate evolutionarily significant unit or not.

Development of Integrated Management Plan of the Thane Creek Flamingo Sanctuary 2016–2025



Objectives: WII will develop this 10-year management plan for the Thane Creek Flamingo Sanctuary (TCFS), addressing the issues of (1) conservation of the biodiversity and ecological integrity of the TCFS through protection, restoration and management of the biodiversity and its ecosystems in the TCFS; (2) integrated and sustainable development around the TCFS region, maintaining the ecological integrity of the coastal and marine ecosystems to ensure wise use of common ecological goods and services for the benefit of the local inhabitants and community; and (3) integration of multi-sectoral plans in managing the globally important, fragile, coastal and marine ecosystem and biodiversity of TCFS.

Progress and Outcomes: The Government of Maharashtra established TCFS under the provisions of the Indian Wildlife (Protection) Act, 1972 in August 2015. TCFS encompasses an area of about 16.905 km² of Thane Creek. The sanctuary is located on the western bank of Thane Creek, between Airoli and Vashi bridges, which connect Mumbai with Navi Mumbai. The primary objective of the establishment of TCFS is to conserve flamingos along with their habitats and the coastal biodiversity of the Thane Creek region by providing protection and through management and restoration of the degraded coastal habitats and their fauna and flora.

This management plan is being prepared using a participatory approach involving various stakeholders of TCFS. Information related to the status and distribution of the various habitats and taxa of TCFS are being gathered from secondary sources, and threats are being identified with conservation perspectives. A series of consultative discussions/meetings were conducted to formulate conservation actions to minimise or remove prevailing threats and conserve the biodiversity and ecological integrity of TCFS through protection, restoration and management. Adequate attention is being provided to involving local communities and other stakeholders actively in the process of preparation of the management plan.

Milestones: Integration of the management of plan of TCFS with other ongoing development plans at the regional level will be emphasised.

- **Funding Source**
Maharashtra Forest Department
- **Investigators**
Dr. K. Sivakumar,
Dr. J.A. Johnson and
Dr. Gopi G.V.
- **Researchers**
Sumant Mali,
Arundathi Mohanty and
Aditya Singh Chauhan
- **Date of Initiation**
March 2016
- **Date of Completion**
October 2016



ACADEMIC AND TRAINING ACTIVITIES

Academic and Training Activities

Academic programme

XV M.Sc. (Wildlife Science)

The 2-year XV M.Sc. in Wildlife Science course commenced in June 2015 with 15 students, of whom 14 were from India and one student was from Malaysia. The candidates were selected through the National Eligibility Test on merit basis. Six students were awarded WII fellowships, and nine students were self-sponsored.

Dr. V.P. Uniyal



The students were taken to Kolluchaur, Laldarwaja, Chokhamb and Haldupadau during the orientation tour between 20 and 25 July 2015. On 5 and 6 September 2015 they were taken to the Laldhang and Kotdwara ranges of Lansdowne Forest Division for their field visit. The students were taken to Rawasan Chilla and Gohri ranges of Rajaji National Park from 15 October to 28 November 2015 for the techniques tour for training in different wildlife techniques and obtaining the knowledge for identifying plants and animals. The students visited various protected areas in Madhya Pradesh, Rajasthan and Gujarat between 1 and 24 February 2016 for their wetland techniques and national parks tour.

Dissertations Supervised

Aditi Bhardwaj (2015). **Relocation and rehabilitation: A case study of the Gujjar tribe of Rajaji National Park.** Master of Arts in Development Studies from Tata Institute of Social Science, Mumbai. 14 April to 14 June 2015. Supervisor: Dr. R. Badola.

Aneesh C.R. (2015). **Riverine habitats under changing land-use: A resource selection study of smooth-coated otter, *Lutrogale perspicillata*, Geoffroy, 1826 in Kabini River and tributaries.**

Supervisors: Dr. S.A. Hussain, Dr. J.A. Johnson and Dr. Gautam Talukdar.

Anindita Sen (2015). **Analysis of soil and water quality of Kusheshwar Asthan Bird Sanctuary and Salim Ali Jubba Sahni Bird Sanctuary.** M.Sc. in Environment Management from Forest Research Institute (Deemed) University, Dehradun. Supervisor: Dr. R. Badola.

Benjamin Ziipoa (2015). **Effects of land use practices on diversity and abundance of honey bee forage plants in Senapati District, Manipur.** Saurashtra University, Rajkot. Supervisors: Dr. G.S. Rawat, Dr. Gopi G.V. and Dr. G. Talukdar.

Bhim Singh (2015). **Genetic assessment of Western Ghats tiger, *Panthera tigris*: An approach through opportunistically collected biological samples.** Master of Science (Biotechnology) from Graphic Era Deemed University, Dehradun. Supervisor: Dr. S.K. Gupta.

Chitrak Bhattacharya (2015). **Estimation of density, diversity and feeding guilds of birds in two wetlands of north Bihar.** M.Sc. in Forestry from Forest Research Institute (Deemed) University, Dehradun. Supervisors: Dr. S.A. Hussain and Dr. R. Badola.

Devanshi Kukadia (2015). **Avian responses to varying landscape parameters in mangrove forests of coastal Gujarat.** Saurashtra University, Rajkot. Supervisors: Dr. Gautam Talukdar, Dr. K. Sivakumar and Dr. Gopi G.V.

Dipak Anand (2015). **Vegetation structure, distribution and carbon sequestration potential of mangrove along soil salinity gradient in Coringa Wildlife Sanctuary, A.P.** Saurashtra University, Rajkot. Supervisors: Dr. K. Sivakumar and Dr. Gopi G.V. Co-supervisor: Dr. R. Badola.

Harshvardhan, S.R. (2015). **Response of leopard, *Panthera pardus fusca* in varying density of tiger *Panthera tigris tigris* in Rajaji National Park, Uttarakhand.** Saurashtra University, Rajkot. Co-supervisor: Dr. Bilal Habib.

Pallavi G. (2015). **A whistle among the growls: Dholes in a multi-predator system in dry deciduous forests of India.** Saurashtra University, Rajkot. Supervisor: Dr. Bilal Habib.

Pragya, L. (2015). **Activity patterns and food habits of the Phayre's leaf monkey, *Trachypithecus phayrei* in free-ranging and captive conditions in Sepahijala Wildlife Sanctuary, Tripura.** Saurashtra University, Rajkot. Supervisor: Shri P.C. Tyagi. Co-supervisors: Dr. Parag Nigam and Dr. K Sankar.

Prasad, Leela (2015). **Resource selection and**

conservation of smooth coated otter, *Lutrogale perspicillata* in and around the Coringa Wildlife Sanctuary, Andhra Pradesh. M.Sc. dissertation, Saurashtra University, Rajkot. Supervisor: Dr. S.A. Hussain.

Priti Kumari (2015). **An assessment of socio-economic status and conservation attitudes of local people towards Salim Ali Jubba Sahni Bird Sanctuary in Lower Gangetic Plains, Bihar.** M.Sc. in Environmental Science, Maharaja Sayajiro University, Vadodara. Supervisors: Dr. S.A. Hussain and Dr. R. Badola.

Priyanka Shantaram Salunkhe (2015). **Assessment of anthropogenic pressure on mangroves and its related impact on ecosystem services in Konkan region, Maharashtra.** M.Sc. in Environment Management, Forest Research Institute (Deemed) University. Supervisor: Dr. R. Badola.

Surabhi Sati (2015). **Phylogenetics of a spider species, *Makdiops montigenus* using partial fragment of DNA barcode region.** Master of Science

(Biotechnology), HNB Garhwal University, Srinagar. Supervisor: Dr. S.K. Gupta.

Talukdar, A. (2015). **Assessing prevalence of parasitic diseases of swamp deer, *Rucervus duvacelli duvaucelli*–livestock interface at Jhilmil Jheel Conservation Reserve and Kishanpur Wildlife Sanctuary.** Submitted to Saurashtra University as a part of M.Sc. dissertation. Supervisor: Dr. Parag Nigam. Co-supervisor: Dr. Bivash Pandav.

Tanyah Banerjee (2015). **Stakeholder analysis in wetlands: Case studies from Bihar, India.** M.Sc. in Forestry, Forestry Research Institute (Deemed) University. Supervisor: Dr. R. Badola.

Vinitesh Garima (2015). **Conservation approaches and development of local communities: A debate. Case study on Rajaji National Park.** MBA, Xavier Institute of Management, Xavier University, Bhubneshwar. April–October 2015. Supervisor: Dr. R. Badola.

Dissertation proposals: XV M.Sc., WII, Saurashtra University, Rajkot

Name of the student	Title of the dissertation	Supervisor	Co-supervisor	External co-supervisor
Aishwarya Bhandari	The number game: Influence of pack size variation on dhole behaviour	Dr. Bilal Habib	Dr. Parag Nigam	
Kumar Ankit	Effect of habitat characteristics on waterbird diversity along River Ganga in Allahabad, U.P.	Dr. Gopi G.V.	Dr. S.A. Hussain	
Ashish A.P.	Comparison of natural resource governance mechanisms for conservation and management of rare and threatened species of medicinal plants and other minor forest products from Kerala	Dr. Anil K. Bhardwaj	Dr. Sonali Ghosh	Shri Pramod J. Krishnan, CCF, Kerala Forest Department
Ashwin Warudkar	Community organization of ground spiders in Nicobar Islands: Influence of habitat structure and island biogeography	Shri Qamar Qureshi	Dr. K. Sivakumar	
Krishna Murari	Grassland communities and evaluation of potential habitat for greater one-horned rhinoceros (<i>Rhinoceros unicornis</i>) in Valmiki Tiger Reserve, Bihar	Dr. G. Talukdar	Dr. Bivash Pandav, Dr. Y.V. Jhala	
Monisha S. Mohandas	Feral dogs: Population status, ranging patterns and resource utilization in Desert National Park	Dr. Y.V. Jhala	Shri Q. Qureshi, Sutirtha Dutta	

Name of the student	Title of the dissertation	Supervisor	Co-supervisor	External co-supervisor
Naman Goyal	Response of island endemics to introduced congeners: A case study of the Nicobar Bulbul and the Red-whiskered Bulbul.	Shri Manoj Nair, IFS	Dr. K. Sivakumar, Dr. Pratap Singh	
Nimisha Srivastava	Response of mammals to human-mediated resource base in Chamoli District of Uttarakhand	Dr. S. Sathyakumar	Dr. K. Ramesh	
Priyanka Justa	Niche overlap and resource partitioning among two sympatric primate species in the Askot region of Uttarakhand	Dr. R. Suresh Kumar	Dr. G. Talukdar	Dr. Anindya Sinha, National Institute of Advanced Studies, Bengaluru
Rajat Rastogi	Responding the invaders: To understand the pattern of insect and plant assemblages across the gradient of plant invasion in Kanha Tiger Reserve	Shri Aseem Srivastava	Shri Q. Qureshi, Dr. Y.V. Jhala	
Rakesh Mondol	Effect of village relocation on ground birds (Galliformes) and small mammals in Sariska Tiger Reserve, Rajasthan	Dr. S.P. Goyal	Dr. Bilal Habib, Dr. P. Nigam	
Ravi Kumar Sharma	Carnivore outside protected areas: Aspects of leopard ecology at Jawai, Rajasthan	Dr. Abhijit Das	Shri Q. Qureshi	
Samyuktha Rao Kandregula	Effects of lunar cycle on intertidal benthic faunal assemblages in Nicobar Island, India	Dr. K. Sivakumar	Dr. J.A. Johnson	Dr. Punyasloke Bhadury, IISER-K, Kolkata
Sijagurumayum Rohikanta Sharma	Diversity and abundance of wet grassland birds in disturbed and undisturbed wetlands of Barak-Chindwin River Basin with special emphasis on globally threatened species	Dr. S.A. Hussain	Shri Manoj Nair, Dr. Chongpi Tuboi	
Sultan	Impacts of vehicular traffic on the habitat use by wildlife along road edges	Dr. Bivash Pandav	Dr. Bilal Habib	

Status of Doctoral Research in WII

Theses submitted

Vinayak Krishna Patil (2016). **Diversity of spider assemblage in sacred groves of Ratnagiri, Maharashtra: Implications for conservation management in the landscape.** Forest Research Institute (Deemed) University, Dehradun. Supervisor: Dr. V.P. Uniyal.

Awarded

Pariva, D. (2015). **Assessment of provisioning services and the recreational value of Nanda Devi Biosphere Reserve.** Ph.D. thesis, Saurashtra University, Rajkot. Supervisor: Dr. S.A. Hussain.

Registered

Mona Chauhan (2016). **Community structure of dung beetles in Kailash Sacred Landscape, Pithoragarh, Uttarakhand, India.** Saurashtra University, Rajkot. Supervisor: Dr. V.P. Uniyal.

Training programmes

XXXVI P.G. Diploma Course in Advanced Wildlife Management concluded, 1 September 2014 to 30 June 2015.

The 10-month P.G. Diploma Course in Advanced Wildlife Management concluded on 30 June 2015. All the departments of the institute were involved in imparting training and teaching inputs in addition to specialised inputs provided by the guest faculty from time to time. The Management Term Paper Exercise was carried out at Chikhaldara, Melghat Tiger Reserve in Maharashtra from 8 to 17 April 2015. The Management Term Papers were presented at a seminar by individual officer trainees on 6 and 7 April 2015, after which there was interaction. The Management Plan Exercise was carried out at Dudhwa Tiger Reserve, in Uttar Pradesh, from 20 April to 13 May 2015.

As part of the Management Tour (Foreign Component), the officer trainees visited Kruger National Park, Johannesburg Zoo, Pretoria Zoo, South African Wildlife College and other conservation facilities in South Africa during the period 17-30 May 2015. Besides, a briefing and discussions on wildlife conservation issues, lectures and interactions were organised by the officials of South Africa National Parks, Southern African Wildlife College, Khamani Reptile Park, Moholoholo Wildlife Rehabilitation Centre, Cheetah Breeding Project, Johannesburg Zoo and Pretoria Zoo. The officer trainees made a presentation of what they had learnt on the tour to the faculty at the institute.

All the officer trainees successfully completed the course, and seven of them were awarded the

S. Wilson



S. Wilson



S. Wilson

Diploma with Honours. The following awards and prizes were also given to the officer trainees: The Institute's Gold Medal for the Top Trainee, the Silver Medal for the 'Best All Round Wildlifer, the N.R. Nair Memorial Silver Medal for the Best Management Plan and Top Trainee in Wildlife Biology (Book Prize) were awarded to Dr. J.D. Pati; the Wildlife Preservation Society Silver Medal for the Second in Merit was given to Ms K.C. Bhutia; the Best Management Term Paper A.K. Chatterjee Silver Medal was bagged by Dr. Aditi Sharma; and the Silver Medal for the Best Foreign Trainee was given to Shri G.M. Abu Baker Siddique from Bangladesh.

XXXVII Post-Graduate Diploma in Advanced Wildlife Management commenced, 1 September 2015 to 30 June 2016.

The 10-month Post-Graduate Diploma Course in Advance Wildlife Management for IFS officers of state forest departments and equivalent foreign nationals commenced on 1 September 2015 at the institute. A total of 13 officer trainees joined the course from Indian states and foreign countries. Eleven of the candidates are from Indian states (two each from Maharashtra, Madhya Pradesh and Tripura and one each from Manipur, Nagaland, Rajasthan, Andhra Pradesh and Telangana), and two foreign nationals are from Myanmar. Five officer trainees joined the course as Hari Singh Fellows.

The orientation tour to Corbett National Park was conducted between 25 and 30 September 2015. The high-altitude ecology tour to Kedarnath Wildlife Sanctuary was conducted between 24 and 30 October 2015. The officer trainees were taken to Keoladeo National Park, Bharatpur, National Chambal Sanctuary, Dhaulpur, in Rajasthan, and National Chambal Wildlife Sanctuary, Morena, in Madhya Pradesh, from 17 to 23 January 2016 for the wetland tour. They also visited Sariska Tiger Reserve, Rajasthan for a field study tour for a chemical immobilization exercise between 23 and 26 January 2016.

XXXI Certificate Course in Wildlife Management concluded, 1 November 2015 to 31 January 2016.

The XXXI Certificate Course in Wildlife Management commenced on 1 November 2015. This time 24

candidates joined this course, of whom nine were foreign nationals (three from Malaysia and six from Myanmar, including one lady officer). Among the Indian participants, 10 were from Madhya Pradesh, and there was one from each of the Maharashtra, Uttarakhand, Goa and Telangana forest departments, while a trainee officer from Tamilnadu Agriculture University was inducted to the course for the first time.

The orientation-cum-techniques tour was conducted at Panna Tiger Reserve from 22 November to 4 December 2015, wherein the officer trainees learnt various techniques, such as vegetation sampling techniques, determining the health condition of wild ungulates, carrying out dung/pellet counts to study the relative abundance of ungulates and carrying out vehicle-based transects for estimating animal densities. During the reporting period, the trainee officers visited various protected areas of Gujarat, starting from GEER Foundation—Wild Ass Sanctuary, Gulf of Marine National Park, Khijadia Wildlife Sanctuary, Narara Wildlife Sanctuary, Pirotan Wildlife Sanctuary and Okha Wildlife Sanctuary—for their management tour from 7 to 24 January 2016. They visited the Reliance refinery, Gir National Park, Sakarbagh Zoo and Velavadar National Park

to understand their practices. The focus of the field visit and interactions was on habitat fragmentation; wild animal conflicts with human societies; conservation breeding and zoo management; management of grasslands and plantations; population management and protection strategies; staff deployment and amenities; and involvement of local communities in conservation. In addition to lectures there were short-exposure visits to the Forest Research Institute and Asan Conservation Reserve for exposure to waterbird identification and wetland conservation. The trainees were taken to Rajaji National Park and briefed about succession of vegetation, wildlife and recovery of forests and wildlife after relocation programmes.

All the officer trainees completed the course successfully. The trainees who received medals for their outstanding performances are the following:

Dr. K. Baranidharan received the institute's Gold Medal for the Top Trainee; the Institute's Silver Medal for the Best All Round Wildlifer, the Institute's Silver Medal for Wildlife Management and the Institute's Silver Medal for the Best Foreign Trainee were awarded to Shri Zaw Min Htun.

Vinod Verma





**CAPACITY
BUILDING AND
PROFESSIONAL
EXCHANGE**

Organised by WII

Training Workshop on Managing Wild Animals in Distress, Udaipur Forest Division, Rajasthan, 13–15 April 2015. The three-day training programme was organised by the Udaipur Forest Division, Rajasthan Forest Department in collaboration with WII. The workshop aimed at enhancing capacities of the frontline staff in the area of emergency management and rescue and rehabilitation of wild animals. Thirty forest officials including frontline staff members participated in the workshop. The workshop provided an opportunity to the participants to understand the biology and behaviour of selected animals in conflicts, management of wild animals in distress, scientific and ethical handling of animals, wildlife forensics, protocols for identification of animals in conflict, infrastructural needs for managing wild animals in distress and safety considerations when working with wild animals. The workshop was coordinated by Shri Rahul Bhatnagar, CCF, Udaipur and Dr. Parag Nigam, from WII.

Raising the Bar of Biodiversity in Impact Assessment for Promoting Inclusive Development Florence, Italy, 18-19 April 2015. This course was organized in response to the request from the International Association for Impact Assessment (IAIA) for conducting pre-meeting training courses in conjunction with its Annual Meeting. The course was the eleventh in the series of international courses conducted and coordinated in collaboration with Dr. V.B. Mathur. It was organized by International Association for Impact Assessment (IAIA).

The two-day course was targeted for mid career EA professionals including trainers, practitioners, development planners, business groups, conservation community, decision-makers, donor agencies and economists with the following objectives: (1) improve the scope and practice of impact assessment for raising the bar of biodiversity for ensuring more integrated and inclusive economic growth; (2) enhance the treatment of biodiversity and ecosystem services in impact assessment to achieve excellence; (3) set higher expectations of quality for informed decision-making that ensure responsible and inclusive development.

Capacity Building Workshop on Wild Animal Capture and Restraint, Kalagarh, 22–24 April 2015. The three-day workshop was jointly organised by WII and the Uttarakhand Forest Department (UKFD) at Corbett Wildlife Training Centre, Kalagarh. The objective of the training programme was to provide exposure to various

aspects of wild animal capture and to enhance skills in managing rescue and rehabilitation operations involving wild animals in distress. The workshop was attended by 25 participants representing UKFD and included frontline staff members from Kedarnath Wildlife Division, Badrinath Forest Division, Almora Civil and Soyam Forest Division, Almora Forest Division, Champawat Forest Division, Gopeshwar Forest Division, Ramnagar Forest Division, Corbett Tiger Reserve and Binsar Vanya Jeev Vihar, Almora. The participants got an opportunity to witness and participate in field immobilization, biological sampling and monitoring and providing care for captive leopards after immobilization.

Vertical Integration Training in Tiger Reserve Management for the Officers of Different Tiger Reserves in India, Dehradun, 8–20 June 2015. The National Tiger Conservation Authority (NTCA) has given the task of organising two customised training programmes every year for the officers of different tiger reserves in India to WII. The first such training programme, sponsored by NTCA, was organised by WII at Dehradun. The objectives of this training programme were to (1) understand the ecological aspects, current status and related issues of tiger conservation; (2) provide inputs on essential components of managerial intervention including techniques required for management of tiger reserves; and (3) share experiences and good practices in tiger conservation.

Dr. H.S. Pabla, Retired Principal Chief Conservator of Forests & Chief Wildlife Warden, Madhya Pradesh Forest Department gave the keynote address as the chief guest of the function at the inaugural session. A total of 26 officers of different seniority levels representing 17 tiger reserves of eight States participated in this training programme. The participants were exposed to a range of subjects related to the management of tiger reserves.



Vinod Verma

The group was taken to Kanha Tiger Reserve, Madhya Pradesh to be provided field inputs. The valedictory session was graced by Shri B.S. Bonal, Member-Secretary, National Tiger Conservation Authority, MoEFCC, Government of India.

Two-Day Training Workshop for Indian Forest Service Officers on “Management Effectiveness Evaluation of Protected Areas”, Dehradun, 27–28 July 2015. The training workshop was conducted by WII for IFS officers sponsored by MoEFCC, Government of India, New Delhi. A total of 17 participants attended the workshop. Six participants made group presentations during the workshop. All the sessions of the course were attended by all the participants.

Vinod Verma



Vinod Verma



Workshop on “Master Planning for Zoo Education”, Ahmedabad, 27–30 July 2015. WII was entrusted with the task of organising training-cum-plan development workshops for identified zoos in the country. This was the second workshop in this series and was attended by 30 managers and personnel. The first workshop was organised at Dehradun in December 2014. Senior forest department officials including Shri C.N. Pandey, IFS, PCCF & Chief Wildlife Warden, Gujarat Forest Department and Ms Meenakhshiben Patel, Mayor graced the programme as the chief guests.

WII Photo Library



The workshop was planned in such a way that every aspect pertaining to zoo education could be discussed during the workshop. The following technical sessions were organized: Elements of Zoo Education; Discussion on Zoo Education Plan Format, and Setting of Goals and Objectives of the Plan; Understanding Visitor Motivations and Profiling Zoo Visitors; Development of a Visitor Survey Questionnaire; Critical Review of Interpretative Signage in Indian Zoos; Range of Effective Communication Techniques in Conservation Education and Interpretation, Including Use of Online Media; Zoo Beyond Boundaries; Marketing of Zoos & Practicality of Media Management; Major Consideration in Designing Interpretive Facilities for Zoos; Targeting Urban Audience in a Zoo: Case Study of Indroda Nature Park; and Formulation of Working Groups for Preparation of Master Plan on Zoo Education and Interpretation. The participants were taken for a visit to Indroda Nature Park and Kamla Nehru Zoological Park to understand the practices.

The working groups prepared a master plan for zoo education, and after a discussion, they consolidated the plan.

Training Programme on Mainstreaming Biodiversity in Energy Sector, Dehradun, 3-5 August 2015.

Developments in energy sector (especially Hydropower) are essential components for mainstreaming biodiversity in impact assessments can offer the planning and decision support for encouraging green energy projects. The success of such efforts is linked to commitment of business groups; competence of EIA consultants; availability of best practice models; state of the art methodologies and informed decisions.

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This course aimed to build the capacity of the corporate sector to think 'out-of-the-box' for evolving 'win-win' opportunities for both development and biodiversity and provide guidance on how to invest in sustainable green energy development plans for promoting responsible development. The objectives of the training programme were to (1) enhance the

conceptual understanding of the need to mainstream biodiversity in developments in the energy sector; (2) provide guidance on 'how to' approaches for biodiversity-inclusive impact assessments for harmonising conservation with development; (3) help the course participants to review a range of mitigation options to address significant impacts on biodiversity; and (4) promote the concepts of 'no net loss', 'ecological neutrality' and 'biodiversity offsets' that can support both energy development and biodiversity objectives. It was organized by Wildlife Institute of India. A total of 22 participants attended the training programme.

Sixth Asia Regional Conservation Forum, Bangkok, 10–12 August 2015. The Sixth Asia Regional Conservation Forum (RCF) was held at Bangkok, where more than 500 representatives of NGOs, governments and the business sector from across Asia gathered together to discuss how they can work together to deal with Asia's environmental issues and to share their experiences. Twenty participants from India, representing NGOs and the government participated in the RCF. An exhibition depicting the publications, posters and films of the members of the Indian National Committee of IUCN was set up during the RCF.

The Indian National Committee of IUCN produced the annual report of the activities of its members for the year 2014–2015. The annual report was released on the first day of the RCF by Shri Zhang Xinsheng, IUCN President, Professor Youngbae Suh, former Chair of the IUCN Asia Regional Member's Committee in the presence of Ms Meena Gupta, Vice Chair of the Governance and Constituency Committee, Shri Vinod Ranjan, ADG (WL) and Dr. Bitapi C. Sinha, Coordinator, INC-IUCN.



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Shri Zhang Zinsheng, the RCF-IUCN President met the members of the Indian National Committee of IUCN. The IUCN President appreciated the efforts of the Indian National Committee and discussed issues that required focus during the World Conservation Congress at Hawaii in 2016. The RCF organised a photographic contest. Shri Nilanjan Chatterjee of WII won the first prize in the individual category for his picture. The award was received on his behalf by Dr. Bitapi C. Sinha from Thailand's Minister of Natural Resources and Environment.

Celebration of Librarian's Day, Dehradun, 12 August 2015. The WII and Central Government Library Association (CGLA) jointly organised Librarian's Day celebrations on the occasion of Dr. Rangnathan's (Father of Library Science) birthday with a technical session, "New Frontiers in Digital Library", at WII. The librarians of various organisations/academic institutes, e.g., Survey of India, Forest Survey of India, Indira Gandhi National Forest Academy, Central Soil and Water Conservation Research & Training Institute, Welham Girls School, St. Joseph Academy and University of Petroleum and Energy Studies, Dehradun participated in the celebrations. The function was attended by 35 participants from different institutes.



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In his opening remarks, Dr. V.B. Mathur, Director, WII emphasised the importance of information technology in the growth of any institution. He also talked about the need for consortia and the challenges before libraries. A technical session was organised to discuss the existing situation of the library and to evolve plans to meet the challenges of

planning and managing digital resources by libraries.

Release of report 'Management Effectiveness Evaluation' (MEE) of National Parks and Wildlife Sanctuaries in India 2006- 2014, New Delhi, 2 September, 2015.

Report on 'Management Effectiveness Evaluation' (MEE) of National Parks and Wildlife Sanctuaries in India 2006- 2014 was released on 2 September, 2015 by Shri Prakash Javadekar, Hon'ble Minister of State (Independent Charge), Environment, Forest and Climate Change, Government of India.

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XI Internal Annual Research Seminar, 30 August 2015 and XXIX Annual Research Seminar of WII, Dehradun, 3-4 September 2015. The XI Internal Annual Research Seminar (IARS) was chaired by Shri Vinod Rishi, Former, ADG (WL), MoEFCC, Government of India, New Delhi. During the IARS, a total of 13 presentations were made in four technical sessions. The presentations were based on recently initiated and ongoing research studies and

were made by research fellows of the institute. Also, 10 e-posters were presented and evaluated during the IARS.

The three best oral and e-poster presentations were selected, and the winning research personnel were awarded book prizes.

The XXIX Annual Research Seminar (ARS) of the Institute was conducted at WII under the chairmanship of Shri P.R. Sinha, former Director of the institute and present Chairman of WII-Training, Research and Academic Council. A total of 24 presentations were made in seven technical sessions. The presentations were based on ongoing/completed research studies and were made by research fellows and faculty members of the institute. In addition, 15 e-poster presentations were also made by the researchers. The oral and poster presentations were evaluated by a panel of judges.

About 300 delegates attended the ARS, including the Principal Chief Conservators of Forests, Chief Wildlife Wardens and other senior officials representing state forest departments, delegates representing NGOs, scientists, wildlife experts, faculty members, researchers, M.Sc. students and officer trainees of the Post-Graduate Diploma Course in Advanced Wildlife Management.

A panel of eminent scientists and wildlife managers evaluated the relevance and quality of research made through oral and e-poster presentations. The following oral and e-poster presentations were adjudged the best presentations of the ARS, and the researchers were awarded book prizes:

Vinod Verma



Vinod Verma



Oral Presentation Awards for ARS

Rank	Name	Title of Presentation
I	Ankita Sinha	Studying riverine ecosystems through riverine birds: A case study of the upper Ganges
II	Sutirtha Dutta	Shifting sands: Yardstick to monitor the status of bustard, associated wildlife and habitat in Thar landscape
III	Anita Devi	Preliminary findings on the food habits of large herbivores in Kaziranga Tiger Reserve
IV	Indranil Mondal	Characterisation of human–tiger conflicts along probable movement pathways in human-dominated areas of East Vidarbha Landscape
V	Ajaz Hussain	Patterns of human–wildlife conflicts in and around community forests of Pithoragarh District, Western Himalaya

e-Poster Presentation Awards of ARS

I	B. Navaneethan	Home range, habitat use and food habits of reintroduced gaur, <i>Bos gaurus gaurus</i> in Bandhavgarh Tiger Reserve, Madhya Pradesh
II	Pallavi Surendra Ghaskadbi	A whistle amongst growls: Dholes in a multi-predator system in dry deciduous forests of India Vaijayanti Vijayaraghavan New insights on the movement and ranging behaviour of critically endangered great Indian bustard in Maharashtra, India
III	Giridhar Malla	Ecology and conservation perspectives of the fishing cat, <i>Prionailurus viverrinus</i> in Coringa Wildlife Sanctuary, Andhra Pradesh

Third School in Herpetology (Phase II),

Dehradun, 1–15 October 2015. An intensive course in herpetology (the study of amphibians and reptiles), sponsored by Science Engineering Research Board, Department of Science and Technology, titled “School in Herpetology”, was conducted at WII. It was the third time that the school was organised at WII. The course targeted master's students, doctoral students and young faculty members from India. The course was designed to assist students with pursuing careers in herpetology. In all, 24 participants from India were selected for the course.

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Shri S.K. Mukherjee, former Director, WII was the chief guest on the occasion. The students were

trained in laboratory techniques, such as preservation, curation, morphometry, behavioural observation of larvae and regeneration experiments. A field trip was organised to Dhanaulti and Benog Wildlife Sanctuary. The participants were exposed to field techniques in herpetology and photo-documentation. During the field trip, the participants used various field techniques and recorded amphibians and reptiles in the field. Field work was organised at Dhanaulti and Benog Wildlife Sanctuary, Mussoorie Wildlife Division to demonstrate herpetofaunal sampling techniques, such as stream transect acoustics searches, stream characterisation and visual encounter surveys. A workshop on field photography was also organised. The participants were asked to prepare a poster on their own research work.

Training Programme on “Landscape Management Approach for Biodiversity Conservation and Human Well-being”, Thekkady, Kerala, 13–17

October 2015. The training programme for frontline professionals under the Biodiversity Conservation & Rural Livelihood Improvement Project (BCRLIP) was conducted at Periyar Tiger Reserve, Thekkady, Kerala. This training programme was a part of the national capacity building component of the project. The objectives of this training programme were (1)

to understand the importance of biodiversity, PAs and potential threats to the PA network; (2) to disseminate the core concept of the landscape approach to biodiversity conservation and human well-being; (3) to share the existing experience of linking biodiversity conservation and sustainable livelihoods; and (4) to discuss a framework for mainstreaming conservation in development for landscape management.

The training was conducted by WII in association with Kerala Forest & Wildlife Department, Tamil Nadu Forest Department, Periyar Tiger Conservation Foundation (PTCF) and Kalakad–Mundanthurai Tiger Conservation Foundation (KMTCF). Officers of other developmental departments/agencies working in the Agasthyamalai Landscape, as well as other areas, were deputed for this training programme. The programme also included a one-day interactive workshop with the representatives of developmental departments/line agencies. In total, 30 participants attended the training programme.

Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) Capacity-Building Forum, Dehradun, 19–22 October 2015.

Governments, organisations and other stakeholders met in India to discuss opportunities for aligned investments in ecological knowledge for sustainable development. A key international initiative for addressing concerns over threats towards biodiversity and ecosystem services, IPBES was established in 2012 and currently consists of 124 member states.

The first IPBES capacity-building forum was organised at Dehradun, India at WII. A total of 75

participants attended this training programme. The first meeting of the forum aimed to promote dialogue amongst receivers, implementers and funders of capacity-building activities. The meeting explored opportunities for cooperation on aligned investments in capacity-building needs; further partnerships for piloting and delivering the IPBES capacity-building programme; and further action, including preparation for future meetings of the forum.

Shri Hem Pande, Special Secretary, MoEFCC and Dr. Zakri Abdul Hamid, IPBES Founding Chair and Science Advisor to Malaysia's Prime Minister and the member of the UN Secretary-General's Scientific Advisory Board graced the occasion. The Director of WII, Dr. V.B. Mathur, is a member of the IPBES Multidisciplinary Expert Panel. Shri Ivar Baste, IPBES Bureau-Member; Co-chair and Director of the Trondheim Conference on Biodiversity and Senior Adviser, Norwegian Environment Agency was also present at the forum.

Management of Coastal and Marine Biodiversity in India: Challenges and Prospect for IFS Officers, Port Blair, Andaman & Nicobar Islands,

2–6 November 2015. The one-week refresher training course for Indian Forest Service officers was organised jointly by MoEFCC, WII, GIZ and A&N Islands Forest & Plantation Development Corporation. This course was designed to achieve the objective of promoting integrated management of coastal and marine biodiversity in India. Service officers from various states including the Andaman & Nicobar Islands, Gujarat, Kerala, Karnataka, Madhya Pradesh, Maharashtra, New Delhi and West Bengal participated. Resource persons from reputed organisations delivered lectures on diverse aspects of management, conservation and challenges in the coastal areas of India.

Second Special Certificate Course on Coastal and Marine Biodiversity and Protected Area Management, Havelock, Port Blair, Andaman & Nicobar Islands, 1–18 December 2015.

This certificate course for the field-level staff of forest departments was inaugurated on 1 December 2015, with 13 participants, comprising largely Range Forest Officers, representing Gujarat, Maharashtra, Kerala, Andhra Pradesh, Odisha and the Andaman & Nicobar Islands. The first part of the course included open water scuba diving training and underwater biodiversity monitoring. The course was jointly organised by WII and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. It was the part of the project titled “Conservation and Sustainable Management of Coastal and Marine Protected

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Areas” of the Indo-German Biodiversity Programme of GIZ, which aims to strengthen the capacities of key training and learning organisations relevant to marine protected areas (MPAs).

The course was intended to enable the participants to have a sound understanding of the concepts and issues related to managing coastal and marine biodiversity, coastal and marine protected areas, the ecological and socio-political context, conservation approaches, the legal policy framework relating to terrestrial PAs and coastal and marine protected areas as well as to provide them the necessary skills for assessment and monitoring of coastal and marine habitats and species, preparing field reports and developing under supervision operational plans for MPAs on the basis of management effectiveness guidelines.

One-week Compulsory Training Programme of IFS Officers on “Ecodevelopment for Biodiversity Conservation: Assessment and Way Forward”, Dehradun, 7–11 December 2015. The course was conducted by WII and sponsored by MoEFCC. The inaugural and keynote address, titled “Human Dimensions of Protected Area Management and Eco-development”, was delivered by the chief guest, Dr. H.S. Pabla, Retired PCCF & CWLW, Madhya Pradesh. A total of 13 officers participated in the course.

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The course was planned keeping in mind the requirements of MoEFCC. There were three panel discussions during the course, which provided opportunities for interaction among the participants and experts in related subject areas. The group was taken to Rajaji Tiger Reserve for a field visit on 9 December 2015. The objective of the field visit was to provide hands-on experience to the participants relating to different eco-development aspects of Rajaji Tiger Reserve as well as the relocation programme carried out by the tiger reserve for *Gujjars*.

Attachment of Officer Trainees of Indian Revenue Service (Customs & Central Excise) Group-A 66th Batch with Wildlife Institute of India, Dehradun, 4–15 and 18–29 January 2016. The training module essentially aimed at sensitising the young officers of the 66th batch of the Indian Revenue Service (Customs & Central Excise) to the wildlife trade in the country and their role in checking it. The course was divided into two parts to accommodate the participation of 192 officer trainees.

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Various inputs including an introduction to the importance of biodiversity and its conservation and the status of endangered species including flagship species such as the tiger and monitoring it, and special inputs on the illegal trade in wildlife articles, including butterflies, shahtoosh, rhino horn, wild animal hides, and tiger bones, were facilitated during the course. Most of the inputs were provided by the senior faculty members of the institute as well as guest speakers from esteemed organisations. A visit to the Forest Research Institute was also

arranged for the officer trainees to expose them to the various aspects of forestry. Apart from receiving classroom inputs, the officers also went to Corbett Tiger Reserve. Jungle safaris in the Dhikala, Bijrani and Jhirna tourism zones of Corbett Tiger Reserve sensitised them towards conservation of flagship and keystone species. The young and enthusiastic officer trainees had the privilege of interacting with the top officials of the tiger reserve.

National Stakeholder Consultation on Biodiversity Finance Initiative for Public & Private Sector, New Delhi, 14-15 January, 2016.

A National Stakeholder Consultation on Biodiversity Finance Initiative was organized by Wildlife Institute of India at MoEFCC New Delhi from 14-15 January, 2016. Stakeholders from Public & Private Sector participated in this meeting.



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Meeting of Senior Officers of Tiger Range Countries at Wildlife Institute of India, Dehradun, 20–21 January 2016. The Global Tiger Forum (GTF), along with the National Tiger Conservation Authority (NTCA), Government of India organised the Third Asia Ministerial Conference (AMC) on tiger conservation at New Delhi between 12 and 14 April 2016. As part of the preparations for this meeting, a senior officers' meeting was organised at WII, with the objective of finalising the agenda and likely outcomes.

The meeting was attended by senior officers from five tiger-range countries (Bangladesh, Bhutan, India, Myanmar and Nepal) as well as senior representatives from the GTF, Global Tiger Initiative Council (GTIC), NTCA, Uttarakhand Forest Department and WII.

Three-week International Field Course: Interventions in Wild Animal Health, Field Sites in Rajasthan and Uttar Pradesh, 6–27 February 2016. A 21-day-long field course, “Interventions in Wild Animal Health”, was jointly organised by WII, Zoological Society of London and the University of Edinburgh at various field sites in Rajasthan and Uttar Pradesh. The course was specially designed

for wildlife health professionals. The course provided practical knowledge about the interventions required to address human–wildlife conflict issues; to carry out effective meta-population management through translocation; to reduce the risk of disease in reintroduction and translocation programmes; to carry out investigations in disease outbreaks in free-living and captive wildlife; and to understand the role of disease in the decline of species.

The entire programme was carried out in the field to develop skills in human–wildlife conflict management, disease risk analysis and translocation techniques, disease outbreak investigation and the monitoring of the health of declining species. Techniques for monitoring wildlife in the field were included in the programme.

The field inputs of in the course were provided by faculty members from WII, University of Edinburgh and Zoological Society of London. The field sites included Sariska Tiger Reserve, Ranthambore National Park, Elephant Conservation and Care Centre, Agra (Wildlife SOS Rehabilitation Centre) and Keoladeo National Park. The course was attended by 12 wildlife health professionals from abroad, representing eight countries, namely the United States of America, the United Kingdom, France, Nigeria, Spain, Switzerland, South Africa and Rwanda, and nine Indian participants nominated from the forest departments of Uttarakhand, Himachal Pradesh and Jammu & Kashmir.

Training Programme on Mainstreaming Biodiversity in Road and Rail Transportation Projects for Promoting Smart Green Infrastructure, Dehradun, 17–19 February 2016. Developments in the road and rail sector can be undoubtedly singled out as the most pervasive linear intrusion that poses the biggest challenges of reconciling the pursuit of economic growth with the protection of ecological integrity of wildlife habitats. The challenges become even more daunting given that roads and rails cut across many of India's protected areas, fragment wildlife habitats and endanger many of the species that are already being negatively impacted by

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growing anthropogenic pressures. Central to the practice of transportation ecology is the belief that roads can be planned to avoid sensitive landscapes, designed to address connectivity of landscapes of conservation importance and encouraged as smart green infrastructure to connect people and wildlife.

This three-day course provided an opportunity to road and rail agencies EIA consultants and conservation organisations to become abreast with the recent developments in the field of transportation ecology and to upgrade technical skills for responsible planning of roads to balance growth and mobility of people with the security of habitat connectivity and permeability for wildlife species.

The objectives of the training programme were to (1) revisit current trends of road and rail development in India and countries in the region to review their socio-economic merits and implications for biodiversity conservation; (2) provide an overview of key ecological impacts of developments in road and rail sectors; (3) Promote partnership for responsible planning of roads and rails in India and countries in South Asia; and (4) encourage global and regional best practice guidance for steering developments in road and rail sector more responsibly. The training programme was jointly organized by Wildlife Institute of India & National Tiger Conservation Authority. In all 40 participants attended the training programme.

Ecological Niche Modelling and Disease Transmission Risk Mapping, Dehradun, 22–26 February 2016. The conceptual framework of Disease transmission risk mapping is at the interface of public health, biogeography, and ecology. This training workshop was conducted to enable the capacity building of research scholars of WII. It was organised by WII, Dehradun. A total of 20 participants took part in the workshop.

International Consultation Workshop on “Enhancing Capacity for Effective Management of Coastal and Marine World Heritage Sites of

the Asia-Pacific Region”, Sunderbans World Heritage Site, West Bengal, 26–28 February 2016.

The workshop was jointly organised by the newly established UNESCO-WHS Category 2 Centre (C2C), WII, Dehradun, GIZ, New Delhi and West Bengal Forest Department at the Sunderbans World Heritage Site. A total of 27 participants from the Asia-Pacific Region, including Natural World Heritage Site managers, PA managers and professionals engaged in conservation of coastal and marine biodiversity, decision makers, NGOs, experts of fisheries attended the workshop. Resource persons from the IUCN, Secretariat of Pacific Region Environment Programme (SPREP), UNESCO-WHS C2C, GIZ, WWF-India, WII, West Bengal Forest Department, etc. provided inputs at this 3-day training workshop.

The main objectives of the workshop were to (1) sensitise the participants to the existing policy and legal issues, international guidelines and framework of management planning with reference to Coastal and Marine World Heritage Sites (WHS); (2) equip the site managers to deal with disaster events and adopt risk reduction strategies; (3) introduce the concept of “climate proofing”, management of climate change and adoption of mitigation measures; (4) share experiences and best practices in Coastal and Marine WHS management in the region; and (5) evolve a road map towards effective management of Coastal and Marine WHS in the region.

Workshop on Publishing Scientific Results, Dehradun, 29 February 2016. This workshop was intended to give clarity in dealing with the publishing process after the scientific results. This training workshop was conducted to enable the capacity building of Research Scholars of WII. The workshop was organised by WII, Dehradun. In all, 61 participants attended the workshop.

Biodiversity Conservation and Rural Livelihood Improvement Project

This World Bank-assisted project of MoEFCC, Government of India is being implemented in partnership with the state forest departments concerned. WII is one of the implementing partners in this project, which is aimed at enhancing the capacities of the project implementers, and is a knowledge management centre for the landscape approach to biodiversity conservation.

The following training course and workshop were conducted under the project during the reporting period:

(1) *Core Training Course on “Landscape Management Approach for Biodiversity*



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Conservation and Human Well-being”, Kanha Tiger Reserve, Madhya Pradesh, 29 February to 4 March 2016. This core training course was organised for Range Officers and frontline professionals of other lines departments. In all, 60 officials of the forest departments of Madhya Pradesh and Maharashtra, handicraft departments, the Zila Panchayats of Chhindwara and Mandla, the National Rural Livelihood Mission (NRLM), Wildlife Conservation Trust and NGOs participated in the training course.

(2) Workshop on “Biodiversity Concerns and Human Well-being: Towards Landscape Approach”, Dehradun, 16–17 March 2016. This was a workshop for senior forest officers. A total of 25 officials of the forest departments of Madhya Pradesh, Gujarat, Kerala and Maharashtra and trainee officers of the P.G. Diploma Course of WII took part in the workshop.

Training programme on 'Economic Valuation of Ecosystem Services' Dehradun, 14–17 March 2016. Valuing ecosystem services by “putting a price on nature” is often regarded as the key argument to increase investments to protect the environment and safeguarding nature as basis for sustainable development. This necessitated the need to offer a training programme to provide participants with the necessary know-how to understand and apply economic valuation methods and instruments correctly, with relevance to their specific policy purpose and based on a sound understanding of the underlying economic principles. The course was also relevant for further building up on the arguments highlighted in the “Economics of Ecosystems and Biodiversity (TEEB)” Initiative for the protection of certain ecosystems and species for human well-being. This training programme was jointly organized by the Wildlife Institute of India and *Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH* at Wildlife Institute of India.

The course was taught by Kim Bonine, Training Director - Conservation Strategy Fund, California and Dr. Alejandro von Bertrab, Advisor – ValuES, GIZ, Germany. Dr. Asha Rajvanshi, Dr. Ruchi Badola and Dr. Sonali Ghosh participated in this course to



subsequently introduce such a course as a part of curriculum of Masters Course and Postgraduate Diploma Course in Advance Wildlife Management conducted at WII's.

The objectives of the training programme were to (1) have a better understanding of some basic economic concepts; (2) be able to contextualize valuation – what, how, and for what? (3) have some knowledge about economic valuation methods -method types, when and how to apply them, advantages and disadvantages of each method, and how to complement them with other methods; and (4) have an understanding on how this knowledge can be integrated or used for policies, other measures or the development of regulatory instruments.

The practitioners from the field of environment and development; technical staff in environmental and planning units of regional governments and municipalities; professionals of varied interest including scientists, professionals, foresters and researchers having diverse background from applied to social sciences and professionals from GIZ offices. In all, 25 participants attended the training programme.

Vinod Verma



Attended by WII Personnel

National Workshop on “Environmental Awareness e-Waste Management”, 4 April 2015. This workshop was organised by the University of Petroleum and Energy Studies (UPES), Dehradun in collaboration with the Uttarakhand State Council for Science & Technology (UCOST). Dr. Manoj Agarwal and Dr. Pranab Pal attended this workshop.

Forest and Environment Ministers Conference at Vigyan Bhawan, New Delhi, 6-7 April 2015.

Dr. V.B. Mathur, Director, WII participated in the Forest and Environment Ministers Conference on 6-7 April 2015 at Vigyan Bhawan, New Delhi.

Fifth meeting of the Multidisciplinary Expert Panel of UN-IPBES in Bonn, Germany, 13-16 April, 2015.

Dr. V.B. Mathur, Director, Wildlife Institute of India has been reappointment as a member of the Multidisciplinary Expert Panel (MEP), for a second term. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) invited Dr. V.B. Mathur in his capacity as Member of the MEP to participate in the 5th meeting of the Multidisciplinary Expert Panel of IPBES at Bonn, Germany from 13-16 April 2015. This MEP meeting was attended by 21 MEP members and 16 observers, including 8 Bureau members, 4 representatives from UN agencies and 4 MEA representatives. It took place at the headquarters of the IPBES Secretariat, in the UN campus in Bonn.

This was the first meeting of the newly elected regular UN-IPBES MEP in which Dr. V.B. Mathur had the opportunity to deliberate on various matters relating to IPBES Work Calendar and also to select the experts for the Asia Pacific Regional Biodiversity Assessment. During this meeting Dr. V.B. Mathur was also elected as the Regional Vice Chair for the Asia Pacific Region. The candidature was unanimously selected with proposal from Japan which was seconded by China and Malaysia. 232 experts had sent their nominations of which 115 were selected of which 23 are from India and 6 from WII. All these experts will be invited to the First Authors Meeting in Tokyo, Japan from 17-21st August, 2015. It is a matter of great pride that Indian expertise and contributions are being duly recognized by UN-IPBES.

35th Annual Conference of the International Association of Impact Assessment (IAIA) on Impact Assessment in the Digital Era, Florence, Italy, 20-23 April, 2015. Dr. Asha Rajvanshi and Dr. Vinod B. Mathur attended the IAIA's

international conference. They chaired and co-chaired concurrent session 'Digital biodiversity data for fast-tracking impact assessment' under IAIA section: Biodiversity and Ecology. Dr. Mathur and Dr. Rajvanshi also provided inputs in the following technical sessions: (1) presented the paper on 'Digital biodiversity data for EIA decision making' in concurrent session Digital biodiversity data for fast-tracking impact assessment under IAIA section: Biodiversity and Ecology; (2) presented the paper on 'Impacts of NH-7: Lessons for conservation' in concurrent session on 'Mitigation hierarchy best practices for roadways under IAIA section: Biodiversity and ecology'. (3) Presented the paper on 'SEA Capacity development in India' in concurrent session towards a systems approach to SEA capacity development: Lessons learned under IAIA section: SEA.

It was organised by International Association of Impact Assessment (IAIA). The participation of the WII representatives was supported by GIZ under Indo-German Environment Partnership (IGEP) Programme.

Training on Remote Sensing: An Overview for Decision Makers, Indian Institute of Remote Sensing (IIRS), Dehradun, 15–18 June 2015. This training programme was specially designed for decision makers at senior levels in government departments and the private sector. The main objective was to provide a broad overview of recent trends in geospatial technologies (remote sensing, GIS, GPS) and their applications in natural resource management, disaster management support, infrastructure projects, environmental monitoring, etc. Dr. Sonali Ghosh and Dr. Panna Lal attended this programme.

Management Group Meeting for the IPBES Regional Assessment on Biodiversity and Ecosystem Services for the Asia-Pacific, Tokyo, Japan, 17-19 June 2015.

The Chair of the Board of Directors, Institute for Global Environmental Strategies (IGES), Japan invited Dr. V.B. Mathur, Director, Wildlife Institute of India to participate in the Management Group Meeting for the IPBES Regional Assessment on Biodiversity and Ecosystem Services for the Asia-Pacific from 17-19 June 2015 at Tokyo, Japan. The purpose of this meeting was to (a) Complete the selection of the Lead Authors of the Regional Assessment, (b) Discuss the detailed scope of each chapter, to develop an Implementation Plan for the Asia-Pacific Regional Assessment, and (c) Prepare the agenda of the First Authors Meeting scheduled in August 2015.

232 experts had applied from the countries of the Asia Pacific region for selection as CLAs and LAs for

S. No	Name	Designation	Category	Assessment chapters
1	Dr. Gopal Rawat	Scientist G	Coordinating Lead Author	Chapter 3
2	Dr. Asha Rajvanshi	Scientist G	Coordinating Lead Author	Chapter 2
3	Dr. Ruchi Badola	Scientist G	Lead Author	Chapter 5
4	Dr. Malvika Onial	Scientist E	Lead Author	Chapter 6
5	Dr. Gautam Talukdar	Scientist D	Lead Author	Chapter 1
6	Dr. Sonali Ghosh	Scientist E	Young Fellow	Chapter 5

the Biodiversity Assessment in the region. Dr. V.B. Mathur was part of the selection process and after applying rigorous protocols including competence, geographic and gender balance. 26 Experts were selected from India of these 6 are from the Wildlife Institute of India.

As indicated above, Dr. Sonali Ghosh, Scientist, WII (at serial No. 6) above has been selected as on IPBES Young Fellow for the Asia-Pacific Regional Biodiversity Assessment. It is a matter of grate pride both India and WII that experts have been selected on the basis of a very competitive process.



39th Session of the UNESCO World Heritage Committee, Bonn, Germany, 28 June, 2015 to 8 July, 2015

The 39th Session of the UNESCO World Heritage Committee (WHC) was organized from 28 June, 2015 to 8 July, 2015 in Bonn, Germany. India is currently a member of the 21-member WHC.

India not only participated as a World Heritage Committee (WHC) Member in the 39th Session of the World Heritage Committee of UNESCO at Bonn, Germany held from June 28–July 8, 2015 but was also proactive as the Vice Chair & Bureau member in the WHC. In the role of Vice Chair, Ms Ruchira Kamboj, Permanent Representative of India to UNESCO also chaired the 39th World Heritage Session on several occasions. Her interim chairpersonship during the session was appreciated by a several other member states and helped in creating a strong presence of India at the 39th World Heritage Session. This was the fourth and last session that India attended as a Committee Member

in its term (2011-2015) since it got elected as a member in the 21 member Intergovernmental World Heritage Committee of UNESCO in Nov. 2011.

The Indian delegation was led by the Director General, Archaeological Survey of India from 1st July -3rd July and Additional Secretary, Ministry of Culture from 4th July- 8th July. It further comprised of the Permanent Representative of India to UNESCO, representatives of the Ministry of Environment, Forest and Climate Change and Member Secretary of the Advisory Committee on World Heritage Matters (ACWHM).

As in the past three sessions, India continued to play a crucial role in this World Heritage Session as a Committee Member even in this last session with several interventions pertaining to new nominations, State of Conservation reports of existing World Heritage properties, working methods of the Advisory Bodies, adoption of changes in the Operational Guidelines, Budget and other matters.



National Database for Emergency Management (NDEM) Regional Training Programme—North, Dehradun, 2 July 2015. This programme was organised by the National Remote Sensing Centre (NRSC), Hyderabad and Uttarakhand Space Application Centre (USAC), Dehradun at USAC, Dehradun. The main objective of the NDEM is to develop decision support system (DSS) tools for addressing disaster/emergency management by establishing computer infrastructure to facilitate network connectivity, data ingestion, validation, GIS database organisation, data dissemination and service hosting. Shri Rajesh Thapa participated in this programme.

Training on Management Development Programme (MDP) on Public Procurement, Faridabad, 29 June to 4 July 2015. This programme was conducted at the National Institute of Financial Management, Faridabad. Lectures were held on equipment procurement and case studies by various distinguished resource persons from different central government departments and organisations. During the training programme, two hands-on sessions on online procurement through the Central Public Procurement Portal (CPPP) were also conducted. The training was ended with an open session in which participants shared their knowledge. Dr. Manoj Agarwal and Shri Harendra Kumar attended this programme.

GBIF Asia Nodes Meeting at Lienhuachih Research Center, Taiwan Forestry Research Institute (TFRI), Taiwan, 29 June to 3 July 2015. The objective of the meeting was to review and update the regional strategies and work programme. It was organised by the Global Biodiversity Information Facility (GBIF). The discussions were anchored on the GBIF framework and strategy, given the region's circumstances of data availability, lack of membership and gaps in data integration. A survey was proposed to grasp the current status of biodiversity informatics in Asian countries. Strategies to promote data publication and pursue larger-scale contributions of data from the Asian region were suggested.



Consultation meeting on “First Authors Meeting for the IPBES Regional Assessment on Biodiversity and Ecosystem Services for the Asia-Pacific”, Tokyo, Japan, 17–21 August 2015. Dr. Asha Rajvanshi was selected as one of the experts for the assessment of Asia-Pacific region, based on the nomination sent by the Ministry of Environment, Forest and Climate Change (MoEFCC), Govt. of India, and was nominated as one of the Coordinating Lead Authors (CLA). In the capacity as a CLA, Dr. Rajvanshi was responsible for coordinating chapter 2 of the Asia Pacific assessment report. She participated in First Authors Meeting for the Asia-Pacific Regional Assessment. The purpose of this meeting was to become familiar with the members of the assessment team (Secretariat, TSU, CLA and LA by chapter – Co-chairs) understand the IPBES Conceptual Framework, determine the overall content of the Asia-Pacific regional assessment and agree on the scope of the contents, responsibilities and timeline of activities towards the production of the Regional Assessment Report.



As one of the three Coordinating Lead Authors, Dr. Rajvanshi participated in the Author's workshop and steered the discussions for the development of the chapter 2 outline and identification of author responsibilities. The meeting was organised by Intergovernmental Science Policy Platform for Biodiversity and Ecosystem Services (IPBES). The Fund support for participation in the workshop was provided by the Institute for Global Environmental Strategies (IGES).

Event of "Signing of Agreement between UNESCO and Government of India for the establishment of UNESCO Category 2 Centre for World Natural



Heritage Management & Training for Asia and the Pacific Region at Wildlife Institute of India, Dehradun", New Delhi, 18 August, 2015.

Dr. V.B. Mathur, Director, WII participated in the event of "Signing of Agreement between UNESCO and Government of India for the establishment of UNESCO Category 2 Centre for World Natural Heritage Management & Training for Asia and the Pacific Region at Wildlife Institute of India, Dehradun" on 18 August, 2015.

Workshop on the National Skill Qualification Framework (NSQF) Implementation, FICCI Federation House, New Delhi, 11 September 2015. The workshop focused on discussing the issues of NSQF implementation across India and throughout education and training systems, thus improving the understanding of NSQF functions and carving the way forward for developing stakeholder cooperation further. It was organised by the Ministry of Skill Development & Entrepreneurship, Government of India.

The Ministry of Skill Development & Entrepreneurship, Government of India is trying to develop criteria for certification of different semi-skilled/skilled personnel. To organise this manpower and provide the necessary certification for different skills is the purpose of this initiative. Because of this, the unorganised sector will have better opportunities for employment nationally and internationally. Dr. A.K. Bhardwaj and Shri K.K. Shrivastava attended the workshop.

Meeting of the Informal Advisory Group (IAG) concerning cooperation among the biodiversity-related conventions, Geneva, Switzerland, 17-18 September 2015

The CBD Secretariat requested Dr. V.B. Mathur, Director, Wildlife Institute of India to Chair the Informal Advisory Group. Dr. Mathur participate in the Meeting of the Informal Advisory Group (IAG) concerning cooperation among the biodiversity-related conventions at Geneva, Switzerland from 17-18 September 2015. This was the first time when Director, Wildlife Institute of India as a representative

of the Ministry of Environment, Forest & Climate Change, Government of India was invited to Chair an important meeting in which Chief Executives of the 7 Biodiversity-related UN Conventions participated. The IAG meeting led to deliberations on how to further build synergies between conventions and also to prepare a road map for enhancing their effectiveness. It was great honour for India and the interventions of the u/s, based on experience of understanding of various biodiversity related conventions were very well received and have become part of the Minutes of the IAG meeting.

Conference on Mountain of Our Future Earth, Perth, Scotland, 3–8 October 2015. Dr. V.P. Uniyal participated in this conference, organised at the University of the Highlands and Islands, Perth College, Centre for Mountain Studies, Perth, Scotland.

Global Biodiversity Information Facility (GBIF) Governing Board (GB-21) Meeting and Associated Events, Madagascar, 4–11 October 2015. The objective of the meeting was to frame the strategies and work programme. The meeting was organised by GBIF. The Governing Board of GBIF gathers once a year for the official Governing Board Meeting, which runs over 3 days, and about 100 international delegates attended the meeting. The meeting focused on the science work programme, the previous year's financial statements and the auditors' report. In addition to the official Governing Board meeting, other events were also organised, such as the Ebbe Nielsen Prize ceremony, presenting the Young Researchers Award, electing officers, approving the following year's budget, a symposium on innovative research and uses of GBIF mediated data. Dr. G. Talukdar attended the meeting.

6th Multidisciplinary Expert Panel meeting of the UN-IPBES, Bonn, Germany, 8-12 October, 2015.

The Executive Secretary, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) invited Dr. V.B. Mathur, Director, Wildlife Institute of India to participate in the 6th Multidisciplinary Expert Panel meeting of the UN-IPBES from 8-12 October, 2015 at Bonn, Germany.



White-bellied Heron Workshop, Bhutan, 1–4 December 2015. The objective of the workshop was to refine the Species Conservation Strategy for conservation of the white-bellied heron. It was organised by the IUCN—White-Bellied Heron Specialist Group and Synchronicity Earth, London. The Chair, IUCN Species Survival Commission and the Director, International Crane Foundation chaired the workshop. Delegates from species-range countries participated in the workshop. As part of a delegation, Dr. J.A. Johnson made a presentation titled “Himalayan Fish Fauna: Issues and Challenges”.

'Convention of Biodiversity (CBD) Workshop for South, Central and West Asia on achieving Aichi Biodiversity Targets 11 and 12', New Delhi, 7–10 December, 2015.

Dr. V.B. Mathur, Director, WII participated in the 'Convention of Biodiversity (CBD) Workshop for South, Central and West Asia on achieving Aichi Biodiversity Targets 11 and 12', New Delhi, 7–10 December, 2015.



Workshop of Convention of Biological Diversity (CBD) Informal Advisory Group (IAG) on Synergies among the biodiversity-related conventions, Geneva, Switzerland, 8–11 February, 2016.

The UN Convention on Biological Diversity (CBD) has established an 'Informal Advisory Group (IAG)' to promote synergies and cooperation amongst the seven biodiversity related Conventions. India is one of the ten countries that are member of



IAG. The Executive Secretary, UN CBD invited Dr. V.B. Mathur, Director, Wildlife Institute of India to Co-Chair a workshop convened by the IAG from 8–11 February, 2016 at Geneva, Switzerland.

The IAG workshop provided a unique opportunity for India to share the experience of promoting synergies among seven biodiversity-related convention. In addition to Co-Chairing the IAG workshop, the u/s contributed significantly to the deliberations in two Working Groups viz. 'Information and Knowledge Management' and 'Awareness Raising and Communications'. The outcomes of the IAG meeting would be presented in the first meeting of the Subsidiary Body for Implementation (SBI) in May, 2016 at Montreal and also shared in the Side Event during the SBI meeting.

1985 Batch IFS Officers Workshop, Dehradun, 11–12 February 2016. This workshop is part of the in-service capacity building initiative of the Government of India. The workshop is for IFS officers with 30 years of service. It was organised by MoEFCC, Government of India at Indira Gandhi National Forest Academy, Dehradun. Dr. A.K. Bhardwaj attended this programme.

Fourth Session of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services, Kuala Lumpur, Malaysia, 22 to 28 February 2016

The fourth session of the Plenary of the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) was held from 22–28 February 2016 in Kuala Lumpur, Malaysia. The meeting was preceded by the regional consultations on 20–21 February 2016. Nearly 600 participants attended the meeting, representing IPBES member and non-member governments, UN agencies and convention secretariats, intergovernmental organizations, non-governmental organizations and various stakeholder groups.

From Indian side, Shri Hem Pande (team leader), Special Secretary, Ministry of Environment, Forest and Climate Change, Dr. V.B. Mathur, Director, Wildlife Institute of India and Dr. Ritesh Joshi, Joint



Director, Ministry of Environment, Forest and Climate Change participated in the meeting. Dr. Mathur participated in the meeting as the Member of Multidisciplinary Expert Panel (MEP) of the IPBES.

Dr. V.B. Mathur as IPBES-MEP member participated in the daily meetings of the MEP members convened to discuss responses to deliberations taking place in the Plenary and Contact Groups. He also contributed as a panelist on the agenda item pertaining to the 'Task Force on Capacity Building'.

National Conference, "Hill Agriculture in Perspective" (HAP-2016), Pantnagar, Uttarakhand, 26–27 February 2016. Dr. S. Sathyakumar was the invited speaker at this conference, organised by the G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand. He delivered a talk titled "Human–Wildlife Interactions (Conflicts) in the Indian Himalayan Region: Current Scenario and the Path Ahead".

IIRS Users Interaction Meet—2016, IIRS, Dehradun, 18 February 2016. The focus of the meet was to understand the present and future requirements of the industry, skill gaps and strategy required to meet the demand–supply gap in human resource development. Dr. Panna Lal and Dr. Manoj Agarwal participated in this meet.

Uttara Bio-fest 2016, Dehradun, 18–19 March 2016. Dr. V.P. Uniyal participated in the National Conference on Natural Resource Management Avenues and Application (NRMAA), Dehradun.

National Workshop on Taxonomic Keys and Identification of Flora and Fauna including Molecular Tools, Hardwar, 28 March 2016. Dr. V.P. Uniyal attended this national workshop, held at Gurukul Kangri University, Hardwar.

Study Tours and Visits

Participation of WII Faculty Members in IPBES—First Authors' Meet for Regional Assessment of Biodiversity and Ecosystem Services, Tokyo, Japan, 17–21 August 2015. The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES; www.ipbes.net), a newly established independent intergovernmental body to provide for science policy interface for biodiversity and ecosystem services for conservation and sustainable use, long term human well-being and sustainable development is currently assessing the status and trends in biodiversity and ecosystems globally. On the basis of the recommendations of the MoEFCC and the approval of the Chairman, WII's Governing Body, Dr. Gopal Rawat, Dr. Asha Rajvanshi, Dr. Ruchi Badola, Dr. Gautam Talukdar and Dr. Sonali Ghosh participated in the first authors meeting, "Assessment of Status and Trends of

Biodiversity and Ecosystem Services", for the Asia Pacific region, organised by IPBES at United Nations University, Tokyo, Japan between 17 and 24 August 2015.

The meeting was attended by more than 150 experts and professionals from the Asia Pacific region. In addition to the WII faculty members, some experts representing the Zoological Survey of India, ICAR, IISc and GBPIHED also participated in the meeting. The meeting provided the participants an excellent opportunity to understand the process of making global assessments, networking among the leading experts in their respective fields and contributing to scientific assessments for the science policy interface.

Regional Consultation on Sustainable Grassland and Pasture Management in Asia, Lanzhou University, China, 27–30 November 2015. The Food and Agriculture Organization of the United Nations (FAO), in collaboration with Lanzhou University, China, Animal Production and Health Commission for Asia, and Global Agenda for Sustainable Livestock, organised a 3-day regional consultation on sustainable grassland and pasture management in Asia. The major objective of the workshop was to make a regional assessment of the status and prospects of grassland restoration in Asia and identify pathways towards the development of site-specific and holistic policies and programmes for grassland restoration that take into account the array of ecosystem services provided by the grasslands.

Dr. G.S. Rawat, Dean FWS participated in this workshop as an expert from India. The deliberations of the workshop and various sessions were highly relevant to India's current efforts in biodiversity conservation and sustainable management of grassland ecosystems. He participated in various sessions and also chaired one session on country presentations from India, Pakistan, Bhutan and Nepal. The concluding session deliberated on a possible action plan for grassland restoration and key messages for the policy makers. It was unanimously agreed that grassland ecosystems have to be managed for multiple functions including biodiversity, ecosystem services and socio-cultural values. Therefore, the national governments need to formulate appropriate policies and programmes through local people's participation. The rangeland countries also need to devise mechanisms to empower pastoral communities and recognise their role as custodians of the rangeland resources and mainstream payment for ecosystem services (PES) through local institutions.



**PROFESSIONAL
SUPPORT**

International Collaboration

Global Biodiversity Information Facility

The Global Biodiversity Information Facility (GBIF) was established in March 2001 as an open-ended international coordinating body to promote compilation, linking, standardisation, digitisation and dissemination of the world's biodiversity data in the form of a distributed open access system, within an appropriate framework for property rights and due attribution. India had signed the third memorandum of understanding (MoU) with GBIF, for 2012–2016 (5 years) which has now expired and needs to be renewed. India has published 69,068 records in GBIF through eight occurrence data sets and one checklist data set.

WII conducted several activities related to biodiversity informatics such as (1) conducting a workshop, “Publishing Science and Data Papers”, on 29 February 2016 at WII, (2) conducting a 1-week workshop on biodiversity informatics with respect to niche modelling and spatial epidemiology, from 22 to 26 February 2016 at WII; (3) sorting out licensing issues for all the data sets hosted from the WII Integrated Publishing Toolkit according to the new GBIF guidelines; and (4) submitting a joint proposal, “Biodiversity Informatics Cookbook”, to the GBIF—Biodiversity Information Fund for Asia in collaboration with Taiwan, Japan and Philippines. This proposal got funded, and GBIF-Taiwan is leading the initiative.

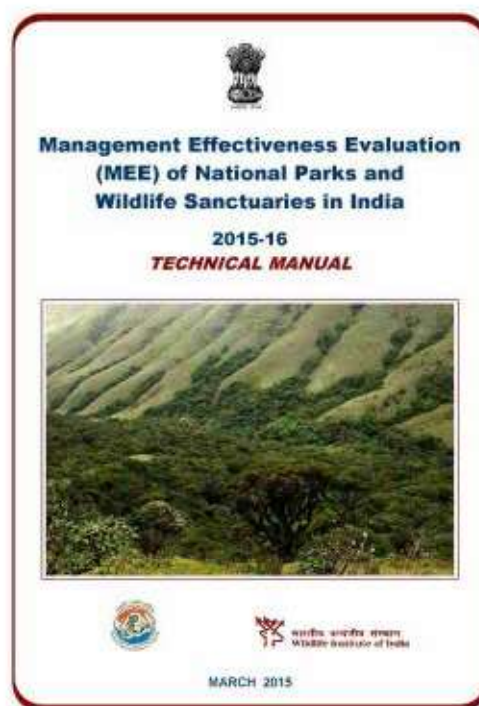
Dr. Gautam Talukdar attended the Asian Regional Meeting of the GBIF Participant Nodes at Tagaytay, Philippines from 27 June to 1 July 2016 to (1) discuss the ongoing GBIF—Biodiversity Information Fund for Asia (BIFA) projects in Asia; (2) review the strategies and work programme for regional collaboration; (3) agree on the realistic components of an Asia Regional Plan of Action; (4) formulate suggestions to prioritise different work areas for the 23rd meeting of the GBIF Governing Board; and (5) nominate a regional representative.

The strategies and outcomes of this meeting were communicated to the 23rd Governing Board Meeting of GBIF, which was held in October 2016 in Brazil.

Services

Management Effectiveness Evaluation (MEE) of Protected Areas in India (2015-16)

The Ministry of Environment, Forest and Climate Change, Government of India assigned the responsibility of technical backstopping of Independent Management Effectiveness Evaluation (MEE) of 40 Protected Areas in India. The Institute prepared a Technical Manual to guide the MEE process.



Management planning of Kusheshwar Asthan and Baraila Wetlands, Bihar

Investigators: Dr. S.A. Hussain, Dr. R. Badola, Dr. Bitapi C. Sinha, Dr. G. Talukdar and Dr. Gopi G.V.

Researchers: Michelle Irengbam, Tanveer Ahmed, Aftab Usmani, Devendra Kumar and Shasank Arya

Objectives: The objectives of the project are to (1) study the wetland–society linkages, resource dependence, and attitude of the local communities; (2) devise management strategies for the conservation and sustainable use of the Kusheshwar Asthan and Baraila wetlands and their resources; and (3) formulate these strategies in the form of a management plan.

Progress and Outcomes: The Kusheshwar Asthan and Baraila wetlands, located in north Bihar, are among the few remnant wetlands of the Lower Gangetic Plains. These wetlands not only perform essential ecosystem services to the surrounding environment but also play a significant role in providing livelihoods, fuel, fodder and food to the local communities living near it. Overexploitation and other anthropogenic pressures have caused degradation of these important wetlands. Therefore, it was important to devise strategies for sustainable use and management of these wetlands. The management plans for both the wetlands, viz., Kusheshwar Asthan and Baraila, were submitted in January 2016. The management strategies were formulated after extensive field work and data collection, compilation and analysis. Stakeholders' workshops were held in August 2015 at both the sites. A state-level stakeholders' consultative workshop was also organised at Patna, wherein the progress of the project was discussed and recommendations were made by the officials of the Environment and Forest Department, Patna and representatives from other government departments. Draft strategies were presented and refined at these meetings, taking the suggestions from stakeholders into consideration.

As a major part of both the wetlands comprises privately owned lands and only a small part consists of government-owned lands (less than 5% in both the wetlands), it was recommended that both the wetlands be notified as community reserves, keeping the sanctuary areas (government owned) as core areas (Minimum Intervention Zone) and dividing the remaining privately owned areas into Sustainable Use Zones, Tourism Zones and Ecological Restoration Zones. Proper demarcation of the wetland boundaries and formation of eco-development committees (EDCs) were also recommended. The management plans had three parts, and they were proposed for a period of 10 years (2016–2026), with a mid-term review after 5 years (in 2021).

Milestones: The draft management plans were submitted in January 2016. A poster titled “Wetlands Within Human-Dominated Landscapes: Linking Wetland Conservation with Local Livelihoods in Bihar, India” was presented at the workshop “Forests Within Landscapes: Connecting Forests with Farming Systems” conducted jointly by WII, Foundation for Ecological Security (FES), United States Forest Service and Forest PLUS.

Biodiversity Conservation and Rural Livelihoods Improvement Project (BCRLIP)

Funding Source: IDA and GEF through World Bank

Objectives: Recognising the need for integrating conservation and development for biodiversity conservation and human well-being, the Biodiversity Conservation and Rural Livelihood Improvement Project (BCRLIP) was designed using learnings and knowledge from earlier participatory programmes, from both India and abroad. Accordingly, the Project Appraisal Document (PAD) defines BCRLIP as an implementation programme “to develop and promote new models of conservation at the landscape scale through enhanced capacity and institution building for mainstreaming biodiversity conservation outcomes”. The BCRLIP Global Environmental Objective is “to enhance the conservation of globally significant biodiversity and ensure its long-term sustainability by promoting appropriate conservation practices in biodiversity-rich landscapes”.

For effective implementation of BCRLIP, the objective is broken down into four components:

- Component 1 : Demonstration of landscape conservation approaches at two pilot sites
- Component 2 : Strengthening knowledge management and national capacity for landscape conservation
- Component 3 : Scaling up and replication of successful models of conservation in additional landscapes
- Component 4 : National coordination for landscape conservation

For the implementation of Component 1, four landscape demonstration sites, namely the Askot Landscape, in Uttarakhand, the Little Rann of Kutch (LRK), in Gujarat, the Satpura Landscape, in Madhya Pradesh and Maharashtra, and the Agasthyamalai Landscape, in Tamil Nadu and Kerala, were selected. For Component 2, WII was identified as the Knowledge Management Centre, and the Gir Conservation Area, in Gujarat, Periyar Tiger Reserve, in Kerala, and Kalakkad–Mundanthurai Tiger Reserve, in Tamil Nadu, were selected for Field Learning Centres for dissemination of the knowledge acquired on integration of conservation and development. MoEFCC will be the National Coordinator implementing Component 4.

Progress: Ecological Mapping and Biological

Indicator Works: In June 2015, an expedition to Chipla Kedar, Pithoragarh District was conducted for collection of primary data on the caterpillar fungus, which could help conservation strategies including

participatory resource management and conservation awareness among local communities in Uttarakhand.

A high-altitude mammal survey across the entire landscape was conducted in June 2015. The survey was carried out in expedition mode, and the methodology followed was vantage point scan sampling and trail walking. Information was collected from direct sightings of Himalayan tahr, Himalayan musk deer, blue sheep, Himalayan black bear, Himalayan marmot, Himalayan stoat and wolf and from indirect evidence for snow leopards. A camera-trapping exercise is being carried out to assess mammal communities in the Ghosi Gad micro-watershed of Gori Valley, in the Askot Landscape, Uttarakhand. This area is one of the four pilot sites selected as representative of the entire landscape. After a preliminary survey of the pilot sites from October 2015 to January 2016, 60 camera traps were deployed in a systematic grid methodology covering the entire micro watershed area. The exercise revealed the presence of a female tiger. The tigress was photographed on 4 March 2016 at three locations 1 km apart at elevations of 2899 m, 2979 m and 3274 m. This is the highest elevational record of the tiger in Uttarakhand as well as in India.

Workshops conducted during 2015–2016

Local-Level Consultative Workshop, Dehradun, 15 May 2015. A local-level consultative workshop for improving the proposed curricula for core training courses was organised in WII, in which 22 participants from the Uttarakhand Forest Department, Indian Council of Forestry Research and Education, Central Academy for State Forest Service and Indira Gandhi National Forest Academy, Dehradun took part.

Vertical Integration Training in Tiger Reserve Management, Dehradun and Kanha Tiger Reserve, Madhya Pradesh, 8–20 June 2015. The objectives of the training were to (1) understand the ecological aspects, current status and related issues of tiger conservation; (2) provide inputs on essential components of managerial intervention including techniques required for management of tiger reserves; and (3) share experiences and good practices in tiger conservation.

The training was organised by WII, Dehradun and sponsored by the National Tiger Conservation Authority, MoEFCC, New Delhi. A total of 26 participants attended the training programme.

Training in Population Estimation and Monitoring of Tigers, Prey and Their Habitat, Dehradun, 3–14 August 2015. The main

objective was to impart training on the software programme of the tiger monitoring. It was organised by WII, Dehradun and sponsored by the SFRI, Jabalpur, Madhya Pradesh; Periyar Tiger Conservation Foundation, Kerala; and the Karnataka Forest Department. Sixteen participants attended the training programme.

Training Programme for Frontline Professionals on Landscape Management Approach for Biodiversity Conservation and Human Well-being, Thekkady, Kerala, 13–17 October 2015. One core training course on was organised for Range Officers and frontline professionals of other line departments, in which 35 participants from the forest departments of Kerala and Tamil Nadu and local communities participated. The objectives of the programme were (1) to understand the importance of biodiversity, PAs and potential threats to the PA network; (2) to disseminate the core concept of the landscape approach to biodiversity conservation and human well-being; (3) to share the existing experience of linking biodiversity conservation and sustainable livelihoods; and (4) to discuss a framework for mainstreaming conservation in development for landscape management. It was organised by WII, Dehradun in association with the Kerala Forest and Wildlife Department and Periyar Tiger Conservation Foundation under the BCRLI project.

Core Training Course on “Landscape Management Approach for Biodiversity Conservation and Human Well-being”, Chhindwara, Madhya Pradesh, 19–21 November 2015. A core training course for mid-level officers was organized, in which 64 participants from the Madhya Pradesh Forest Department; Veterinary Department; Agriculture Department; Government Autonomous P.G. College, Chhindwara; press/media; NGOs; and the Maharashtra Forest Department took part.

The objectives of the training programme were (1) to understand the concept of biodiversity and PAs and the importance of the landscape approach for human well-being and biodiversity conservation; (2) to share the existing experience of linking biodiversity conservation and sustainable livelihoods; and (3) to discuss a framework for mainstreaming conservation in development for landscape management.

One-Week Compulsory Training Programme of IFS Officers on “Ecodevelopment for Biodiversity Conservation: Assessment and Way Forward”, Dehradun, 7–11 December 2015. The objectives of the training programme were (1) to understand the concept and evolution of the eco-development programme in India; (2) to discuss the relevance of this approach in biodiversity conservation; (3) to discuss and debate the strengths and weaknesses of the ongoing eco-development initiatives; and (4) to

suggest possible future interventions for making the programme more effective.

It was organised by WII, Dehradun and sponsored by MoEFCC, Government of India. A total of 13 officers attended the training programme.

Training Programme on “Landscape Management Approach for Biodiversity Conservation and Human Well-being”, Kanha Tiger Reserve, Madhya Pradesh, 29 February to 4 March 2016. The core training course was organised by WII, Dehradun in association with the Madhya Pradesh Forest Department under the BCRLI project for Range Officers and frontline professionals of other line departments. A total of 60 participants from the forest departments of Madhya Pradesh and Maharashtra, the Handicraft Department, District Panchayats, Chhindwara and Mandla, Madhya Pradesh, the National Rural Livelihood Mission (NRLM), Madhya Pradesh, Wildlife Conservation Trust and NGOs participated in the training course. The objectives of the training programme were (1) to provide an understanding of the importance of biodiversity and PAs and potential threats to the PA network; (2) to disseminate the core concept of the landscape approach to biodiversity conservation and human well-being; (3) to share the existing experience of linking biodiversity conservation and sustainable livelihoods; and (4) to discuss a framework for mainstreaming conservation in development for landscape management.

Two-Day Training Programme on “Biodiversity Concerns and Human Well-being: Towards Landscape Approach”, Dehradun, 16–17 March 2016. This workshop was organized for senior forest officers. A total of 25 participants from the forest departments of Madhya Pradesh, Gujarat, Kerala and Maharashtra and Diploma trainees of the institute participated. It was organised by WII, Dehradun under the BCRLI project. The objectives of the training programme were (1) to discuss the concept and related issues of the landscape conservation approach to biodiversity conservation and human well-being; (2) to share the experiences of ongoing landscape management initiatives at the implementation sites and beyond; and (3) to understand the issues and challenges of ongoing landscape conservation initiatives and discuss possible strategies for effective implementation.

Training Programme for Frontline Staff of Haryana Forest Department on “Community Participation in Biodiversity Conservation, Habitat Assessment and Microplanning”, Pinjore, Haryana, 18–19 March 2016. The objectives of the workshop were to (1) understand the concept and approach of biodiversity

conservation and issues related to local communities; (2) apprise the participants about the fundamental principles of community participation in biodiversity conservation planning and implementation; (3) discuss the process and framework of village microplanning for biodiversity conservation programmes; and (4) provide a hands-on understanding of the basic techniques of habitat assessment and monitoring.

It was organised by WII, Dehradun and sponsored by the Haryana Forest Department. In all, 40 participants took part in the workshop.

Technical Support for Preparation of State Biodiversity Action Plan for Meghalaya

Funding Source: Meghalaya Forest Department

Investigators: Dr. V.B. Mathur, Dr. G.S. Rawat and Shri S. Lyngdoh

Project Associate: Dr. Rishi Kumar

Date of Initiation: July 2015

Date of Completion: July 2016

WII, in close collaboration with the Meghalaya State Biodiversity Board, is currently preparing a comprehensive State Biodiversity Action Plan (SBAP) for the state. The state represents one of the richest and unique biogeographic regions in India. With almost 55% of its area under forest cover and with three distinct bio-cultural sub-divisions, viz., Khasi, Garo and Jaintia hills, the state has been the centre of attraction for a large number of naturalists, bio-geographers and explorers since the 18th century. The preparation of the SBAP involves (1) a desktop review of the existing information on the flora and fauna of the state, including rare, endemic and threatened taxa and causes of threats; (2) a review of the PA coverage, gaps and their management effectiveness; (3) documentation of cultural and traditional practices that support biodiversity conservation for upscaling such practices as maintaining sacred groves; (4) performing rapid assessments of threats to biodiversity hotspots and eco-sensitive areas and developing mitigation strategies; (5) carrying out stakeholder consultations at the local, sub-divisional and state levels; (6) mapping departments/agencies that have a bearing on biodiversity conservation in the state (as undertaken at the national level in updating the NBAP) and that are relevant in the context of National Biodiversity Targets (NBTs); (6) redefining the NBT monitoring framework in the context of Meghalaya and identifying organisations/institutions for monitoring and reporting; and (7) prioritisation of activities according to the NBTs.

Management Effectiveness Evaluation of PAs of Sikkim

Funding Source

Sikkim Biodiversity Conservation & Forest Management Project, Department of Forest, Environment & Wildlife Management, Forest Secretariat, Deorali, Gangtok

Investigators: Dr. Anil Bhardwaj, Dr. S. Sathyakumar, Shri Ajay Srivastava and Dr. Pratap Singh

Researchers: Nasim Ahmad Ansari

Date of Initiation: October 2014

Date of Completion: Dec 2015, extended up to July 2016

Objectives: The objectives of the project are to (1) to build the capacity of core team of officers and staff of the Department in the area of Management Effectiveness Evaluation (MEE) and PA management planning; (2) to undertake the Management Effectiveness Evaluation (MEE) of PAs of State Sikkim; and (3) to understand the strengths and weaknesses of existing management of PAs and suggest improvements.

Progress: Training programme, field work and data analysis for Management Effectiveness Evaluation of Protected Areas of Sikkim have been completed and subsequently incorporated in the final report. The final report has been officially submitted to funding agency in February 2016.



Nasim Ahmad Ansari

Outputs and Outcomes: After the analysis of findings and results, an overall mean MEE score of 55% have been recorded of PAs of Sikkim. Out of total 8 PAs evaluated, 4 PAs each in 'Good' and 'Fair' category of MEE rating. Khangchendzonga National Park has the highest MEE score of 62.50% while Fambong Lho Wildlife Sanctuary has the lowest MEE score of 46.67%.

Milestones: This project provides an insight about the overall assessment of PAs of the State; strengths and weaknesses of their management and possible way forward for improvement in the working of different PAs. Also highlighted overall issues of PA management in the State and what policy level and institutional reforms are needed to strengthen biodiversity conservation initiatives of the State.

Nasim Ahmad Ansari



Cells

Environmental Impact Assessment Cell

The Environmental Impact Assessment (EIA) Cell of WII continued to undertake R&D related studies, provide professional support in capacity building initiatives at WII and other institutions; professional bodies; and Government and corporate organizations. Efforts of networking with global and regional institutions and collaborations with international agencies also continued to expand and diversify.

IAIA Endorsement of WII Training Courses

WII has made conscious efforts to deliver world class training in the field of impact assessment both internationally and nationally. The courses taught by two trainers Dr. Asha Rajvanshi and Dr. Vinod B. Mathur in past three years were vetted and ranked for high quality by the Training & Professional Development Committee (TPDC) of International Association for Impact Assessment, the leading global network on best practice in the use of impact assessment. Based on this evaluation the two trainers became eligible to receive IAIA endorsement for delivery of identical courses outside IAIA meeting or conference venues. WII has been successful in receiving the endorsement of IAIA, for training courses taught at WII that would be identical to courses taught by the same trainers. The endorsement would entitle us to use IAIA logo on all promotional material and on the certificates awarded to the participants at WII over the next three years. One such course that had IAIA endorsement has already been taught and more are being planned on several different themes over the next three years.

Research and Development Efforts

The EIA Cell undertook Research and Development efforts in promoting and validating impact assessment approaches for strengthening biodiversity conservation. This involved undertaking short term research study on Assessment of the compatibility of the development plans and land-use patterns with the objectives of biodiversity conservation and resource planning in the Munnar landscape and suggesting measures to enhance project outcomes.

The UNDP initiated the India High Range Landscape Project to develop an effective multiple-use management framework for conserving biodiversity in the mountain landscape of the High Ranges, the Western Ghats, India.

Wildlife Institute of India was invited to undertake the study on one of the specific component of the project that relates to the assessment of the compatibility of the development plans and land-use patterns with the objectives of biodiversity conservation and resource planning in the Munnar landscape.

The overall aim of this study was to understand the natural and socio-economic resource base of the project area to assess the sustainability of projects, sectoral development plans and land-use patterns in the context of ecological, social, economic and environmental attributes of the Munnar Landscape and suggest measures to enhance compatibility. The study adopted the Strategic Environmental Assessment approach to suggest a project implementation plan for the landscape that ensures compatibility of multiple forms of developments and land use within diverse and distinct areas of the larger planning unit of the Munnar Landscape and present options to re-align and re-design development and project objectives if necessary for mutually compatible and sustainable practices in the long term beyond the time horizon of the Munnar Landscape project.

The key findings of the study suggested that most human-managed land uses in the landscape have the potential to conflict with objectives of biodiversity conservation in the landscape. Increasing development pressures and degradation of natural resources pose a challenge for Munnar landscape's long-term ecological sustainability, biodiversity conservation and livelihood security. The tourism sector that depends mostly on the natural wealth of the landscape seems to have the largest impact on natural areas. In addition to direct impacts, this sector has a 'snowballing' effect where tourism activities are leading to increases in vehicular traffic, and driving both planned and unplanned land use conversion for infrastructure. An integrated planning approach is required in order to protect and conserve its biodiversity from unsustainable growth in the tourism sector. It should take into consideration all the priority areas for conservation and all the conflict areas.

The study provided a very appropriate opportunity to establish the relevance and importance of SEA as a tool for landscape planning.

The EIA Cell undertook development of best practice guidance tools for aiding impact assessment practice for promoting responsible development on different key sectors.

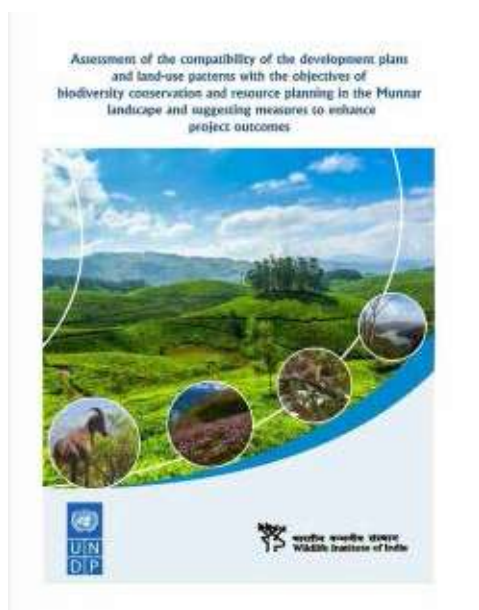
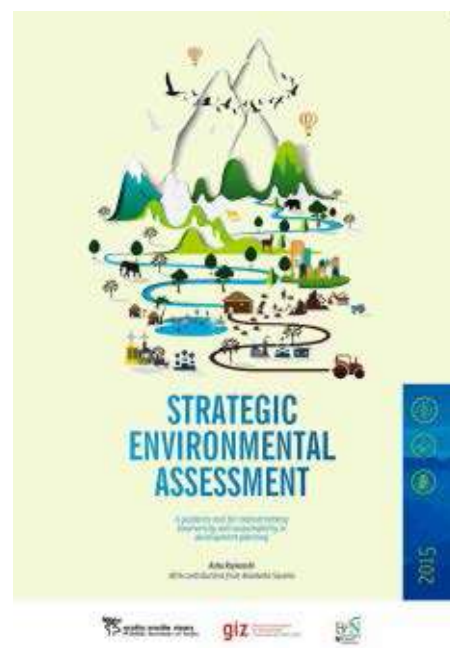
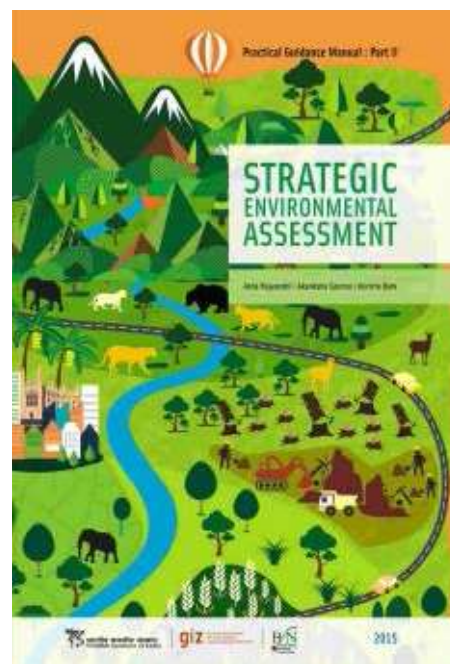
Development of Best Practice Guidance Manuals

In the light of proposals received for consideration of the development, expansion and upgradation of linear projects through protected areas and other sensitive habitats, National Board for Wildlife (SC of NBWL) in its 32nd meeting held on 21 January, 2015 directed the Wildlife Institute of India (WII) to prepare a guidance document on 'Eco-friendly measures to mitigate the negative impacts on wildlife values from linear infrastructure development projects'. In response to this directive, WII has initiated the preparation of this Best practice guide: Eco-friendly Measures to Mitigate Impacts of Linear Infrastructure. The scope of the guidance document has been finalised in consultation with the officials of MoEFCC, Govt of India. The task is being lead by the Dr.Vinod Mathur, Director Wildlife Institute of India and coordinated by Dr. Asha Rajvanshi, Scientist G. A large number of WII faculty members and research personnel are providing inputs. The draft of guidance document for planning and implementing 'Smart green infrastructure was reviewed by Senior Officials of MoEFCC on 17th December 2015. This guidance document was also shared with the participants of the training course on Mainstreaming Biodiversity in Road and Rail Transportation Projects for Promoting Smart Green Infrastructure during 17–19 February, 2016 at WII for inviting comments. The final draft of the guidance document was subsequently hosted on WII website and sent out for peer review by international experts.

Under the Collaboration with the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) for the project: Strategic Environmental

Assessment - Increasing Planning Efficiency & Reducing Conflicts of

Interest - Relevance, scoping and Needs assessment of SEA in India, the potential usefulness of the SEA tool was well established in the context of land-use/spatial and socio-economic development planning for ensuring a more environment/nature compatible planning, also integrating aspects relevant to biodiversity. This experience of evaluating the potential of SEA application for promoting integrated development at landscape levels was distilled in developing the SEA guidance tools kits and practice manuals.



These manuals were road tested for their usefulness in promoting SEA through a series of training programmes. The manuals were subsequently showcased at the 35th IAIA annual meeting held in Florence Italy during 20-23 April 2015.



Professional Support to Other Organisations

Professional support to the Indian Road Congress: Dr. Asha Rajvanshi was invited to serve on the Committee on Reduction of Carbon Footprint in Road Construction and Environment (G-3) for the period 2015-2017 of the Indian Roads Congress, which is a premier technical body for ensuring environmental conservation and sustainable development of highways projects in India. In the capacity of the member, Dr. Rajvanshi provided professional support to the above Committee of Environment of Indian Road Congress.

Professional support to Quality Council of India's National Registration Board for Personnel and Training: As part of the ongoing initiative of MoE&F for revision of environmental clearance process, the Quality Council of India initiated the development of registration scheme for EIA consultants through National Registration Board for Personnel and Training (NRBPT). Subsequently in March 2012, Dr. Asha Rajvanshi was invited to serve on Accreditation Committee for registration of EIA consultant organizations for NRBPT registration. During the reporting year, Dr. Rajvanshi continued to provide professional inputs in the evaluation of applications received for seeking accreditation of QCI and continued to provide professional support to QCI in taking forward the scheme through contributions in

several consultative meetings organized during the reporting year.

Professional Support to IAIA: IAIA (International Association for Impact Assessment) is an interdisciplinary, non-profit professional society established in 1980. This professional body with over 2,500 members representing EIA professional, practitioners, government officials, project planners, administrators, teachers and students from across the globe is the leading global authority for advancing innovations and communication of best practices in all forms of impact assessment. Dr. Asha Rajvanshi and Dr. V.B. Mathur have been members of this association for over a decade and have actively contributed to the activities of the Biodiversity and Ecology Section. They have been directly involved in the planning of sessions for the annual meeting and in delivering of training course. Based on her longstanding experience of imparting training in the field of Impact Assessment and the practical applications of IA, IAIA invited Dr. Asha Rajvanshi to serve as the member of the IAIA's Committee for Professional Development Programme (PDP) to guide the development of a suite of web-based training courses. In this capacity, Dr. Rajvanshi is providing professional support in the development of various training modules

Advisory support to Ministry of Environment, Forest & Climate Change, Govt. of India on matters related to environmental decision making: Dr. Asha Rajvanshi was invited to become the member of the reconstituted Expert Appraisal Committee (Non-coal Mining) of the MoEFCC for EIA and evaluation of projects. In this capacity, she has been reviewing the EIA reports for non-coal mining projects and attended the EAC meetings.

Contributions to 'Intergovernmental Platform on Biodiversity and Ecosystem Services' (IPBES): As one of the three Coordinating Lead Authors for chapter 2 Nature's benefits to people and quality of life of the Asia Pacific assessment on Biodiversity and Ecosystem Services, Dr. Asha Rajvanshi coordinated the development of the chapter, contributed to the writing of the sections, reviewed the contributions from lead authors and contributing lead authors to the chapter and presented the first draft to the IPBES. This can become a part of the combined reporting incorporating inputs of all members of WII faculty.

Collaboration with Australian Research Centre for Urban Ecology: The collaboration and professional exchange between WII and Australian Research Centre for Urban Ecology, University of Melbourne, Victoria, Australia provided a valuable opportunity to promote road ecology as a discipline at the Wildlife

Institute. Dr. Asha Rajvanshi and Dr. Vinod Mathur contributed to the initiatives of the Australasian Network for Ecology and Transportation through the support of Dr. Rodney van der Ree, Deputy Director, Australian Research Centre for Urban Ecology, a renowned road ecologist. He provided the much needed support in training at WII and in the review of WII's research proposal in the field of road induced impacts on wildlife. WII hosted Dr. Ree for his term at WII as a recipient of Caughley Travel Fellowship. During this period, he interacted with Dr. Asha Rajvanshi and other members of WII faculty, students and researchers.



Information Technology, Remote Sensing and Geographic Information System Cell

The Information Technology, Remote Sensing and Geographic Information System is a part of almost all wildlife research projects, education and training. The facility is available 24 hours a day to the faculty members, trainees, researchers, students and collaborators working with the institute. A large number of desktop computers configured with Windows, Linux and specialised analytical software for data processing are made available in the dedicated lab. The computer facility is equipped with a wide range of hardware connected to a local area network (LAN). There are Intel Xeon servers for the Internet, Intranet, database management and library automation services. The computer laboratory has a storage area network (SAN) system, and there are more than 300 nodes and 450 users on the WII LAN. Wi-Fi connectivity is provided in the hostels, guest house, classrooms, auditorium, board room and Porta Cabin. The institute has 30 Mbps (1:1) Internet leased line connectivity. All the computers of the institute are provided with Internet and mailing services.

The Geoinformatics Laboratory caters to the research and training programmes of the institute. The laboratory is equipped with several workstations, an

AO scanner-cum-plotter and software, (ArcGIS, ERDAS Imagine, IDRISI, GRASS and several open source software packages for landscape-level analysis). A dedicated team is available for providing support and training in IT and geoinformatics. The module "Remote Sensing, GIS and Landscape Ecology" is conducted for the M.Sc., P.G. Diploma and Certificate courses at WII. Hands-on training is also provided to other graduate and post-graduate students and interns.

WII has a video conferencing facility consisting of Polycom HDX 8000 VC systems with high-definition cameras and displays based on an IP Internet Leased Line connection. These systems are regularly used for conducting lectures, meetings, classes, interviews and presentations within the country and abroad.

The following were the new activities of the IT and RS/GIS Cell during the reporting year:

Leave and Attendance Management System (LAMS). The institute implemented LAMS software for managing the attendance, leave and tour records of all the employees and research scholars. This software is integrated with the existing Biometric Attendance Management System (BBMAS). LAMS is a Web-based software package that can be accessed from anywhere by inputting a username and password. This software has been specifically designed and customised according to the requirements of WII.

Upgrading of campus-wide network. The existing campus-wide network of the institute was established in 2000. This network is based on a star network topology with structured cabling and managed network switches. The performance and reliability of the institute's network were deteriorating due to the old and redundant network switches. Hence all the old network switches were replaced with new CISCO gigabit managed network switches. This resulted in a significant enhancement in the performance and reliability of the WII network. Presently, a total of 30 gigabit managed network switches are being utilised on the institute's campus-wide area network, which has more than 300 nodes and 450 users.

Enhancement of Wi-Fi. The Wi-Fi facility in the auditorium, Porta Cabin, classrooms, hostels and guest house has been enhanced by placing high-speed access points capable of supporting a large number of users and devices.

Network video recorder (NVR). The institute established a network video recorder (NVR) system with 25 TB storage capacity and software to manage and view surveillance videos.

The institute has installed IP CCTV cameras at various locations, viz., the Forensic Lab, Computer Lab, Library, foyer and the reception areas of the hostels and guest house. All these cameras are connected to the NVR via a LAN and operate 24×7. The NVR can store the video recordings of the CCTV cameras for 2 months.

Anti-virus software. To protect all the computer systems on the institute's campus-wide network from threats and attacks of viruses, Trojans and spyware, the institute procured Quick Heal Endpoint Security, with 300 users' license. Quick Heal is a Web-based management anti-virus software package that integrates desktops, laptops and network servers.

Website Quality Certificate. STQC (Standardisation, Testing and Quality Certification) Website Quality Certification Services, Ministry of Communications and Information Technology, New Delhi issued a Website Quality Certificate for the WII website, <http://www.wii.gov.in>, on 30 March 2016. This certification is valid for 3 years, i.e., until 29 March 2019. The certification verifies that the WII website meets the requirement of the Guidelines for India Government Websites (GIGW).



The WII website is the 46th certified client of STQC for website quality certification according to the list hosted on the STQC website, http://www.stqc.gov.in/sites/upload_files/stqc/files/list_CQW_clients_07042016%20.pdf.

Procurement. The following new computer hardware and software were obtained by the institute during the reporting period: (1) Hardware: Desktop computers, 9; laptop computers, 6; workstation computers, 7; servers, 4; Network Video Recorder (32 channels), 1; laser printers/MFP, 4; computer network managed switches, 13; access points for Wi-Fi, 5; UPS systems, 6. (2) Software: Leave and Attendance Management System (LAMS)-500 users; Quick Heal Endpoint Security-300 users; MS Windows Server 2012 OS-4 users; MS Office ProPlus 2016-30 licenses; MS Office Standard 2016-100 licenses; Grammarly@edu-100 users.

Application of geoinformatics in research projects. Geoinformatics technology is being used in most of the research projects of the institute for wildlife research and conservation. Work is in progress on the development of a spatial database of the boundaries of all the national parks, wildlife sanctuaries, conservation reserves and community reserves in the country. Similarly, digitisation of the division, range and beat boundaries of the 17 tiger-range states in the country is in progress. Compilation of country-level data on the climate, vegetation, topography and animal distribution is also in progress.

Library and Documentation Centre

The Library and Documentation Centre (L&DC) of WII plays a vital role in disseminating information to a wide range of users including scientists, researchers and wildlife managers. It was established in line with WII's mission of being a multidisciplinary information and learning resource centre on biodiversity conservation and management. It has the following objectives: (1) to serve as a repository of all the wildlife-related literature published in India; (2) to acquire, organise and disseminate all the relevant literature on biodiversity conservation and related fields; (3) to serve the user readership through normal and special library and information services; (4) to establish and maintain links with other national information systems in India and other countries to ensure a free flow of information at the national and international levels; (5) to serve as a training centre for information personnel and users; and (6) to bring out periodic updates/bulletins on the current content of periodicals, research in progress and unpublished research literature, i.e., dissertations, theses and thematic bibliographies for ENVIS bulletins and a database of WII publications.

The L&DC now holds 28,141 books, 7700 maps/toposheets and more than 6803 bound volumes of old and rare journals. The library also



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maintains a good collection of scientific papers numbering 11,006. It subscribes to more than 250 print and online journals. The L&DC is fully computerised, using LIBSYS (Library Management Software), UNESCO'S WINISIS software, barcode and related technologies. All library users, i.e., researchers, officer trainees and faculty members can access online journals and online databases subscribed to by the L&DC through the Intranet. The current contents of the latest print journals are also updated on the Intranet. Being connected to the library facility, the users have the privilege to access all in-house databases such as books, reprints, Indian wildlife abstracts, map/toposheet collections, press clippings and specialised bibliographic databases—Musk Deer, Application of Telemetry in Wildlife, Wildlife and Protected Area Management in Madhya Pradesh, Mountain Ungulates, Rainforest Conservation in India, Ungulates of India, Rajaji National Park, Galliformes of India, Freshwater Turtles of India, Telemetry in Wildlife Science, Coastal and Marine Protected Areas of India, Waterbirds of India and Ecology and Management of Grassland Habitats in India. Users can access the online database Indiatat.com through the Intranet. The L&DC provides its users a variety of library and information services.

During 2015–2016, approximately 50,000 documents were issued and consulted. Value-added services were provided to 3600 clients, and the Ready Reference Service was provided to approximately 350 clients. Approximately 500 queries from outside users were attended to, and more than 8000 bibliographic references were provided to users. The in-house databases were regularly updated during the reporting period. The WII publication database was updated by adding the research papers, theses, reports, popular articles and papers presented during this period. Specialised bibliographies were also compiled for different courses and on requests from users. The E-Document delivery service was also provided to outsiders during this period.

Wildlife Forensic and Conservation Genetics Cell

The Wildlife Forensic and Conservation Genetics (WFCG) Cell was established to strengthen the enforcement of the Wildlife (Protection) Act, 1972 of India. The main functions of the cell include identification of species from the variety of wildlife parts and products received for forensic investigations and developing and maintaining a repository of wildlife reference samples of different species. In addition, the WFCG Cell plays a role in sensitising enforcement agencies in crime scene examination and proper collection of evidence through regular training and workshops. Being a focal agency in the Southeast Asian region, it also provides scientific organisations of neighbouring countries, e.g., Nepal and Bangladesh, advanced training for wildlife crime analysis to build their capacity to combat wildlife crime.

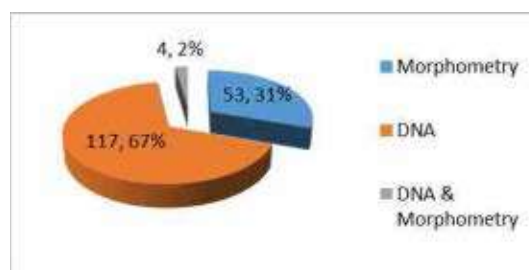


Figure 1. Different forms of biological material received at wildlife forensic for analysis.

During 2015–2016, the cell received a total of 174 wildlife offence cases from enforcement agencies across the country, of which 62% were from forest departments, 13% were from the police, 16% were from honourable courts, 4% from the CBI, 3% from MoEFCC and the rest (2%) from the customs and hospitals. An assortment of biological products were received for species identification, and of these, 67% contained tissue samples requiring DNA-based techniques, 30% cases required morphometric techniques, and 3% of the cases required both morphometric and DNA-based techniques for species identification. The cell provided reports on species identification for 323 cases, and a further 69 summons were received for appearances as expert scientific witnesses during this period.

Field exercises and lectures were conducted on crime scene management and evidence collection for officer trainees of the Diploma Course and Certificate Course of the institute and for officer trainees and forest officers at the Indira Gandhi National Forest Academy (IGNFA), Dehradun and the Central Academy for State Forest Service (CASFOS), Dehradun. Hands-on training was also provided on the identification of various body parts

and products encountered in the illegal wildlife trade for the forest officers and customs probationers. Along with these training programmes, popular lectures were delivered for various visitors/classes at the WFCG Cell and at IGNFA and CASFOS, Dehradun.

The use of molecular approaches to address questions on phylogeography, phylogeny and population genetics have resulted in major findings, leading to critical conservation actions. For example, great Indian bustard populations showed very low genetic variation and low effective population sizes, which supported upgrading the conservation status of the species to "Critically Endangered". Similarly, it was shown that the most diverse and ancient lineages of wolves and golden jackals belong to India. The molecular phylogeny of the sambar indicated that there were two distinct ancestors in India with a high level of genetic variation. These studies emphasise the need to prioritise the focus of conservation at subpopulation levels. Another important research dimension, that of wildlife health, was addressed in two recent studies, on avian malaria and on the major histo-compatibility complex (MHC) in tigers. The MHC class I gene was evaluated in tiger populations of Ranthambore, Bandhavgarh and Bandipur. A high level of MHC class I variability was observed in these populations, and it was observed that they had comparable immunological fitness. A country-wide analysis of tiger genetics suggests a close affinity between the morphologically distinct Sunderban tiger and central Indian tiger, while the tigers in the north-east and Simlipal are genetically distinct. These findings have major implications in tiger reintroductions and supplementation, identifying ESUs and detecting poaching hotspots and permit prioritisation of conservation investments.

Wildlife Extension & Audio-visual Cell

The cell caters to the needs of various academic activities. It maintains 16 mm films, video films, CDs/DVDs, a conference system, a projection system, various audio-visual equipment, still cameras and video cameras with accessories and a photo library.

During the reporting period, the cell provided support to 33 workshops, seminars, meetings and courses; 26 visiting classes; nine guest lectures; and 12 celebrations of important days or events.

As part of its information dissemination activities, the institute prepares four quarterly issues of the e-newsletter of WII. The issues were uploaded to the website of the institute during the reporting period.

Celebration of International Yoga Day, Dehradun, 21 June 2015.

WII's faculty, staff, researchers and students and their families joined over 600 participants of Dehradun-based institutions, led by the Indira Gandhi National Forest Academy (IGNFA), Dehradun, at the sports ground of IGNFA. They

gathered to celebrate International Yoga Day in the presence of Shri Prakash Javadekar, Minister of Environment, Forest & Climate Change, Government of India on 21 June 2015. Yoga asanas and pranyams were performed under the guidance of trained yoga instructors.

Himalaya Day celebrations, Dehradun, 9 September 2015.

Over 250 members of WII, including eminent scientists, wildlife managers, researchers and students of wildlife sciences, gathered to celebrate Himalaya Day at the Institute. The state government has officially declared 9 September "Himalaya Diwas"—a day that will be celebrated across the State to spread the message of conservation of Himalayan ecosystems. The focal theme for the year 2015 is "Sab ka Himalaya".

Dr. V.B. Mathur, Director, WII, Dehradun, stated that the institute has been observing Himalaya Day every year since 2011. This year the institute invited Prof. Shekhar Pathak, a noted historian, writer, orator and naturalist, for a talk titled "Kailash- Manas Prakruti and Sanskriti". In his elaborate talk, he mentioned the Kailash-Mansarovar Yatra and the natural and cultural values of this landscape.

XIII WII-Friends of the Doon "Wildlife & Environment Quiz 2015", Dehradun, 1 October 2015.

The XIII WII-FoD Wildlife & Environment Quiz 2015, a collaborative activity of WII and Friends of Doon Society, was organised on 1 October 2015 at WII to mark the celebrations of Wildlife Week 2015. Twenty-two schools participated in the preliminary round. The quiz was prepared and hosted by the M.Sc. students with the help of two faculty members of the institute. Five teams qualified for the final round. The final quiz had six rounds: Know our Uttarakhand; Biogeography; Acronym; Pancha-mantra; League of Legends; and Rapid Fire.

Ann Mary School topped the list and won the WII-FoD Rolling Trophy and the cash prize of 2000 per participant, and Scholar's Home School won the second prize. Shri Jairaj, Additional PCCF, Environment, Uttarakhand graced the occasion as

S. Wilson



the chief guest and distributed the prizes to the winning teams. Shri S.K Mukherjee, Former Director, WII was also present on the occasion.

Wildlife Health Services

Professional support

Assistance to Uttarakhand Forest Department in rescuing ensnared leopardess. Upon receiving a request from the Uttarakhand Forest Department on 2 September 2015, the team from WII successfully immobilised and rescued a leopardess from a snare in Badsa village in Thanu Range, Dehradun Forest Division. After the animal was thoroughly examined and first aid provided, it was released in a forested area nearby. The field operations were carried out by Dr. Parag Nigam and Dr. Sanath Krishna.

On receiving a request from the Director, Rajaji National Park, Dr. Parag Nigam provided assistance with managing the captive elephant Raja, which was in musth on 16 May 2015. The animal became a threat to life and property and was successfully immobilised and tethered.

Assistance with health management of rescued elephant calf, Rajaji Tiger Reserve (RTR). A request was received from the Field Director, Rajaji Tiger Reserve (RTR) for assistance with providing health care and managing a rescued elephant calf housed in the Chilla elephant camp, RTR. The Project Veterinarian made periodic visits to the Chilla elephant camp, RTR in June and July 2015 to ensure that the calf's health condition was stabilised. The necessary advice was provided to the officials of RTR for subsequent management. The animal is keeping well and is being managed by park officials.

Assistance to Rajasthan Forest Department with managing ailing tiger at Sajjargarh Biological Park, Udaipur. On receiving a request from the CCF, Wildlife, Udaipur, technical assistance was provided by Dr. Parag Nigam along with a team of experts from Indian Veterinary Research Institute, Izatnagar and Jaipur Zoo for managing the ailing tiger T24, which was maintained in captivity at Sajjargarh Biological Park, Udaipur. The animal was successfully immobilised and operated for megacolon on 4 December 2015. The animal responded to treatment and recovered from the illness. There was a 5-hour-long operation, and the animal was subjected to radiography, ultrasonography and exploratory laparotomy.

National Wildlife Database Cell

The objectives of the computer-based National Wildlife Database are to (1) provide readily accessible and comprehensive information on the conservation status of biogeographic regions, habitat types, individual animal species and the network of PAs in the country; (2) establish linkages among researchers, among PA managers and planners and with other data centres; and (3) facilitate research and training activities related to wildlife by providing

bibliographic references on PAs, habitat types and animal species.

During 2015–2016, the main thrust of the activities was on updating the PA, species and wildlife bibliography databases on the basis of the current information collected from various published/unpublished sources in this period. The PA database of the country has been updated, and presently there are 732 PAs including 103 national parks, 536 wildlife sanctuaries, 26 community reserves and 67 conservation reserves in the country, with an extent of 1,60,902 km², which is 4.89% of the total geographical area of the country. The species database was corrected and updated by adding information on the distribution of mammalian species in various PAs. The bibliographic database was updated with the literature published on Indian wildlife in various journals/periodicals during the reporting period. The Review of the Wildlife Protected Area Network was updated by incorporating the latest information. The trainees database was updated, and now there is information on 669 Diploma and 562 Certificate officer trainees trained in various courses, including 231 foreign nationals. The website of the national wildlife database has been updated by incorporating the latest information. Nearly 200 queries were received, and outputs were provided in various desired formats.

ENVIS CENTRE ON WILDLIFE AND PROTECTED AREAS

The Ministry of Environment, Forest and Climate Change, Government of India established the 23rd Centre on Environment Information System in September, 1997 at Wildlife Institute of India. The thematic area of WII ENVIS Centre is 'Wildlife and Protected Areas'. The mission of ENVIS is to support and facilitate the diverse group of clientele from policy makers to researchers and industries and promote national and international level cooperation and exchange of environmental data and information through a nation-wide network. The goals of WII ENVIS Centre are to: (i) Build up a repository and act as a dissemination centre for information on wildlife sciences; (ii) Provide information for decision-making at the apex level relating to conservation and development; (iii) Establish a database on Protected Area Network in India; and (iv) Promote national and international co-operation through networking and exchange of wildlife related information.

Vinod Verma



During the reporting period the ENVIS bulletin on 'Waterbirds of India', Volume 16' was released in XXIX Annual Research Seminar (ARS) of Wildlife Institute of India, Dehradun on 3 September, 2015 by the Chief Guest Dr. Mewa Singh, Professor, University of Mysore in presence of the Shri Vinod Ranjan, Additional Director General of Forest, Ministry of Environment, Forest and Climate Change (MoEFCC) in Wildlife Institute of India, Dehradun.

Research Laboratory

The WII's research/teaching laboratory is well equipped with advanced equipment such as an atomic absorption spectrophotometer, high-performance liquid chromatography equipment, a UV-visible spectrophotometer, a microwave reaction system, fibre and fully automatic nitrogen analysers, a Millipore water purification system, a digital pH and conductivity meter, a flame photometer, digital analytical balances and a stereomicroscope. These are required for analysing various physio-chemical parameters and for analysis of the nutrient content of biological samples. These laboratory facilities are used for teaching and conducting practical classes for various ongoing courses of the institute as well as other organisations/universities around Dehradun. The practical work includes analysis of herbivore pellets and carnivore scats, collection and preservation of biological materials, determination of the age and sex of wild animals on the basis of body parts, osteology of mammals and photomicrography and analysis of ecological (plant, water and soil) samples for various purposes.

During the reporting period, a total of 5536 samples were analysed at the laboratory. Among these were 445 plant samples analysed for ADF, NDF, lignin, cellulose, crude protein, tannin, phosphate, calcium, magnesium and heavy metals (Zn, Cu, Fe, Ni, Mn, Cr and Pb) and 480 soil samples analysed for total nitrogen, phosphate, calcium, magnesium and heavy metals (Zn, Cu, Fe, Ni, Mn, Cr and Pb). In addition, 471 samples were brought to the



laboratory for entomological studies, and 4335 scat samples of tigers, leopards, jackals, wild dogs and sloth bears and 225 pellet/dung samples of chital, sambar, red pandas and wild buffalos were analysed for food habit studies. Technical inputs in various field training programmes were also provided by the laboratory staff, including the demonstration of camera traps, snake rescue, mist netting for birds, radio telemetry and the use of GPS.

Herbarium

The herbarium staff provided inputs to various field activities and surveyed different PAs during the reporting period. Approximately 450 plant species were identified that had been collected by research scholars, Diploma and Certificate trainees and faculty members from various parts of the country (Pithoragarh District, Askot landscape, WII Campus, high-altitude regions of Uttarakhand, Himachal Pradesh and the Trans-Himalaya (Niti Valley, in Nanda Devi Biosphere Reserve), Kedarnath Wildlife Sanctuary and Nanda Devi National Park). Apart from specimens, around 130 photographs from various PAs and places outside PAs were also identified.

Campus Development

During the reporting period, the works of repair/ up gradation of 10 nos. toilets in Administration, Teaching and Library Blocks; Repair/renovation work in the forensic laboratory, and 12 rooms of old hostel block were completed. New furniture was provided for Canteen lounge and New Hostel dining hall. Some repair/renovation work in New Hostel dining hall and Canteen lounge was undertaken. Up-gradation of Wildlife Health Laboratory was done.

The work-station was provided and office chamber, false ceiling and PVC flooring work in Office Rooms O-52, N-27, N-13 & N-24 including electrical and air conditioning work were completed during the period. Anti-termite treatment work was done in the Auditorium Hall and Library Block. The ramps were constructed for handicapped persons at Entrance porch, Auditorium Hall, Old Hostel, New Hostel and Guest House. The internal and external finishing work in Type IV quarters (5 nos.) in Block III was also done. The construction of New Building for UNESCO Category 2 Centre (C2C) has been completed during the reporting year.

WII bagged medal in All India Forest Sports Meet

WII's contingent participated in the 22nd All India Forest Sports Meet (AIFSM), held at Bengaluru between 19 and 23 December 2015. AIFSM is an annual event, where all the state forest departments and institutions under MoEFCC are invited to compete on a national stage. Karnataka hosted the event this year, with professionalism and hospitality. The institute participated with a relatively small

contingent of only 15 players, led by Shri S. Dalal, Registrar for the event. The players participated with great enthusiasm and spirit in tennis (four categories), table tennis (four categories), badminton (two categories), rifle shooting and golf. WII bagged a bronze medal in the tennis men's doubles event (Shri Harendra Kumar and Shri Anant Shankar). In the other events too, the players did well.

Right to Information

Dr. A.K. Bhardwaj, in the capacity of Nodal Officer RTI, facilitated the generation of information to be hosted on the WII-RTI Portal as a part of suo moto disclosure under Section 4 of RTI Act, 2005. The following are the details of RTI for the year 2015–2016 (four quarters) received by the Institute:

Category	Opening balance as on 1 April 2015	No. of applications received as transfer from other Public year Authority u/s 6(3)	Received during the other PAs	No. of cases transferred to were rejected	Decisions where requests/ appeals were accepted u/s 6(3)	Decisions where requests/ appeals 2016	Closing balance as on 31 March
Requests	0	13	36			47	2
First appeal	0	0	6			5	1

Nasim Ahmad Ansari



UNESCO Category 2 Centre for World Natural Heritage Management and Training for the Asia and Pacific Region at Wildlife Institute of India during 2015–2016

Background

On 2 September 2015, the Indian Cabinet of Ministers, chaired by the Honourable Prime Minister, Shri Narendra Modi, formally approved the proposal for signing the MoU for the establishment of the C2C at WII. With this agreement, the C2C is committed to carry forward the agenda of capacity building and training for Natural Heritage Site management in the Asia Pacific region.

The Governing Body meeting held earlier on 8 April 2015 approved the Annual Work Programme 2015–2016 of the UNESCO C2C at WII. The centre has started functioning and has accomplished annual work programmes for the years 2014–2015 and 2015–2016.

Mission and Objectives

The centre's mission is to strengthen the implementation of the World Heritage Convention in Asia and the Pacific region by building the capacity of all those professionals and bodies involved with Natural Heritage Site inscription, protection, conservation and management in Asia and the Pacific region through training, research, dissemination of information and network building.

The overall objective is to focus on natural heritage conservation issues with the aim of:

- contributing to the strengthening of capacities in the management of Natural World Heritage in the region;
- contributing to achieving a more balanced representation of properties from Asia and the Pacific on the World Heritage List;
- raising awareness among the public in general and the youth in particular about the importance of Natural World Heritage and the need to protect it; and
- fostering international cooperation in Natural World Heritage initiatives.

Activities Undertaken

Awareness and Outreach Programmes

Celebration of World Heritage Day, Dehradun, 18 April 2015.

The UNESCO Category 2 Centre on World Natural Heritage Management and Training for Asia and the Pacific Region at WII, Dehradun, India celebrated World Heritage Day on its campus with great enthusiasm. With youth as the focus, the event was

enriched by the presence of nearly 75 students from various schools in Dehradun including Kasiga School, National Institute for the Visually Handicapped and the Asian School. A presentation featuring the rationale and background of the UNESCO World Heritage Programme, with excellent visuals of important World Heritage Sites of the Asia Pacific region, was also exhibited. This was followed by the main event of the day, the Quiz Competition on Biodiversity and Natural World Heritage. A guided nature trail walk was organised on the institute campus for the students. On this occasion, the first issue of the Natural Heritage e-Bulletin, brought out by the Category 2 Centre, was also released.



Celebration of World Environment Day, Dehradun, 5 June 2015.

The C2C celebrated World Environment Day on campus with great enthusiasm. Nearly 100 students from the Graphic Era University, Dehradun, India participated in the event. The main event was an extempore speech contest for the students, who spoke on topics based on current environmental issues. The students also presented their activities for a "Clean Dehradun" campaign, with a specific focus on waste management and eco-friendly practices. Shri J.D. Pati, an Indian Forest Service officer, displayed his fascinating philately collection and gave a presentation on collecting postage stamps depicting biodiversity from across the world. A guided nature walk inside the institute's campus was organised for the students and faculty members of Graphic Era University to provide them an exposure to the natural surroundings of the campus.

On this occasion, the official website of UNESCO C2C was also launched, which aims at providing information about the objectives, functions and activities of UNESCO C2C India.

Raising Awareness amongst Youth about World Heritage Conservation

As part of UNESCO C2C's mandate, team members of UNESCO C2C India interacted with students of different schools and colleges, e.g., Birsa Agricultural University Ranchi, Kathmandu College of Forestry, the Asian School, Kasiga School, National Institute for the Visually Handicapped and Graphic Era University, Dehradun in order to raise awareness amongst youth. One of the objectives of interacting with students was to make them aware about the importance of conserving world heritage sites, future perspectives of forestry and wildlife sciences.

Quarterly Bulletin: UNESCO C2C

The centre publishes a quarterly e-bulletin that is a compilation of news and relevant articles pertaining to Natural World Heritage sites in the Asia Pacific region. Four issues were successfully published during 2015–2016. The second issue of the Natural Heritage Bulletin, April–June 2015, was also launched on 3 July 2015 at a meeting on the focal points of C2Cs at the 39th Session of the World Heritage Committee, at Bonn, Germany. Speaking on the occasion, Dr. V.B. Mathur, Director, WII gave a presentation on the activities of the UNESCO C2C for World Natural Heritage Centre for Management and Training for Asia and the Pacific Region in India. He represented the Indian delegation, comprising senior officials from MoEFCC and the Archaeological Survey of India.



Selection of Logo for UNESCO Category 2 Centre

An open call for a logo design competition was issued on 1 June 2015, and the advertisement, along with necessary criteria, was widely circulated through the WII website, Facebook pages, etc. A total of 35 entries were received, of which the 10 best entries were subjected to doodle poll. The winning logo was one created by Shri Shubhranshu Maurya, who hails from Lucknow and is a freelance graphic designer. As a token of appreciation, UNESCO C2C, WII offered him prize money of ₹ 7,500 (rupees seven thousand & five hundred only). The logo is a combination of mountains, oceans, birds and plants that represent the Natural Heritage Sites of the Asia Pacific region best.

Research and Monitoring

Participation of C2C Faculty in Nanda Devi Expedition, 10 June to 6 July 2015.

The Third Decadal Ecological Monitoring Expedition to Nanda Devi National Park and World Heritage Site was undertaken for a reappraisal of the status of the biodiversity of Nanda Devi National Park. Shri Manoj V. Nair was among the four-member scientific team (along with Dr. B.S. Adhikari and Shri Shashank Arya) chosen to represent WII in this expedition. This extremely arduous expedition is organised once every 10 years by the Uttarakhand Forest Department and involves the participation of several scientific organisations, with technical support from the Indo-Tibetan Border Police. Following well-established methods laid down by the previous two biodiversity monitoring expeditions, rapid assessment techniques were used to assess the status of the flora, fauna, and their habitats along the main route to Nanda Devi. Intensive surveys were also conducted in and around the main camping sites inside Nanda Devi National Park. The expedition was concluded successfully, and the team members gave a set of recommendations to the state forest department for effective management and conservation of this spectacular mountain landscape.

Capacity Building Training and Workshops Conducted

International Workshop and Training on the Role of Natural World Heritage Sites in Disaster Risk Reduction, Dehradun, 24–28 August 2015.

The workshop was jointly funded by the FAO-India office. The overall objective of the workshop was to strengthen and build the capacities of key stakeholders associated with World Natural Heritage Sites in the Asia Pacific Region. The workshop was

attended by over 150 participants from 10 countries (Nepal, India, Bhutan, Thailand, Myanmar, Malaysia, Myanmar, Sri Lanka, Vietnam and Indonesia). Over 25 World Heritage Sites from Asia, including India, were represented by site managers, scientists, representatives of NGOs, students and researchers. The team of eminent speakers included more than 30 resource persons from UNESCO (South Asia, Paris and Kathmandu offices), National Disaster Management Authority, Government of India, UN-SPIDER, UNISDR, IUCN, Tata Institute of Social Sciences—Jamsetji Tata Centre for Disaster Management, King's College London, Indian National Trust for Art and Cultural Heritage, Indian Institute of Remote Sensing, etc.

WII Photo Library



The major outcome of the workshop and training programme was a more sensitised team of site managers, policy makers and practitioners, who now recognise the need to integrate and understand the two-way linkage between disaster risk reduction and natural heritage. A comprehensive network of site managers has been created and documentation compiled that will guide further studies and capacity building initiatives of the UNESCO C2C in the Asia Pacific Region.

International Training Workshop on “Open Standards for the Practice of Conservation in World Natural Heritage Sites” for SAARC Countries, Dehradun, 1–4 December 2015.

The international training workshop was funded by UCOST (Uttarakhand State Council for Science and Technology). The open standards brought together common concepts, approaches and terminology in conservation project design, management and monitoring to help practitioners improve their capacity for developing and monitoring conservation plans for their respective sites. A total of 26 participants representing World Heritage Sites from SAARC countries attended the workshop. The workshop was facilitated by resource persons from

Wild Team (<http://www.wild-team.org/>), United Kingdom. The financial support was provided by MoEFCC, Government of India and UCOST.

WII Photo Library



Enhancing Capacity for Effective Management of Coastal and Marine World Heritage Sites of the Asia Pacific Region, Sunderbans National Park, 26–28 February 2016.

The training workshop was organised at Sunderbans National Park, a World Heritage Site, West Bengal. This workshop was jointly organised and funded by Category 2 Centre, WII; German Corporation for International Cooperation and the West Bengal Forest Department. The workshop was mainly intended to build the capacities of various stakeholders to enhance the participatory management of marine protected areas in India with the following objectives: (1) sensitise the participants to the existing policy and legal issues, international guidelines and framework of management planning concerning coastal and marine WHS; (2) equip the site managers to deal with disaster events and adopt risk reduction strategies; (3) introduce the concepts of “climate proofing”, management of climate change and adoption of mitigation measures; (4) share experiences and best practices in coastal and marine WHS management in the region; and (5) evolve a road map towards effective management of coastal and marine WHS in the region.

Globally renowned eminent resource persons with specific domain expertise participated in the workshop. Among the panel of resource persons were Shri David Sheppard, Former Director General, Secretariat of the Pacific Regional Environment Programme (SPREP) and Shri Stuart Chape, Director, Biodiversity and Ecosystem Management, SPREP. Managers of sites from Bangladesh and Maldives attended the workshop along with PA managers from India.

Ecotourism in Uttarakhand: Responding to Environmental and Social Change, Dehradun, 3–5 March 2016. The University of Montana (UMT) in

collaboration with C2C organised the workshop at WII, Dehradun. The aim of the workshop was to assess the needs of ecotourism development in Uttarakhand in the context of the rapid environmental and social changes occurring in the state and initiate a process for developing a long-term road map for ecotourism development in Uttarakhand. The workshop was led by Dr. Keith Bosak and Dr. Jennifer Thomsen, Associate Professors, College of Forestry and Conservation, University of Montana, USA. Dr. Bosak has been working in Uttarakhand on ecotourism development and PA research since 2001. In all, 52 participants including representatives of the Uttarakhand Forest/Tourism/International Fund for Agricultural Development Project Departments, NGOs, community-based organisations, ecotourism entrepreneurs, university research scholars, UNDP, FRI and WII attended the programme.

The Honourable Minister of Forests and Wildlife, Government of Uttarakhand, Shri Dinesh Agarwal was the chief guest at the inaugural session of the workshop. Key sessions of the workshop included experience-sharing relating to ecotourism in Uttarakhand by the government, civil society and researcher participants. Other technical sessions were designed to (1) understand why ecotourism is being pursued; (2) identify the benefits of and challenges faced by ecotourism in the region; and (3) identify what is needed to successfully manage ecotourism in the future. Various methods such as lecture-demonstrations and participatory group activities were used to conduct the workshop. The major outcome of the workshop was the development of awareness and understanding among the stakeholders of ecotourism in Uttarakhand.

Appreciating Training Programme on Economic Valuation of Ecosystem Services, Dehradun, 14–17 March 2016. The training programme was jointly organised by the C2C and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH at WII. The training programme started with an inaugural session, during which the relevance of the training was highlighted by Dr. G.S. Rawat, Dean of Wildlife Sciences, WII and Shri Ravindra Singh, Senior Advisor, Indo German Biodiversity Programme—GIZ, New Delhi. The theme of the programme was established with a backdrop created by field-based research undertaken by “The Economics of Ecosystems and Biodiversity—India Initiative (TEEB- India Initiative)” as the need for incorporating economics based and ecosystem services approaches to addressing policy challenges in conservation and sustainable use of biodiversity and ecosystem services was felt.

The instructors of the training programme were Ms Kim Bonine, Training Director, Conservation Strategy Fund, California and Dr. Alejandro von Bertrab, Advisor—Values, GIZ, Germany. The objective of the programme was to familiarise the participants with the basics of economic valuation of ecosystem services through modules of the Values project and Conservation Strategy Fund (CSF). The module of the training was designed to balance between theory and practice on each day of the training programme. The training programme was attended by 25 participants from national institutions and international agencies. The concluding session of the training programme was chaired by Dr. V.B. Mathur, Director, WII. During his address, he highlighted the importance of such training programmes and the need to maintain the continuity of such programmes for building the capacities of trainers to support conservation efforts.

Other On-Site Capacity-Building Stakeholder Consultations

Stakeholder Consultation for Inscription of Bhitarkanika Conservation Area as a UNESCO Natural World Heritage Site, Gupti, Rajnagar, 11 August 2015. In January 2016 the completed nomination dossier for the inscription of Bhitarkanika Conservation Area on the World Heritage List was successfully submitted to UNESCO Paris by the State Party of India. The comprehensive dossier was prepared by C2C team with support from the Odisha Forest Department. As part of the consultative process, a workshop was held at Gupti, Rajnagar with a view to creating awareness and interacting with local stakeholders for designation of the Bhitarkanika Conservation Area (BCA) as a UNESCO World Heritage Site. A total of 45 individual stakeholders representatives of local communities, NGOs, the hospitality sector, government departments and the media attended the consultative workshop. The overall objectives of the workshop were to (1) sensitise the people living around the BCA; (2) learn from the knowledge and experience of the local people; (3) foster a sense of ownership in them; and (4) seek their help and support in the process.

Consultative Workshop for Preparation of Nomination Dossier for Inscription of Keibul Lamjao Conservation Area as UNESCO World Heritage Site, Keibul Lamjao National Park, 19–22 December 2015. Keibul Lamjao National Park, in Manipur, represents an extraordinary story of natural antiquity, diversity, beauty and human attachment. The Manipur State Government intends to inscribe Keibul Lamjao along with Loktak Lake as a UNESCO World Heritage Site, for which it has

sought the technical help of C2C this year. In this regard, the first stakeholder consultation workshop and on-site assessment were undertaken by a team of experts from C2C and invited experts at Imphal, Manipur. A stakeholder consultation was held on site at Keibul Lamjao National Park for the purpose of nominating the park as a World Heritage Site. The participants at the workshop comprising general population from villages near the Park, local NGOs, school teachers, local government members, media representatives among others. The programme was jointly organised by the Forest Department of Manipur and UNESCO C2C, WII, Dehradun.

On 21 December 2015, a stakeholder consultation was held at the Forest Head Office, Sanjenthong, in Imphal, for the purpose of nominating the park as a World Heritage Site. The participants included officers from government line departments (Water Resources, Tourism, Forest), NGOs, Manipur University, Agriculture University and Loktak Development Authority and representatives of the print and electronic media. One of the major outcomes of the consultation workshop was the demarcation of the boundary of the proposed World Heritage Site.

Nomination of Kailash Sacred Landscape (KSL) as World Heritage Site, 27 January 2016. The Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI) is a trans-boundary collaborative programme between China, India and Nepal. The KSL consists of a trans-boundary landscape that spreads over the borders of these three countries along their western tri-juncture, with the holy Mount Kailash and Lake Manasarovar as the pivot. All the regions of China, India and Nepal are adjacent to each other and show great ecological and historic cultural trans-boundary linkages. The KSLCDI aims to achieve long-term conservation of ecosystems, habitats and biodiversity while encouraging sustainable development, enhancing the resilience of communities and safeguarding the cultural linkages between local populations at the trans-boundary scale in the KSL. Overall, KSLCDI has been designed by and is being implemented with partner institutions in three countries, including ministries, state agencies, scientific institutions, NGOs and the private sector.

The International Center for Integrated Mountain Development (ICIMOD), an inter-governmental, apolitical knowledge hub based in Kathmandu, is synergising the institutions involved, ensuring uniform approaches in long-term socio-ecological monitoring, and devising livelihood-enhancing

intervention strategies at the local and landscape levels. In the same process, the scope for nominating the KSL as a World Heritage Site (WHS) of UNESCO was emphasised. WII, in collaboration with ICIMOD, hosted a scoping session for nominating the KSL as a trans-boundary WHS. The key objectives of the session were (1) shedding light on the potential of the KSL to become a UNESCO WHS and how it would be beneficial for the communities residing in the landscape; (2) providing clarity on the key steps involved in the process of nominating the KSL as a UNESCO WHS and finding the relevant institutions to be engaged in this process; and (3) brainstorming what the immediate path ahead (a road map to initiate the process in the KSL in Nepal) is and how local stakeholdership can be included in this process.

Various government and non-government agencies, such as the Ministry of Culture, Uttarakhand State Government, Ministry of Tourism, Uttarakhand State Government and state-level officials concerned with the annual Kailash–Manasarovar Yatra, state-level officials of the Archeological Survey of India and state-level representatives of INTACH participated in the one-day session held at WII. The major outcome of this consultative workshop was to initiate a dialogue for declaring the KSL a World Heritage Site in 2016–2017.

A Review of Rights-Based Approach and World Heritage Sites. International Council on Monuments and Sites (ICOMOS)—India and UNESCO Category 2 Centre, WII collaborated on a project titled “Building Capacity to Support Rights Based Approach in the World Heritage Convention: Learning from Practice—India” during June–July 2015. The project was an outcome of a short-term activity for the RBA (Rights Based Approach) supported by the Ministry of Climate and Environment, Norway and ICOMOS Norway. The aim of the project was to undertake national consultations; to identify and map experiences with issues pertaining to addressing rights in the field of heritage managements, with a specific focus on World Heritage (WH). The main objective was to device methodologies to build capacity to support the rights-based approach and analyse good practices in the World Heritage Convention.

Five World Heritage Sites in India, both cultural and natural, were selected for research as case studies for the purpose of this project. These are (1) Western Ghats, Maharashtra (Natural Property, Inscribed); (2) Champaner-Pavagarh Archaeological Park (Cultural Property, Inscribed); (3) Mahabodhi Temple Complex at Bodhgaya (Cultural Property, Inscribed); (4) Sri Harmandir Sahib, Amritsar

(Cultural Property); and (5) Khangchendzonga National Park (Mixed Site, Tentative List).

UNESCO Category 2 Centre, WII contributed case studies for two sites, namely, Western Ghats and Khangchendzonga National Park. The centre was represented by Dr. V.B. Mathur, Director, C2C, WII and members from UNESCO C2C, viz., Dr. Malvika Onial, Shri Niraj Kakati, Ms Persis Farooqy and Shri Dhruv Verma.

Promoting Indigenous Communities to Undertake Digital Documentation of Heritage Sites Under the Aegis of Green Hub.

Green Hub (<http://www.northeastnetwork.org/wp-content/uploads/2015/11/Green-Hub-Application-Form-2016-.pdf>) is a youth- and community-based video documentation centre for recording environmental and human diversity in the North-east, with a vision of engaging and empowering the youth and community in conservation of biodiversity through an innovative model of using visual media to renew and revive love and respect for nature and its resources.

The purpose of this partnership is to establish a cooperative working relationship between the two parties for planning and developing films, documentaries and photographic and audio-visual products on inscribed and tentatively listed World Heritage Sites in north-east India. A budget of 1 lakh has been allotted by UNESCO C2C for supporting this partnership, which includes video documentation by their fellows and a training workshop on World Heritage Site Outstanding Universal Values. The amount was spent to meet the needs in two forms: (1) Capacity building training and orientation on UNESCO World Heritage Site issues and information by C2C at Green Hub, Tezpur, Assam. The training workshop was held on 22 and 23 June 2015. Three resource persons, i.e., Shri Niraj Kakati, Shri Anukul Nath and Ms Persis Farooqy, provided detailed inputs on various aspects of Natural World Heritage Sites, with a special focus on Manas and Kaziranga, in Assam. (2) Financial support to Green Hub interns for carrying out digital documentation at Kaziranga and Manas. Two interns were provided stipends. Their focus was on carrying out video and image documentation at two World Heritage Sites of north-east India, i.e., Kaziranga National Park and Manas National Park, in Assam. They spent over 6 months in the field to capture the Outstanding Universal Values (OUVs) of the sites.

Short-Term Training for Frontline Staff of GHNPCA World Heritage Site, Dehradun, 8–10 March 2016. UNESCO C2C organised a training programme in wildlife habitat management,

methods used to estimate populations and carrying out surveys/censuses in the Himalaya for the frontline staff of the Great Himalayan National Park (GHNP) Circle. The programme was aimed at capacity building, training and developing skills and knowledge. This programme was attended by 29 forest staff members, including the ACF, Range Officers and Forest Guards of the GHNP Circle. The overall objective of this training programme was to introduce the staff to simple wildlife monitoring techniques, which they can use to assess and manage the Outstanding Universal Values (OUV) listed for the World Heritage Site. The 3-day programme included lectures by WII faculty members, a group exercise on SoOUVs and a field visit to Rajaji National Park.



Consultations held for inscribing Garo Hills as UNESCO World Heritage Site, Tura, 23–25

February 2015. The first ever Garo Hills Elephant Reserve Action Plan workshop was organised by the Meghalaya Forest Department in collaboration with CIFA (Conservation Initiative for Asian Elephants), International Elephant Foundation and UNESCO Category 2 Centre for World Natural Heritage Site Management and Training in the Asia Pacific Region at WII.

The three main objectives of the workshop were the following: (1) to bring eminent people working for wildlife conservation in the Garo Hills together and come up with a strategy and action plan for Garo Hills Elephant Reserve; (2) to create awareness about conservation and reach out to local community members to take steps for protecting elephants; and (3) to discuss with the local community the possibility of inscribing Garo Hills Elephant Reserve as a UNESCO World Heritage Site.

More than 150 Nokmas (village headmen) from 100 Akhings participated actively in the workshop. The eminent experts included Shri T.T.C. Marak, former PCCF of Meghalaya; Shri C. Budhnaah, PCCF

& HoFF, Meghalaya; Dr. Subhash Ashutosh, IFS (APPCF, Meghalaya); Shri Ron Chandler, CIFA, USA; Dr. Kashmira Kakati, Sandeep Tiwari, Wildlife Trust of India; Shri Dwipen Kalita, independent elephant expert; Shri Hiten Baishya, Shri Kamal Medhi and Dr. G. Areendran, WWF-India; Dr. Shalini Sharma, TISS, Guwahati; Shri Atul Chakravarty, NERCOMP; and Dr. Ajay Desai and Dr. Sonali Ghosh, from WII, Dehradun.

Training and Capacity Building of C2C Staff

Dr. Malvika Onial participated in the conference “The UNESCO World Heritage and the Role of Civil Society”, organised by World Heritage Watch, in Bonn, Germany on 26 and 27 June 2015. Following the two-day conference, attended by more than 120 representatives of civil society organisations from all over the world and featuring about 50 presentations of different experiences and activities of the civil sector in World Heritage protection, the participants issued a statement/resolution on the participation of civil society in the implementation of the World Heritage Convention. The statement/resolution calls for recognition of the contribution of civil society organisations to the good governance of the convention and urges the WH Committee to explore opportunities for strengthening the participation of civil society in the implementation of the convention.

- UNESCO C2C team members attended a weekly webinar for 4 weeks, an introduction to remote sensing for conservation management. sensing-conservation-management.
- Ms Persis Farooqy gave a talk titled “World Heritage Sites: An Overview” at a heritage workshop held between 16 and 18 August 2015 and organised by the Centre of Urban Design and Development (CUDD), Indian Institute of Technology Roorkee, Uttarakhand.
- Articles on the World Natural Heritage Sites of India—GHNP, Nanda Devi and Western Ghats—contributed by Ms Jyoti Negi, World Heritage Assistant were published in Saevus, wildlife magazine.
- Ms Jyoti Negi participated in the Third Course on Wildlife Conservation for Wildlife Enthusiasts, held from 5 to 14 October 2015 and organised by WII, Dehradun.
- Photographs of the Western Ghats clicked by Shri Anukul Nath were selected for publication in Saevus, wildlife magazine.
- The Second National Conference for Free and

Open Source Software for Geo-spatial (FOSS 4G-India, 2015) on Open Source Geo Spatial tools in Climate Change Research and National Resource Management, held at Indian Institute of Remote Sensing, Dehradun was attended by Shri Chitiz Joshi and Ms Rupa on 9 and 10 June 2015.

- A national workshop on capacity building of states and union territories with sites on the tentative list for future nomination as World Heritage was organised by the Archaeological Survey of India. Dr. Sonali Ghosh and Shri Dhruv Verma participated in the workshop on 10 April 2015.

Advisory and Technical Support Roles

C2C provided technical inputs on World Natural Heritage issues to MoEFCC, Government of India, such as preparation of the revised nomination dossier for Khangchendzonga World Heritage Site and State of Conservation Reports for Manas World Heritage Site and Keoladeo Ghana World Heritage Site. In addition, technical inputs were provided for a variety of issues such as the status of the Great Barrier Reef World Heritage Site and the Western Ghats Serial Site. Scientists from C2C participated in meetings and provided inputs on World Natural Heritage issues for the Advisory Committee on World Heritage Matters (ACWHM).

Technical support to states for SOC preparation for GHNP, Keoladeo National Park and Manas Wildlife Sanctuary. UNESCO C2C provided technical back-stopping to Himachal Pradesh for the Great Himalayan National Park Conservation Area (GHNP) and to Rajasthan for Keoladeo National Park (KNP) in preparing State of Conservation (SoC) reports for submission to World Heritage Centre by the deadline of 1 February 2016. C2C also provided support for minor modifications to the boundaries of the World Heritage Property Manas Wildlife Sanctuary.



VISITORS

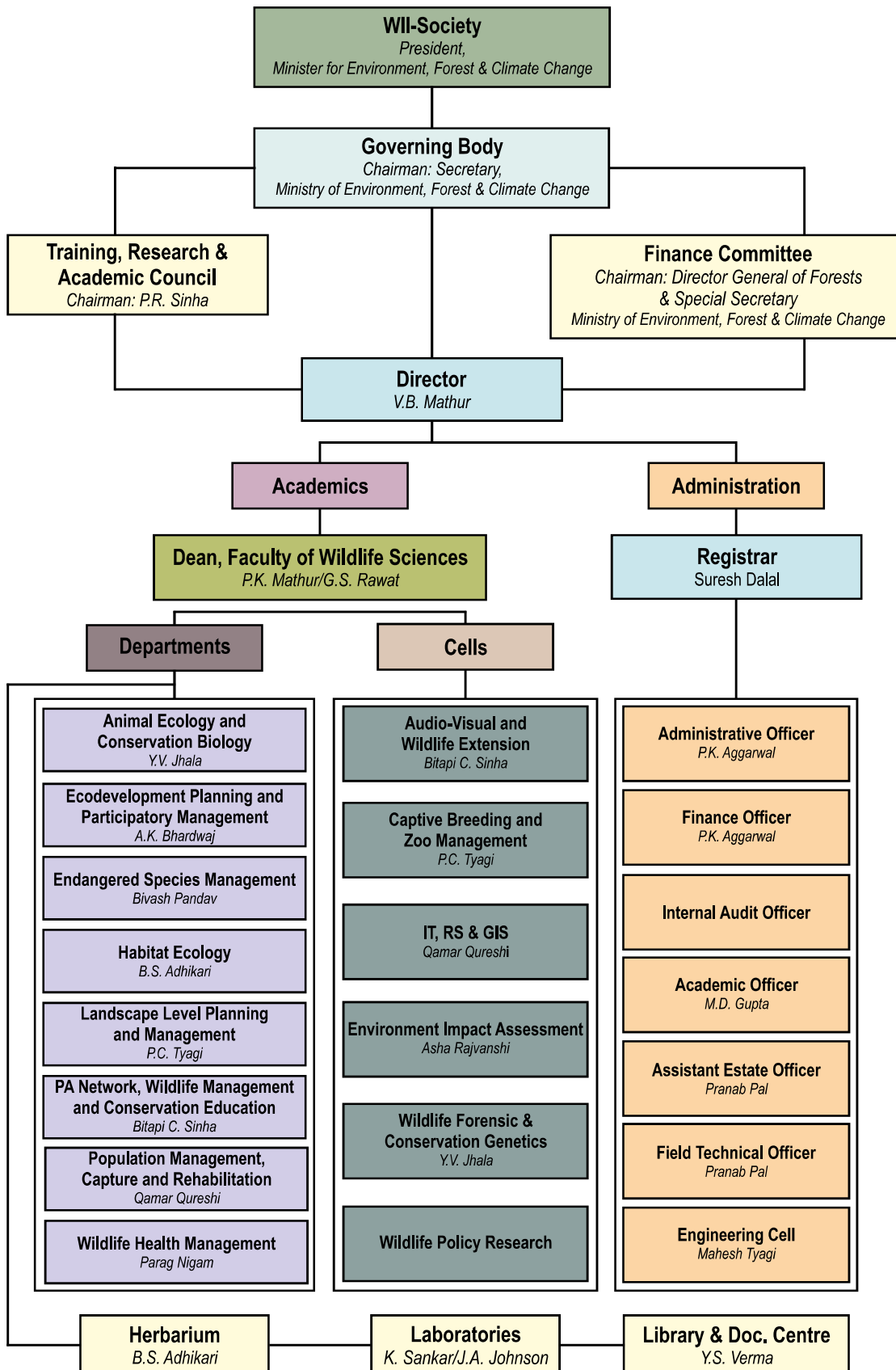
- Students from Dolphin (PG) Institute of Bio-medical & Natural Sciences, Manduwala, Dehradun, 7 April 2015
- Cadets from Indian Military Academy, Dehradun, 8 April 2015
- Students from Vivek College of Management and Technology, Bijnor, 29 April 2015
- Students from Institute of Integrated Himalayan Studies, HPU, Shimla, 29 April 2015
- A group from Uttarakhand Forestry Training, Academy, Haldwani, 6 May 2015
- Officer trainees from Central Academy for State Forest Service, Coimbatore, 14 May 2015
- Rangers from Forest Training Institute & Rangers College, Sundernagar, 2 June 2015
- A group from Kundal Academy, Sangli, Maharashtra, 12 June 2015
- A group from Forest Guard Training School Dhoomi, Akhnoor, J&K, 29 June 2015
- A group from University of Petroleum and Energy Studies, Dehradun, 20 July 2015
- A group from Central Academy for State Forest Service, Dehradun, 24 July 2015
- Graphic Era University, Dehradun, 12 August 2015
- Students from School of Life Science, BFIT, Dehradun, 14 September 2015
- A group from CCF Ecotourism, Uttarakhand, Dehradun, 17 September 2015
- A group from ICAR Network Project on Insect Biosystematics, Division of Entomology, ICAR-IARI, New Delhi, 18 September 2015
- Dr. G.S. Negi College of Veterinary and Animal Science, CSK H.P. Krishi Vishwavidyalaya, Palampur, Himachal Pradesh, 30 September 2015
- A group from Madhya Pradesh Council of Science & Technology, Vigyan Bhawan, Nehru Nagar, Bhopal, 7 October 2015
- Students from College of Forestry, Uttarakhand University of Horticulture & Forestry, Ranichauri, Tehri Garhwal, Uttarakhand, 14 October 2015
- Students from Mass Media Department of St. Xavier's College, Mumbai, 6 November 2015
- Students from Karnataka Veterinary, Animal & Fisheries Sciences University, Veterinary College, Nandinagar, Bidar, 10 November 2015
- Students from Uttaranchal College of Science and Technology, Dehradun, 17 November 2015
- Probationers from Indira Gandhi National Forest Academy, Dehradun, 18 November 2015
- Students from Veterinary College, Hassan, 23 November 2015
- A group from Forest College and Research Institute, Tamil Nadu Agriculture University, Mettupalayam, 23 November 2015
- The Assistant Director of Agriculture (Stella Jacob), Erattupetta, Kottayam, Kerala, 23 November 2015
- Probationers from Central Academy for State Forest Service, Dehradun, 23 November 2015
- Students from Agriculture College and Research Institute, Tamilnadu Agriculture Institute, Navalur Kuttapattu, Tiruchirappalli, 24 November 2015
- Probationers from Indira Gandhi National Forest Academy, Dehradun, 27 November 2015
- Students from Grace Academy, Rajpur Road, Dehradun, 30 November 2015
- Women trainees from Forest Training Institute & Rangers College, Sundernagar, Mandi, Himachal Pradesh, 12 January 2016
- A group from Kathmandu Forestry College, Kathmandu, Nepal, 31 January 2016
- Students from Jain University, Bengaluru, 3 February 2016
- Students from Department of Biotechnology, Elphinstone College, Mumbai, 4 February 2016
- A group from Tribhuvan University, Institute of Forestry, Pokhara Campus, Pokhara, 4 February 2016
- A group from Tribhuvan University, Institute of Forestry, Pokhara Campus, Pokhara, 8 February 2016
- A group from Remote Sensing Applications Centre, Lucknow, Uttar Pradesh, 10 February 2016
- Students from Department of Environmental Studies, Maharaja Sayajirao University of Baroda, Gujarat, 12 February 2016
- Students from Sam Higginbottom Institute of Agriculture, Technology & Sciences, Allahabad, 17 February 2016
- A group from Kashmir Forest Training School, Chatternar, Bandipura, Camp Jammu, J&K, 19 February 2016
- P.G. Diploma and M.Tech. students of Indian Institute of Remote Sensing, Dehradun, 25 February 2016
- A group from Tribhuvan University, Institute of Forestry, Hetauda, Nepal, 1 March 2016
- A group from Tribhuvan University, Institute of Forestry, Hetauda, Nepal, 4 March 2016
- A group from Forest Survey of India, Dehradun, 9 March 2016
- Students from ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari, Gujarat, 10 March 2016
- A group from Central Academy for State Forest Service, Dehradun, 17 March 2016
- A group from Uttarakhand Forest Training Academy, Haldwani, 18 March 2016
- Biju Dharmapalan, Head of Department, School of Biosciences, Mar Athanasios College for Advanced Studies (MACFAST), Tiruvalla, Kerala, 22 March 2016



GOVERNANCE

- **Organisational Structure of WII**
- **WII-Society**
- **Governing Body**
- **Training, Research & Academic Council (TRAC)**
- **Finance Committee**

Organizational Structure of WII



Wildlife Institute of India - Society

President

1. Minister of State (Independent Charge)
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'Secretariat',
Shillong (Meghalaya)
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Government of Sikkim,
'Secretariat',
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Government of West Bengal,
'Secretariat',
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6. Lt. General (Retd.) Shri A.K. Member
Singh (PVSM, AVSM)...
Hon'ble Lt. Governor,
Government of Andaman & Nicobar,
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Government of Goa,
Swami Vivekanand Road,
Panaji, Goa - 403 001
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Government of Tamil Nadu,
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Ambala (Haryana)
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Government of Himachal Pradesh,
'Secretariat',
Shimla (Himachal Pradesh)
13. Hon'ble Minister... Member
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Government of Madhya Pradesh,
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Bhopal (Madhya Pradesh)
14. Hon'ble Minister... Member
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Government of Uttarakhand,
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Education and Research,
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R Venkataraman Nagar, Kalapet,
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Resi. 53, Inder Road, Dalanwala
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Ministry of Environment & Forests,
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42. Dr. P.K. Mathur... Member
Dean, FWS
Wildlife Institute of India,
Dehradun - 248 001

43. Shri V.K. Uniyal... Member
Scientist - F
Wildlife Institute of India
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44. Dr. V.B. Mathur... Member-Secretary
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46. Member Secretary
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12. Chief Wildlife Warden,
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13. Chief Wildlife Warden
Government of West Bengal,
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Kolkata – 700 091 (West Bengal)

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Silk Factory Road,
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Rana Pratap Marg,
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Dehra Dun - 248 006

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21. Dr. V.B. Mathur
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Training, Research & Academic Council (TRAC)(20.03.2015 to 19.03.2018)

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Eastern Region (2 Representatives)	Orissa, Jharkhand
Central India (1 Representative)	Chhattisgarh
Western Region (2 Representatives)	Daman & Diu, Goa
Southern Region (2 Representatives)	Kerala, Tamil Nadu
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Research Consultant,
Jhaveri Microbiology Centre,
L. V. Prasad Eye Institute,
L. V. Prasad Marg, Banjara Hills,
Hyderabad – 500 034 (Andhra Pradesh)
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Former, Principal Chief Conservator of Forests
& Chief Wildlife Warden, Government of
Meghalaya,
Lapalang, Dong Madan,
Shillong – 793 006 (Meghalaya)
23. Dr. Rucha Gbate,
Senior NRM Governance Specialist,
International Centre for Integrated Mountain
Development,
Khumaltar, Lalitpur, G.P.O. Box 3226,
Kathmandu (Nepal)
24. A Representative of the
Indian Council of Forest, Research &
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P.O. New Forest,
Dehra Dun – 248 006 (Uttarakhand)
25. Dean, Faculty of Wildlife Sciences,
Wildlife Institute of India,
Chandrabani,
Dehra Dun – 248 001 (Uttarakhand)
- 26 & 27. Two senior most Head of Departments
(in terms of pay-scale)
(to be nominated by Director, WII),
Wildlife Institute of India,
Chandrabani,
Dehra Dun – 248 001 (Uttarakhand)
28. Faculty Member
(In-charge of Research Coordination)
Wildlife Institute of India,
Chandrabani,
Dehra Dun – 248 001 (Uttarakhand)

Member-Secretary

29. Director,
Wildlife Institute of India,
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4. Shri P.R. Sinha
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Country Representative,
India Country Office
International Union for Conservation of Nature
(IUCN)
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5. Dr. Biswajit Mohanty Shantikunj,
Link Road
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6. Dr. P.K. Mathur
Dean, FWS
Wildlife Institute of India
Dehra Dun
7. Dr. V.B. Mathur,
Director,
Wildlife Institute of India
Dehradun



PUBLICATIONS

Peer-Reviewed International Journals

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Mathur VB, Rajvanshi A (2016). Eco-friendly measures to mitigate the impacts of linear infrastructure on wildlife. Presentation before Chairman, National Highway Authority (NHAI), Delhi. 19 January, 2016.

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Rajvanshi A (2015). Living well within planetary boundaries. Plenary lecture on the eve of World Environment Day. University of Kashmir, Srinagar. 5 June 2015.

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Rajvanshi A (2015). Environmental Impact Assessment. Participants of the NNRMS-FE course at Indian Institute of Remote Sensing (IIRS), Kalidas Road, Dehradun. 11 June, 2015.

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Bhattacharya P, Priyadarshani S, Kumar D, **Talukdar G, Mondol S, Rawat G (2015). Detecting climate change impacts on mycorrhizal communities in the Indian Himalayan region in CSIR.** National Conference on Cryptogam Research in India: Progress and Prospects, National Botanical Research Institute, Lucknow, 28–29 September 2015.

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Progress and Prospects, National Botanical Research Institute, Lucknow, 28–29 September 2015.

Pawde AM, Mahendran K, Saxena AC, Mathur A, Karikalan K, Chander V, Vyas H and **Nigam P (2016). Diagnosis and therapeutic management of idiopathic megacolon in Bengal tiger at Sajjagarh Biological Park, Udaipur.** National Symposium on Newer Approaches in Diagnosis and Management of Animal Diseases for Sustainable Health and Production, organised by Guru Angad Dev Veterinary and Animal Science University, Ludhiana, Punjab, 17–19 February 2016. Awarded the Third Best Poster award at the symposium.

Popular Articles

Davate M, Chatterjee N, Dashahre A, Habib B, Nigam P, Trivedi M, Garad GP, Kalaskar A, Ghaskadbi A (2015). **Recent records of rusty-spotted cat in dry deciduous forest of Tadoba, Maharashtra, India.** CAT News [ISSN 1027-2992] 62(Spring 2015): 22–23.

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Vinod Verma





TALKS AND MEETINGS

Teaching inputs provided to other institutions

From WII

Dr. Abhijit Das (8 April 2015). **Lecture and demonstration of scientific handling of snakes.** Indian Military Academy, Dehradun.

Dr. Anil Kumar Bhardwaj (18–19 May 2015). **People and protected areas: Issues related to ecodevelopment for biodiversity conservation.** Indira Gandhi National Forest Academy, Dehradun.

Dr. R. Badola (11 June 2015). **Evaluation of ecosystem services.** NNMRS certificate course. Indian Institute of Remote Sensing, Dehradun.

Dr. R. Badola (12 July 2015). **Motivation.** The Central Academy for State Forest Service, Dehradun.

Dr. V.B. Mathur (20 July, 2015): **'Wildlife Management'**, Central Academy for State Forest Service, New Forest, Dehradun.

Dr. Anil Kumar Bhardwaj (2 September 2015). **Working plan preparation: Wildlife perspective.** Indian Institute of Remote Sensing, Dehradun.

Dr. R. Badola (3 September 2015). **Case studies on PES and valuation of ecosystem services.** TERI University, New Delhi.

Dr. Anil Kumar Bhardwaj (8 September 2015). **Ecodevelopment, interface issues.** Central Academy of State Forest Academy, Dehradun.

Dr. R. Badola (9 October 2015). **Himalayas: Forests and people.** CSE's regional media briefing workshop, "Reporting on the Himalayan ecosystem: Challenges and opportunities", New Delhi.

Dr. V.B. Mathur (13 October, 2015): **'Best Practices developed in the field of wildlife management & future challenges'**, One week compulsory Training Course on 'Best Practices in Forestry', IGNFA, Dehradun.

Dr. J.A. Johnson (21–27 October 2016). **Field inputs during techniques tour for the trainees of Indira Gandhi National Forest Academy, Dehradun.** Panna National Park, Madhya Pradesh.

Dr. Anil Kumar Bhardwaj (3 November 2015). **Community participation in PA management.** Central Academy for State Forest Academy, Dehradun.

Dr. S.K. Gupta (17 November 2015). **Input to higher judicial training programme.** Indira Gandhi National Forest Academy, Dehradun.

Dr. Anil Kumar Bhardwaj (24 November 2015). **Ecodevelopment and ecotourism: Periyar experience.** Indira Gandhi National Forest Academy, Dehradun.

Dr. Parag Nigam (26 November 2015). **Management of wild animals in distress.** Indira Gandhi National Forest Academy, Dehradun.

Dr. Abhijit Das (1–6 December 2015). **Herpetofaunal sampling technique.** Central Academy for State Forest Service, Dehradun.

Dr. R. Badola (9 December 2015). **People participation in ecosystem conservation: Approaches and challenges.** Indian Institute of Remote Sensing, Dehradun.

Dr. Parag Nigam (13 December 2015). **Veterinary considerations in capture and translocation of large felids.** Kanha and Panna Tiger Reserves, Madhya Pradesh.

Dr. Abhijit Das (23 December 2015). **Herpetofauna conservation.** Central Academy for State Forest Service, Dehradun.

Dr. Anil Kumar Bhardwaj (28 December 2015). **Ecodevelopment: Ideas and precautions for young foresters.** Central Academy of State Forest Academy, Dehradun.

Dr. R. Badola (31 December 2015). **People's involvement in conservation.** Professional skill upgrading course. Indira Gandhi National Forest Academy, Dehradun.

Dr. V.B. Mathur (14 March, 2016): **'Wildlife Conservation'**, IGNFA, New Forest, Dehradun.

Dr. S.K. Gupta (17 March 2016). **Wildlife forensics.** Central Academy for State Forest Service, Dehradun.

Dr. Abhijit Das (22 March 2016). **Herpetofauna conservation.** University of Science and Technology, Meghalaya.

Dr. Anil Kumar Bhardwaj (25 March 2016). **Biodiversity conservation in India: Linking science with management.** SG College, Jagraon, Punjab.

Dr. Anil Kumar Bhardwaj (26 March 2016). **Biodiversity conservation, protected areas and human well-being: Role of science.** G.H.G. Khalsa College, Gurusar Sadhar, Ludhiana.

To WII

Shri D.D. Mishra, Chief (Human Resources), Oil and Natural Gas Corporation (ONGC) delivered a presentation titled **"I Had a Dream"**, 7 September 2015.