Programme & Abstracts

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

1ST HIMALAYAN RESEARCH SEMINAR

PROGRAMME

Seminar Chairperson: Dr. L.M.S. Palni, Former Director, GBPNIHESD

Friday, 23rd September 2016

0930 – 0935	Welcome	**Dr. Bitapi C. Sinha, Research Coordinator, WII**
0935 – 0945	Opening Remarks	**Dr. G.S. Rawat, Dean, FWS, WII**

TECHNICAL SESSION – I

National Mission for Sustaining the Himalayan Ecosystem (NMSHE)

Chair	**:**	**Dr. G.S. Rawat, Dean, FWS**
Co-Chair(s)	**:**	**Dr. V.P. Uniyal, Scientist-F**
		Dr. J.A. Johnson, Scientist-D

0945-0955	An introduction to the WII - NMSHE Project	**Ishwari Dutt Rai**
0955-1005	Distribution and relative abundance of mammals in alpine areas of Bhagirathi basin, Uttarakhand	**Ranjana Pal**
1005-1015	Distribution and relative abundance of ungulates in Temperate and Sub-tropical Forests of the Bhagirathi Basin	**Shashank Arya**
1015-1025	Distribution and relative abundance of carnivores in Temperate and Sub-Tropical Forests of Bhagirathi Basin	**Shagun Thakur**
1025-1035	Bird community as an indicator of climate change in Bhagirathi Basin: Preliminary findings	**Sohini Chaudhuri**
1035-1045	Assessing the effects of climate change on Himalayan herpetofauna: Preliminary findings	**Naitik G. Patel**

1045-1105	Discussion
1105-1125	**Tea**
1125-1135	Research gaps in conservation of fishes in the Indian Himalayan Region **Vineet K Dubey**
1135-1145	Spatial distributional pattern of the fishes in the Bhagirathi river basin **Aashna Sharma**
1145-1155	Trends and Gaps in Butterfly Research in the Indian Himalayan Region **Manish Bhardwaj**
1155-1205	Baseline study on diversity and distribution of Dragonflies and Damselflies (Insecta: Odonata) along elevation gradient in Bhagirathi River Basin **Shuvendu Das**
1205-1215	Response of soil bacterial communities to climate change in the Indian Himalayan Region – standardization of methods **Pamela Bhattacharya**
1215-1225	Use of fungi and lichens as indicators of climate change in the Indian Himalayan Region: An update **Sonam Priyadarshani**
1225-1235	Preliminary findings on Nematodes in Gangotri National Park, Uttarakhand **Priyanka Kashyap**
1235-1245	Introduction to climate futures: Climate change projections and implications for Uttarakhand Himalayan Region **Sujata Upgupta**
1245-1305	Discussion and remarks by session Chair and Co-chair
1305-1400	**Lunch**

TECHNICAL SESSION – II

Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI)

Chair	**:**	**Dr. B.S. Adhikari, Scientist-F**
Co-Chair(s)	**:**	**Dr. Gautam Talukdar, Scientist-D**
		Dr. R. Suresh Kumar, Scientist-D

1400-1410	Patterns of invasion by an alien invasive plant *Ageratina adenophora* in Gokerneshwar Gad watershed, Kailash Sacred Landscape – India **Alka Chaudhary**
1410-1420	Strategies for minimizing Human-wildlife conflicts in selected pilot areas in KSL India **Ajaz Hussain**
1420-1430	Seasonal and habitat influences on bird diversity in Kailash Sacred Landscape (KSL) India (Bans village) **Sumit Arya**
1430-1440	Conservation status and distribution of *Diploknema butyracea* in Kailash Sacred Landscape, India **Vipin Upadhyay**
1440-1450	Insects: A focal taxa for long term monitoring in Kailash Sacred Landscape, Pithoragarh, Uttarakhand, India **Mona Chauhan**
1450-1510	Discussion and remarks by session Chair and Co-chair
1510-1530	**Tea**

TECHNICAL SESSION – III

Biodiversity Conservation & Rural Livelihood Improvement Project (BCRLIP)

Chair : Dr. Ruchi Badola, Scientist-G

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

Dr. Samrat Mondol, Scientist-D

1530-1540 Space use and activity patterns of mammalian community in Askot landscape, Uttarakhand, India

Ankita Bhattacharya

1540-1550 Stream health assessment using ecological indicators: A case study from Askot landscape, Uttarakhand

Vandana Rajput

1550-1600 Structural attributes of vegetation communities along elevational gradient in Askot landscape, Uttarakhand, India

Soni Bisht

1600-1610 Can a stitch in time save nine: Potential strategy to mitigate future human wildlife conflict in Askot conservation landscape

Amrita Laha

1610-1630 Discussion and remarks by session Chair and Co-chair

1630-1645 Seminar closing remarks

Dr. L.M.S. Palni, Former Director, GBPNIHESD

NMSHE

Project Details & Abstracts

Project Title	Assessment and Monitoring of Climate Change Effects on Wildlife Species and Ecosystems for Developing Adaptation and Mitigation Strategies in the Indian Himalayan Region
Principal Investigator	Dr. V.B. Mathur, Director
Nodal Scientist	Dr. S. Sathyakumar, Scientist – G (Mammals and Birds)
Co. P.I.	Dr. G.S. Rawat, Scientist- G (Micro flora) Dr. R. Badola, Scientist – G (Human Ecology) Dr. A. Rajvanshi, Scientist- G (Human Ecology) Dr. P. Singh, Scientist – G (Birds) Dr. V.P. Uniyal, Scientist- F (Insects and Microfauna) Dr. K. Sivakumar, Scientist – E (Aquatic Ecology) Dr. K. Ramesh, Scientist – D (Spatial Ecology, Bird) Dr. J. A. Johnson, Scientist – D (Aquatic Ecology) Dr. G. Talukdar, Scientist – D (Spatial Ecology, Micro-flora) Dr. A. Das Scientist – C (Herpetofauna)
Project Scientists	Dr. I. D. Rai (Micro-flora) Ms. S. Upgupta (Spatial Ecology) Dr. T. Bhattacharya (Mammals and Birds)
Project Associates	Mr. A. Kumar (Spatial Ecology) Dr. M. Bharadwaj (Insect and Micro-fauna) Dr. V. K. Dubey (Aquatic Ecology).
Project Fellows	Ms. A. Sharma (Aquatic Ecology) Mr. N. G. Patel (Herpetofauna) Ms. P. Bhattachaarya (Micro-flora) Ms. R. Pal (Mammals and Human ecology) Mr. S. Arya (Mammals) Ms. S. Chaudhury (Birds) Ms. T. Gaur (Spatial Ecology)
NMHS H-JRF(s)	Ms. M. Bandyopadhyay (Spatial Ecology) Ms. P. Kashyap (Micro-fauna) Ms. S. Priyadarshini (Micro-flora) Ms. S. Thakur (Mammals) Mr. S. Das (Insects
Project Assistants	Ms. B. Iyer (Mammals and Birds) Ms. M. Pandey (Mammals) Ms. N. Aswal (Project management)
Funding Agency	Department of Science and Technology, Govt. of India
Duration	2015-2019

DISTRIBUTION OF TASKS/RESPONSIBILITIES

S.No	Name & Position	Theme / Faunal Group / Task(s)	Faculty Supervisor (s)
1	Dr. Ishwari Datt Rai Project Scientist	Micro-flora, Project outputs / deliverables	GSR
2	Dr. Sujata Upgupta Project Scientist	Spatial Ecology- Climate modelling, Visualization, Project outputs/ deliverables	KR, GT, SSK
3	Dr. Tapajit Bhattacharya Project Scientist	Terrestrial Ecology- Mammals, Birds, Project outputs / deliverables	PS, SSK
4	Sh. Arun Kumar Project Associate	Spatial Ecology-DSS, Visualization, Project outputs / deliverables	KR, GT, SSK
5	Dr. Vineet Kumar Dubey Project Associate	Aquatic Ecology-Fish	KSK, JAJ
6	Dr. Manish Bharadwaj Project Associate	Terrestrial Ecology- Invertebrates, micro fauna, Project outputs / deliverables	VPU, SSK
7	Ms. Aashna Sharma Project Fellow	Aquatic Ecology-Fish	KSK, JAJ
8	Ms. Pamela Bhattacharya Project Fellow	Terrestrial Ecology- Mico flora and mciro fauna	GSR, VPU
9	Sh. Naitik Patel Project Fellow	Terrestrial Ecology- Herpetofauna	AD
10	Ms. Ranjana Pal Project Fellow	Terrestrial Ecology-Mammals, Human Ecology (Human-Wildlife Interactions)	SSK, AR, RB
11	Ms. Sohini Chaudhuri Project Fellow	Terrestrial Ecology- Birds	PS, SSK
12	Ms. Tanvi Gaur Project Fellow	Spatial Ecology, Distribution modelling, visualization	KR, GT
13	Mr. Shashank Arya Project Fellow	Terrestrial Ecology- Mammals	SSK
14.	Ms. Meghna Bandyopadhyay H-JRF	Spatial Ecology	KR
15.	Mr. Shuvendu Das H-JRF	Terrestrial Ecology- Invertebrates	VPU
16.	Ms. Priyanka Kashyap H-JRF	Terrestrial Ecology-Micro fauna	VPU
17.	Ms. Sonam Priyadarshini H-JRF	Terrestrial Ecology - Microflora	GSR, VPU
18.	Ms. Shagun Thakur H-JRF	Terrestrial Ecology - Mammals	SSK
19.	Ms. Neha Aswal Project Assistant	Project Management Unit	SSK
20.	Ms. Bhavya Iyer Project Assistant	Terrestrial Ecology- Mammals and Birds	SSK, PS
21.	Ms. Malvika Pandey	Terrestrial Ecology-Mammals	SSK

An introduction to the WII - NMSHE project

-Dr. Ishwari Datt Rai

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

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

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

Combining the findings of all the thematic groups, potential sites have been identified in Bhagirathi basin for intensive studies and long-term monitoring. Field work will be continued and spatial modelling will be initiated. Reconnaissance of other study sites in the IHR is planned.

Distribution and relative abundance of mammals in alpine areas of Bhagirathi Basin, Uttarakhand

- Ranjana Pal

Alpine habitats of the Himalaya are home to many wildlife species that are highly dependent on specific climatic conditions and are vulnerable to climate change. An assessment of the distribution and relative abundance of mammals in alpine habitats of Bhagirathi Basin was done.

The study was carried out in alpine areas of Bhagirathi Basin (3000 m to 5100 m). Six sites were studied covering moist alpine meadows, dry alpine meadows, dry steppe and sub-alpine forest.

The study area was subdivided into 256 km^2 grids according to the average home range of the largest mammal found in the area, the brown bear. Each 256 km^2 were further subdivided into 4 x 4 km grids and camera units were deployed in 3 to 4 such 4 x 4 km grids. Camera traps were deployed at 57 sites for eight months (October 2015 to June 2016). Scanning from vantage points (n=17, 30hrs) and trail sampling (n=15, 228km) were also carried out.

A total of 22 species of mammals were photo-captured (2850 photographs) in camera traps (effort=7,866 trap nights). Red fox *Vulpes vulpes* was the most photo-captured (31.72± 6.21, #/100 trap nights, n= 2099) followed by snow leopard *Panthera uncia* (3.62±0.81, n=288), Tibetan wolf *Canis lupus* (2.61±0.83, n=197), sambar *Rusa unicolor* (1.22±0.76, n=68) and musk deer *Moscus chyrsogaster* (1.03±0.6, n=93). During trail sampling and scanning, 38 groups (399 individuals) of blue sheep *Pseudois nayaur* and 7 groups (111 individuals) of Himalayan tahr *Hemitragus jemlahicus* were encountered. Encounter rate of blue sheep was 2.01±0.93/km (n=29, individuals=304, mean group size 10.48±1.98). New distribution records in Uttarakhand include: sand fox *Vulpes ferrilata* (0.03±0.03, n=3), Tibetan woolly hare *Lepus oiostolus* (0.27±0.18, n=23) and Asiatic wild dog *Cuon alpinus* (0.08±0.08, n=5). Use and availability analysis for use of altitude, aspect and slope for the species will be presented and discussed.

Among the carnivores, red fox was the most widely distributed. Tibetan wolf were recorded only in very cold and dry trans-Himalayan habitats. Snow leopard was found in range of different habitat types whereas brown bear was found in alpine meadow and subalpine habitats. Among the ungulates, most of the blue sheep encounters were in the cold and dry alpine.

Present study generates information on distribution of mammals in alpine areas which can serve as baseline for long term monitoring.

Keywords: Camera traps, photo capture rate, temperature range, precipitation range

Distribution and relative abundance of ungulates in temperate and sub-tropical forests of the Bhagirathi Basin

-Shashank Arya

Temperate and Sub-tropical forests are habitat for many ungulates that form prey base for carnivores and are indicators of habitat status and protection levels. The objective of the study is to generate primary information on distribution and relative abundance of ungulates in the sub-tropical and temperate habitats of Bhagirathi Basin in Uttarakhand.

Total seven sub-basins of Bhagirathi River Basin were assessed.

Primary data has been collected from temperate and sub-tropical forests of the study area from an elevation of 500m to 3,000m.The study area was subdivided into 16 x 16 km (256 km^2) grids according to the average home range of the largest mammal found in the area, the brown bear. Each of these 256 km^2 were further subdivided into 4 km x 4 km grids and camera units were deployed in 3 to 4 such 4 x 4 km grids. Camera traps were deployed at 36 sites for nine months (October 2015 to June 2016). Visual encounters of ungulates based on field surveys were also recorded.

A total of seven ungulates species were photo-captured (834 photographs) in 2,180 trap nights. Barking deer *Muntiacus vaginalis* (19.04 ± 5.82) was the most photo-captured (#/100 trap nights) ungulate followed by sambar *Rusa unicolor* (10.38 ± 3.07), wild pig *Sus scrofa* (8.60 ± 3.39), goral *Naemorhedus goral* (8.07 ± 4.86), musk deer *Moschus chrysogaster* (0.033 ± 0.033), Himalayan tahr *Hemitragus jemlahicus* (2.88 ± 2.21), and Himalayan serow *Capricornis thar* (0.63 ± 0.39). Use and availability analysis showed that barking deer (n=20), serow (n=5) and goral (n=7) used steep slopes (30-40°) in lower and mid elevation (500 m- 2,800m). Sambar (n=18) used gentle slopes (20-30°) in both lower and middle altitudes (2,000m-3,000m). Serow (n=5) captures were from gentle and steep slopes only in mid elevation areas (2300 to 2900m). Tahr (n=4) used very steep middle and high elevation areas. Wild pig (n=17) used gentle slopes of wide altitudinal classes (900 to 3000m). Ungulate diversity was more in temperate forests (n=7).. Evidence of livestock grazing, presence of stray dogs, and habitat degradation were encountered which may pose threat to the survival of mountain ungulate populations in the Study Area.

Present study generates baseline information on distribution and relative abundance of mammals in subtropical and temperate areas for comparison with future estimates.

Keywords: Ungulates, camera traps, photo capture rate, anthropogenic pressures

Distribution and relative abundance of carnivores in temperate and sub-tropical forests of Bhagirathi basin

-Shagun Thakur

The aim of the study is to generate baseline information on the distribution and relative abundance of carnivores in the sub-tropical and temperate habitats of Bhagirathi Basin in Uttarakhand.

In total, seven sub-basins of Bhagirathi River Basin were assessed. Primary data has been collected from temperate and sub-tropical forests of the study area from an elevation of 500m to 3,500m.

The study area was subdivided into 16 x 16 km (256 km^2) grids which were further subdivided into 4 km x 4 km grids. Camera traps were deployed in these grids at 43 sites from Oct 2015 to June 2016.

A total of 12 carnivore species were recorded (2,137 photographs) in camera traps based on the total effort of 2,951 trap nights. Maximum photo-captures (#/100 trap nights) were recorded for red fox *Vulpes vulpes* (43.13 ± 26.44,n=1,699) in mixed conifer habitat (2,100m to 3,300m) followed by Common leopard *Panthera pardus* (6.20 ± 1.38, n=140) in subtropical mixed forests, scrub and upper temperate oak and conifer habitats (900m to 3500m). Leopard cat *Prionailurus bengalensis* photo-captures (3.21 ± 0.84, n=64) were in habitats ranging from scrub to mixed conifer forests (900m to 2,200m0. Himalayan Yellow-throated marten photo-captures (1.51 ± 0.60,n=34) were obtained from subtropical pine forest to mixed temperate conifer forests (1,300m to 3,500m). Asiatic black bear (*Ursus thibetanus*) was photo-captured (n=12) in oak and deodar forest habitats (2,600m to 3,100m). First photographic confirmation of Asiatic wild dog *Cuon alpinus* (n=2) and Himalayan brown bear (n=2) was made in Kheda tal (2,500m) and Harsil-Kiyarkoti (3,500m) regions of the study area. Only one photo-capture each was recorded for four carnivores *viz*. Jackal *Canis aureus*, Himalayan brown bear*,* Jungle cat *Felis chaus* and Stone marten *Martes foina* in the study area.

Common leopard was the most widely distributed carnivore in the study area followed by red fox. The Himalayan brown bear, jungle cat, jackal and stone marten were patchily distributed. The baseline data on distribution and relative abundance of carnivores in the temperate and sub-tropical zones generated by this study will be used for long-term monitoring.

Keywords: Carnivores, camera trapping, long-term monitoring, trap effort, photographic capture rates, baseline information.

Bird community as an indicator of climate change in Bhagirathi Basin : Preliminary findings

- Sohini Chaudhuri

Birds are used as representative group for identifying changes in vegetal cover occurring in an ecosystem. They are diverse and sensitive to most climatic variables and thus recognised as useful indicators of climate change. The study aims to create a baseline data and investigate possible effects of climatic variables on several aspects such as avian distribution, geographical range, reproductive biology and phenological changes along environmental gradient across different vegetation types in the Indian Himalayan region.

The study was conducted in Bhagirathi Basin of Uttrakhand that encompasses different environmental gradients (1,000m -5,000m) and vegetation types.

According to the findings of reconnaissance survey, the entire study area was classified into 9 elevation zones (500m), five disturbance categories (1= low, 5=Very high), and 5 habitat types (sub-tropical forest, mixed temperate forest, conifer forest, sub-alpine scrub and alpine meadows). To focus on the decoupling of anthropogenic impacts and impacts of climate change, areas having least disturbance (DI=1) were selected for intensive study. A total of 12 sites were selected for long-term monitoring. Out of these, Point count (n=32) and Spot mapping (n=7) were carried out in 7 sites. For spot mapping, the area was first surveyed and then permanent plots of 200m X 250m were established. The survey was carried out during early hours on two consecutive days. At a single site, five point count stations (200m apart) were selected and carried out early morning. During the survey, breeding behaviours were also recorded in order to correlate the impact of climatic variables on avian breeding phenology.

A total of 212 species were observed along the elevation gradient. From the current study, an average of 202 individuals and 30 species of birds were encountered in lower elevation plots (500m–2,000m). Then 187 individuals and 30 species were observed in mid-elevation plots (2,000m-3,500m) and finally higher elevation (3,500m-5,000m) plots showed 98 individuals and 26 species. Three nests were recorded in each plot (n=21) and 12 abandoned nests were also observed. Most number of individuals and species were mid elevations (n=133; n=44)).

Preliminary study indicates findings about distribution of species, breeding activity of plots. The study indicates that certain families (Muscicapide, Paridae, Fringilliade, Picidae) were more abundant and can be considered as indicators species for long-term monitoring with respect to climatic change. Further Studies on community compositions, changes in the community structures and ecological interactions can be carried out.

Keywords: Avian breeding phenology, elevation gradient, long term monitoring, point count, spot mapping

Assessing the effect of climate change on Himalayan herpetofauna: Preliminary findings

-Naitik Patel

To determine herpetofaunal species richness along an elevation gradient in Bhagirathi Basin and assessing Beautiful stream frog (*Amolops formosus*) and Himalayan pit viper (*Gloydius himalayanus*) as possible climate change indicators.

The study was carried out in Bhagirathi Basin, Uttarakhand, India.

We conducted diurnal and nocturnal Visual encounter survey and opportunistic observations from March 2016 to August 2016. Sampling effort for amphibians was concentrated along the stream courses. 400m ×30m belt plot was surveyed after dusk for mark recapture sampling. Natural dorsal marking pattern of the frogs was used to identify unique individuals. Each frog in the sampling plot was photographed from dorsal side using hand held Digital camera. Hotspotter software was used to identify the individual frogs based on their dorsal marking pattern. Our field records are used for distribution modeling for *Gloydius himalayanus.*

6 families, 16 genera, 18 species of Reptiles and 4 families, 8 genera and 12 species of amphibians were documented during the study. Amongst documented species 3 amphibians and 5 reptiles are endemic to Western Himalaya. Preliminary observation showed a mid elevation peak with 20 species. Genus *Asymblepharus* found to have a wide altitudinal range. However its possible cryptic nature is currently under observation based on morphological and molecular taxonomy. A total of 703 photographs of *Amolops formosus* were captured in 4 days occasion in a single session. 314 individuals were identified with 35% recaptures. Distribution of *Gloydius himalayanus* is mapped for Uttarakhand based on 26 locality records from the field data.

Dorsal natural marking are found to be reliable tool for population monitoring of torrent frog *Amolops formosus*. Species richness presumably reflect vulnerability to mid elevation species and needs further study. More geotagged location will help in building more robust distribution model for identifying conservation important area and climate change prediction.

Keywords: Reptiles, àmphibians, diversity, distribution modelling, mark-recapture.

Research gaps in conservation of fishes in the Indian Himalayan Region

-Vineet. K. Dubey

Indian Himalayan Region (IHR) drained by 19 rivers, is known to be home to around 266 fish species, which is about 27% of the India's total freshwater fish species. Keeping in view their fast decline, preventing any further retrogression is an important strategy to address climate change. As such, a bibliographical review based on available publications was done to understand research gaps in fish ecology and conservation in Himalaya by collecting all the available scientific literature on the freshwater fish fauna of IHR and categorizing the trend of scientific development and knowledge gap till date.

Six Himalayan States namely Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh and West Bengal were assessed for their ichthyologic research data.

All available relevant published information was collected through in-depth search of international databases, and libraries of various Indian research institutes. Further, a total of 75 keywords related to different aspects of fishes were browsed and online database searched using term "Himalaya" with names of the six study area states. A database was prepared and analyses were carried out in Microsoft Excel to understand the research trend and knowledge gaps.

Database was analyzed temporally, spatially and according to their 12 broad subject-categories. The ichthyologic research from IHR started growing after 1930s and was at peak during 1991 to 2000 comprising almost 21% of the studies of the database. Total 887 papers were compiled published from the year 1937 up to 2016. The central (Nepal) Himalaya recorded the richest (181 species) fish diversity, followed by the western (167) and the eastern Himalaya (159). The number of publications was highest from Uttarakhand (582) and lowest from Sikkim (25). Majority of studies fell into taxonomy, biology and biodiversity categories whereas ecology, evolution, and climate change related studies remained neglected for IHR states.

Most of the information available for IHR is based on taxonomy, species distribution and biodiversity studies that were scattered and old. Many of the areas are still unexplored that need to be surveyed to determine current threat status of freshwater fishes. Looking after the current challenges which the IHR is facing in terms of severe anthropogenic disturbances and upcoming climate change effects which are more critical for freshwater fishes of this region, studies on the habitat requirements, ecology and biology of freshwater species are essential to fill this information gap.

Keywords: Bibliography, fish, Indian Himalayan Region, ecology, climate change

Spatial distributional patterns of fishes in the Bhagirathi River Basin

-Aashna Sharma

The current distribution patterns of the freshwater fishes in the rivers and streams of the Indian Himalayan Region is largely unknown and also there is lack of reference data on the fish assemblage patterns in relation to the present environmental conditions. In view of climate change, there is very less opportunity to model any future projections and shifts in geographic distribution of fishes. As a first step, a preliminary study was conducted on the freshwater fish species in the Bhagirathi River Basin (BRB) by focusing the current spatial distribution in relation to environmental variables in order to develop a baseline data for future reference.

Study was conducted in six sub basins of BRB covering main Bhagirathi and its major tributaries Balganga, Bhilangana and Asiganga along an elevational gradient of 459 m to 3912 m

A total of 128 sampling sites were sampled for fish diversity and species distribution patterns. Sampling with the help of cast nets and indigenous gears using nylon mosquito nets was done downstream to upstream every 100 m for lower order streams and at every 1 km for higher order streams. Each specimen was measured (standard length) and weighted. Data on various environmental variables was collected at each sampling site using standard methods.

A total of 11 species belonging to 6 genera and 3 families were collected of them Cyprinids dominated. The increase in fish diversity patterns and species richness was recorded along the upstream-downstream gradient. The fish assemblage patterns were characterized by decrease in the most cold water tolerant species (*Salmo trutta fario*) and increase in the rheophilic species of mostly loaches (*Schistura rupecola rupecola*) along the altitudinal gradient. Habitat and environmental conditions were evaluated in order to identify the most important environmental factors affecting the current fish distribution patterns. The past species occurrence data based on the available literature (if any) was also collected to obtain the comparable data to interpret the shifts in range size distributions.

Information collected under the study will develop a baseline data on the current fish diversity and distributional patterns in BRB. The fish habitat associations will provide information on the crucial environmental factors required for individual species growth/survival in view of climate change.

Key Words: Distribution, freshwater, climate change, Bhagirathi river basin, environment

Trends and gaps in butterfly research in the Indian Himalayan Region

-Dr. Manish Bhardwaj

Butterflies are one of the most widespread and widely recognizable insect taxa in the world. Since early 18th century butterflies have been studied systematically and about 19,238 species have been documented worldwide. In Indian subcontinent there are around 1,504 species of butterflies and over 800 species are reported from Indian Himalayan region. A bibliographic database is compiled on research on butterfly which is reported from Indian Himalayan Region to focus on trend of research and knowledge gap.

Online research databases were searched using the search terms “Himalaya” and name of the six Himalayan States viz., Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Northern region of west Bengal and Arunachal Pradesh. A list of 175 periodical journals, dealing exclusively with lepidopterological studies was also referred. A database was prepared and analyses were carried out in Microsoft Excel to understand the research trend and gaps.

The bibliography on butterfly fauna of the Indian Himalayan Region includes 276 unique entries covering a period of nearly two centuries, starting from 1857 to 2016. We categorized the articles in four distinct ways: A) The first category was based on the regions of five Himalayan States, where the studies were carried out. B) The second category was based on their publication dates, in which the studies were grouped in 10-year intervals from 1857 to 2016; to look at research trends and patterns. C) The third category was based on the subject focus of the research e.g., ecology and behaviour, taxonomy, evolution, conservation and climate change impact. A large number of studies are from Jammu and Kashmir (n=), followed by Himachal Pradesh (n=72) and Uttarakhand (n=64) which shows that western Himalayan region was in focus during British era in India. Largest number of studies are reported during 2011-16 (n=65) followed by 2001-2010 (n=59).

Considering the total area of the region information generated is very less. It is observed that most of the researches are confined only to certain localities. Most of the publications are on taxonomy, distribution and regional inventories. Detailed studies focusing on butterfly biodiversity, ecology, larval ecology, evolution is needed from Himalayan region. This information will help in increased knowledge, proper revision of status of butterflies IWPA and their conservation.

Keywords: Ecology, distribution, knowledge gap, bibliography

Baseline study on diversity of Dragonflies and Damselflies (Insecta: Odonata) along elevation gradient in Bhagirathi River Basin

-Shuvendu Das

The study aims to find out how the natural populations of dragonflies and damselflies are associated with the aquatic structure, vegetation structure along with the altitudinal gradient. The patterns in diversity and species composition across elevation, forest type and disturbance gradients was assessed.

The study was done in Bhagirathi River Basin (BRB), which is divided into 7 sub-basins.

Sampling and observation was done along 10 plots at every 250m with an elevation range of 500m-3800m during day time. Sites were selected randomly across different forest types and drainage patterns. Presence of anthropogenic disturbance signs such as logging, lopping and grazing was also noted along 200m transects around the collection site. The recorded individuals were sorted into morpho-species.

Preliminary study finally led to listing of 1187 individuals under which 65 species of Odonates were recorded from the study area belonging to 38 genera and 10 families. During the transact layout, total 46 species were recorded (collected /observed) and 19 species were recorded during opportunistic sampling. Mean encounter rate per transect for all 77 plots are **15.42** and the mean encounter rate per species is **25.81.** Abundance of all families and genus recorded in all plots are **1.71** and **0.62** respectively. Based on morphometric analysis 5 species were recorded for the first time from Uttarakhand.

The composition and richness of species is decreasing with increasing altitude and composition of species is changing with different habitat variability along with topographic factors. The genus *Orthretrum* and *Sympetrum* with high abundance can be studied as indicator species to track environmental changes.

Keywords: Species, richness, Odonates, Orthretrum, Bhagirathi.

Response of soil bacterial communities to climate change in the Indian Himalayan Region – standardization of methods

-Pamela Bhattacharya

The Indian Himalayan region (IHR) is experiencing rate of warming higher than global mean warming level. Climate change impacts on this ecosystem and its resources are of critical concern. In this study we aim to investigate climate change impact on IHR soil organic carbon (SOC) stock through soil bacterial community activities using a combination of metagenomics, enzyme assays and soil physico-chemical analysis. We will assess soil bacterial diversity, SOC degrading enzyme activity, and soil physico-chemical properties across major eco-climatic regions and habitats to monitor climate change impact in IHR.

Study area is Bhagirathi river basin and Tista river basin of Indian Himalayan region, along an altitudinal gradient.

To achieve our goal, we will combine intensive soil sampling with molecular identification of bacterial species, soil physico-chemical and SOC degrading enzymes activity analysis to understand soil bacterial community responses to climatic factors. We collected 20 soil samples across altitudinal gradient in Gangotri National Park (GNP) in 2015. We conducted soil physico-chemical analysis, extracted environmental DNA, amplified and cloned bacterial 16s rDNA, and standardized SOC degrading enzyme glucosidase activities in the laboratory. We further plan to estimate activities of phenoloxidase and dehydrogenase enzyme activities in the soil. Recently, we collected 25 more soil samples and deployed data-loggers at different altitudinal gradients in GNP. Data generated will be used for correlating climatic variables with soil bacterial community and SOC degrading activity. Finally, we plan to set up Open Top Chambers (OTCs) in GNP to assess responses of bacterial communities under experimental climatic setups.

We standardized all required protocols for soil collection, storage, DNA extraction, bacterial 16S rDNA amplification, cloning and sequencing along with soil physico-chemical and enzyme activity analyses. Our results show that SOC and soil nitrogen ranged from 0% and 0.005% in morainic region to 26.6% and 0.88% in *Betula utilis* forest, respectively. Soil pH ranged from 7.26 (neutral) in morainic slopes to 5.29 (acidic) in *B. utilis* forest. Preliminary 16S rDNA sequencing from morainic region identified *Gemmatimonas* and *Mycobacterium spp.* and a few novel bacterial species.

Our results indicate that the high altitude morainic region soils have neutral pH, much less SOC and nitrogen, in comparison to acidic low altitude *B. utilis* forest. Currently, we identified bacterial species only from some morainic soil, and subsequent works on remaining samples from other regions are underway.

Keywords: Indian Himalayan region, Bhagirathi river basin, soil bacterial community, SOC degrading enzyme activity, climate change.

Use of fungi and lichens as indicators of climate change in the Indian Himalayan Region: An update

-Sonam Priyadarshani

Fungi and lichens play major role in ecosystem functioning in the Indian Himalayan Region (IHR). Owing to their specific climatic needs and habitat requirements, they can serve as excellent indicators of the environmental change. However there has been no study for identification of appropriate indicators of climate change on these groups from IHR. This study aims to identify broad taxonomic groups among lichen and fungi at different altitudes so that their relationship with changes in climate can be established.

Bhagirathi basin in Uttarakhand is selected as intensive study area. The area covers an elevation gradient from 500 to 5000m along subtropical, temperate, subalpine and alpine zones including cold desert.

To study diversity of soil fungi, soil samples were collected from different elevational zones mainly focussing on subalpine to alpine region of Gangotri National Park. Lichen samples were collected from different elevation zones from 1000m to 5000m spanning Bhagirathi I, II, III, Asiganga, Balganga, Bhilangana sub-basins covering cold arid regions of Nelang valley. Fungal isolation will be performed by serial dilution method and culturing on media followed by morpho-taxonomy. For all isolates and morphological groups, the diversity will be calculated using the Shannon-Weiner index. Soil physico-chemical parameters were analysed using standard methods.

Proposed methods to meet the objectives are:

- Installation of Open top chamber
- Lichenometry
- Litter trap method

From collected lichen samples, 915 samples of lichen herbarium were prepared and 82 species belonging to 47 genera and 17 families has been identified so far. Parmeliaceae, Physciaceae, Lecanoraceae and Stereocaulaceae are the dominant families as identified. This study will help in identifying major groups of soil fungi which could be associated with different vegetation type along with elevation gradient. We plan to identify potential fungal community which could play major role in nutrient cycling/decomposition at different elevation zones.

Key words: Lichenometry, open top chamber

Preliminary findings on Nematodes in Gangotri National Park, Uttarakhand

-Priyanka Kashyap

Monitoring ecosystem components plays a key role in acquiring basic data to assess the impact of change. Maintaining soil quality is of the utmost importance to preserving biodiversity in an area. Nematodes communities are potential instrument for assessing soil conditions and bio monitoring system. Major objective of current study was to understand the nematode community composition and variability in soil properties.

Study on Nematodes was conducted in Gangotri valley of Gangotri national Park, Uttarakhand during 2015-2016.

A total of 17 samples were collected along elevation gradient from 3000-4000m in Gangotri National Park. Soil samples were processed using Cobb's sieving and decantation technique for extraction of Nematodes comprising collection, fixation, picking and dehydration. Soil analysis was also conducted to know parameters like Nitrogen content, pH, EC (electrical conductivity), OC (organic carbon) and moisture content. Nematode communities were quantified by taxonomic orders and trophic groups (i.e., bacteriovores, fungivores, omnivores, plant-parasites and predators) to assess nematode community structure to monitor ecological condition of soil.

A total of 17 sampling sites along the elevation gradient yielded 6 orders with highest numbers represented by Dorylamida (45.40%) followed by Rhabditida (38.60%) and least number by Araeolamida (1.88%). High nematode diversity was observed in between elevation of 3600-3500m (Shannon diversity index H= 2.53). In terms of abundance, same pattern is followed. These orders were assigned to 4 trophic groups i.e. bacteriovores, omnivores, predators and plant-parasites. Among the nematode community analyzed, Omnivores found to be most dominant in the entire community. Araeolamida are found only in sampling sites where nitrogen content is higher comparatively to the other sampling sites. Bacteriovores number increased where nitrogen content is high.

Omnivores found to be most dominant in the entire community. Current study provides the first insight of nematode diversity from Gangotri National Park.

Keywords: Community structure, plant parasites, elevation gradient, soil analysis, trophic group.

Introduction to climate futures: Climate change projections and implications for the Uttarakhand Himalayan region

-Sujata Upgupta

Climate change is amongst the most serious and ever pressing issues on the planet affecting the lives and livelihoods of vulnerable people and wildlife around the world. Mountain regions are especially sensitive to the impacts of a changing climate. Mountain ecosystems are being affected at a much faster rate than other terrestrial habitats thus putting at risk many ecosystem services provided by them. The present study aims to assess the impacts of a changing climate on the landscape and ecosystems towards planning a strategy for the system to remain sustainable and resilient to devastating influences. The study also aims to identify the climatic and anthropogenic drivers of changes in vegetation cover in the landscape.

The specific study was implemented for the whole of Uttarakhand region.

The existing climate models from IPCC (Intergovernmental Panel on Climate Change), which capture the global climate change for past, current and future conditions for various plausible scenarios were considered. A 17 model ensemble was used to project changes in mean annual temperature and annual precipitation for future periods (2050s and 2080s) with respect to the baseline (1960-1990) and for two scenarios RCP45 and RCP85. Spatial regression modeling was used to identify the climatic and anthropogenic drivers which are the driving forces behind changes in vegetation cover in the landscape.

The results show an increasing warming trend and rising precipitation levels. The warming is projected to be more pronounced in the upper ranges of Himalaya with temperature changes of more than 5° C in the long term and business as usual scenario of RCP85. The high altitude conservation areas and their inhabited wildlife are at higher risk due to climate change effects. The analysis of drivers also indicated that mean temperature, precipitation and human footprint as very important driving force behind changes in vegetation cover.

This understanding of climate change helps to assess and quantify its impacts and vulnerability providing potential opportunities for innovative solutions in climate adaptation, mitigation sustainability and resilience planning.

Keywords: Climate change scenarios, climate models, drivers, spatial regression.

KSLCDI

Project Details & Abstracts

Project Title	Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI)
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Project Coordinator	Dr. B.S. Adhikari, Scientist - F
Co. P.I.	Dr. S. Sathyakumar, Scientist - G (Mammals)
	Dr. V.P. Uniyal, Scientist - F (Insects)
	Dr. K. Sivakumar, Scientist - F (Aquatic)
	Dr. Gopi G.V., Scientist - D (Birds)
Research Associate	Dr. Arti Kala
Project Fellows	Mr. Ajaz Hussain (Mammals)
	Mr. Sumit Arya (Birds)
	Ms. Mona Chauhan (Insects)
	Ms. Alka Chaudhary (Flora)
	Mr. Vpin Upadhyay (RS & GIS)
Funding Agency	International Centre for Integrated Mountain Development (ICIMOD), Nepal
Duration	2013-2017

DISTRIBUTION OF TASKS/RESPONSIBILITIES

S.No	Name & Position	Theme / Faunal Group / Task(s)	Faculty Supervisor(s)
1	Dr. Arti Kala Research Associate	PNRM plans and over all coordination of Project activities	BSA GSR
2	Mr. Ajaz Hussain Project Biologist	Mammals and implementation of ESM plan	SSK GSR
3	Mr. Sumit Arya Junior Research Fellow	Birds and implementation of ESM plan	GGV
4	Ms. Mona Chauhan Project Biologist	Insects and implementation of ESM plan	VPU
5	Ms. Alka Chaudhary Project Biologist	Invasive species management and implementation of ESM plan	BSA GSR
6	Mr. Vipin Upadhyay Junior Research Fellow	RS & GIS	BSA GSR KS

Patterns of invasion by an alien invasive plant *Ageratina adenophora* in Gokerneshwar Gad watershed, Kailash Sacred Landscape – India

-Alka Chaudhary, Project Biologist

Eco-restoration of degraded ecosystems in Indian part of Kailash Sacred Landscape

Gokarneshwar Gad Micro-watershed of Ramganga catchment in Pithoragarh district of Uttarakhand state that forms part of Kailash Sacred Landscape in India.

We conducted rapid survey of forests, grasslands, stream courses and agricultural fallows within the intensive survey area (Gokarneshwar Gad) and recorded presence/absence, abundance and general cover of major alien invasive species, Kala Bansa (*Ageratina adenophora*) using stratified random sampling technique. Geographical coordinates of all patches of *Ageratina* (>25 m^2) were recorded using GPS and patch size were recorded to study the patterns and extent of invasion. Participatory action research for restoration of weed infested site has been initiated with the help of Biodiversity Management Committee (BMC) at village Bans-Maitoli.

Highest abundance of *A. adenophora* was recorded in north facing slope between elevations 1700 – 1800 m asl. Similarly, slopes with inclination of 20 to 30^0 were most severely affected. Highest cover of this invasive species was recorded in fallow land (69.97%) followed by grassland (18.67%), edges of agricultural fields (9.10%) and forests (2.26%). Abundance and occurrence of *A. adenophora* was inversely proportional to the distance from the village. In north-facing slope, nearly 41% stretch along road site was infested with *A. adenophora* and distance from the road was inversely proportional to its cover. Similarly nearly 82% of the area along stream courses was colonized by *A. adenophora*. Stream courses and shady moist village grazing lands have been taken up by the villagers for control of invasive species.

Stream courses and village grazing land at Bans-Maitoli have been highly affected and degraded due to spread of *A. adenophora.* Two sites representing these habitats have been taken up by the BMC of Bans-Maitoli for management and replacement by the native fodder grass. Initial outcomes are encouraging.

Keywords: Eco-restoration, invasive species, ecosystem, watershed

Strategies for minimizing Human-wildlife conflicts in pilot villages of Kailash Sacred Landscape - India

-Ajaz Hussain

Developing species and site specific action plan**s** for minimizing human-wildlife conflicts in pilot sites of Kailash Scared Landscape- India.

Bin and Munakot blocks of Pithoragarh district in Uttarakhand encompassing part of Kailash Sacred Landscape – India.

Detailed assessments of human-wildlife conflicts (HWC) were done in Bin and Munakot blocks of District Pithoragarh (Uttarakhand) during 2015-16. During the current year sites having highest incidences of HWC were revisited and consultative meetings were held to discuss site specific mitigation measures and communities' willingness to implement such mitigation strategies. Based on several possible options available, following long term measures have been suggested by the local communities: (i) removal of dense thickets of invasive alien plant *Ageratina adenophora* from the fringes of agricultural fields, (ii) traditional watch and ward method based on rotation basis initiated by the local communities, (iii) development of bio-fencing (Agave plantation) along strategic locations between reserved forests and agricultural fields, (iv) improvement of wildlife habitat and creation of waterholes within reserved forests to contain wild ungulates most of the time in such forests.

Four species prioritized for HWC mitigation in the pilot areas include wild pig, rhesus macaque, porcupine and common leopard. Major complaints against wildlife included destruction of crops and property, livestock depredation and attacking/injuring humans. The local communities have initiated action on establishing bio-fencing around cultivated fields and creation of waterholes within Reserved Forests surrounding the agricultural fields. Results of such experiments will be known after close monitoring of these experimental sites for at least one crop cycle.

Local communities have shown greater faith in their traditional knowledge for mitigation of HWC in a few pilot sites of KSL. This has led to implementation of site specific management plans and action research by the local communities. Such an initiative by the local communities would require encouragement and hand holding by the conservation agencies.

Keywords: Mitigation, biofencing, habitat restoration, water holes

Seasonal and habitat influences on bird diversity in Kailash Sacred Landscape (KSL) India (Bans village)

-Sumit Arya

The study aims to assess the influence of seasonal and habitat variation on bird diversity in KSL India.

The Study was conducted in differently managed forests *viz.* community managed and Reserve forest of Bans village of Pithoragarh District during January 2015 to April 2016. The study area comprises five major habitat types *viz*., Banj Oak, Chir Pine, Sal, grassland and Agro-ecosystem. The study area covers an area of approximately 5 sq km. with an altitudinal range between 800 m and 1800 m.

Point count method was used to assess the abundance and diversity of birds in the study area within 25 m of radius. A total of 42 points were laid in the study area covering all the major habitats at an interval of 100 m. At each point all the audible and visible birds were recorded. Two replicates in each season were performed to collect the field data. Diversity and richness were calculated using software Past 3x. Two-way ANOVA was used to test the significant difference of diversity across the seasons and different habitats. Multiple linear regression was used to assess the influence of habitat variables on bird diversity.

A 109 bird species were recorded across 4 seasons from the study area in different habitats. Among them 78 are resident, 30 species (26 summer and 4 winter visitors) are altitudinal migrants and status of one species (*Siva cyanouroptera*) is unknown and yet to be ascertained. The maximum average density, diversity and richness of birds were found in agro-ecosystems in most seasons except the spring season. Banj oak forest was the second most abundant and diverse followed by Sal, Chir pine and grassland. Two way ANOVA reveals that species diversity differed significantly in different habitats ($F=24.14$, $P<0.001$), but do not significantly differ in different seasons. A multiple linear regression model predicts that Shrub cover and grass cover significantly influence the diversity of passerine birds.

It is apparent from the results that Bans village exhibits divers habitat types that support high species richness. There is a need for a detailed ecological study on the bird community of the study area to get a better understanding of the functioning of this ecosystem.

Keywords: Diversity, richness, season, habitat and community forest.

Conservation status and distribution of *Diploknema butyracea* in Kailash Sacred Landscape, India

- Vipin Upadhyay

Establishing baseline data on status and distribution of important bio-resources for conservation planning and long term monitoring is one of the objective of this study. The study area lies in human dominated landscape in the sub-tropical zone of eastern Uttarakhand and adjoining areas of Nepal, within Kailash Sacred Landscape (KSL).

We assessed the current status and distribution patterns of Indian butter tree (*Diploknema butyracea)* within KSL-India using a combination of intensive field surveys and geospatial tools to establish baseline data, identify threats and develop protocols for future monitoring. Landsat 8 and LISS III imageries were downloaded from Earth Explorer and Bhuvan, respectively. Multispectral rule based classification using prior knowledge of selected sites and field verification were used to prepare crude distribution map of butter tree. Regeneration status and relative dominance of the species across various strata were assessed in relation to bioclimatic variables.

D. butyracea is spread over *ca.* 144 km^2 area within KSL-India and largely confined to south, south-west and south-east facing slopes and fringes of agricultural fields between 800-1600 masl. Density of *D. butyracea* in open woodlands and forested stands ranged from 36-84 and 92-159 trees ha^{-1}, respectively. Girth class distribution shows a well-established pattern in forests. The regeneration status of butter tree was higher on grassy slopes than that of shrub and *Lantana* infested areas. Maps have been generated for present distribution with respect to aspect and drainage patterns and also for future climatic scenarios. An inverse correlation was observed between frequencies of savannah and forest with bioclimatic variables.

The study reveals that *D. butyracea* is confined to south and south-east facing slopes in KSL-India especially on limestone rich skeletal soil. *Lantana* infestation and forest fire events are likely to hamper the regeneration of butter tree.

Keywords: Butter tree, distribution map, Maxent, population structure

Insect: A focal taxa for long term ecological monitoring in Kailash Sacred Landscape, Pithoragarh, Uttrakahand, India

-Mona Chauhan

Present study aims to identify and establishment of long term ecological monitoring (LTEM) sites and documentation of insect diversity in pilot site of Kailash Sacred landscape, Uttrakhand.

Bans-Maitoli area in Pithoragarh district has been selected as pilot site for long term ecological monitoring. Area is characterized by Oak forest, Chir forest, and Sal forest with an altitudinal range of 800m to 1800m. Owing to vastness of the group, it is not possible to monitor the entire insect taxa. Therefore, two groups Coleoptera (Scarab beetles) and Lepidoptera (moths and butterflies) have been selected for the study. About 25 LTEM sits have been identified and marked for long term ecological monitoring in different forest types and agro-ecosystem. Various insect collection methods like pitfall trap, light trap and hand sorting have been applied to collect insect from long term monitoring sites.

Basic inventory of insect diversity from LTEM sites has been prepared. Altogether 291 morphospecies of insects about 23 species of butterflies, 31 species of scarab beetles and 237 species of moths under cloeptera and lepidoptera orders have been collected from the study area.

Of these, 23 species of butterflies belonging to 04 families, 21 species of scarab beetles under 07 sub-families and 31 species of moths under 10 families have been identified. All the collected butterflies have been identified. The dominant butterfly families were Nymphalidae, followed by Pieridae. It was observed that mean diversity of butterflies was highest in agro-ecosystem (35.9 ±5.3) followed by grassland (34.1 ±4.7) while least in Oak forest (12.0 ±3.7). In Chir forest density of *Heliophorus sena* (3.0±0.32) was found to be the highest. *Neptis hylas* (2.0±1.0) has the maximum density in Sal forest. In Oak forest *Neptis hylas* (2.0±1.0) and *Zizula hylex* (2.0±1.0) were the most densely distributed species, in grassland *Pieriss brassicae* (7.0±0.5) has maximum density followed by *Pieris canidia* (6.0±0.55) while *Gonepteryx rhamni* (1.6±1.0) has minimum density. In Agro-ecosystem *Pieriss brassicae* (6.0±0.57) has highest density. In identified moths dominant families were Arctidae and Geometridae which contained the maximum number of species. Among identified scarab beetles most dominant sub-family was Scarabaeinae

Keywords: Conservation, bio-indicator, ecosystem management, monitoring

BCRLIP

Project Details & Abstracts

Project Title	**Biodiversity Conservation and Rural Livelihood Improvement Project" (BCRLIP)**
Principal Investigator	Dr. Anil Kumar Bhardwaj, Project Coordinator
Nodal Scientist	-
Co. P.I.	Dr. R. Badola Scientist – G (Socio-Economic)
	Dr. S.A. Hussain Scientist – G (Socio-Economic)
	Dr. V.P. Uniyal, Scientist- G (Insects)
	Dr. B.S.Adhikari – Scientist - F (Plant)
	Dr. Gautam Talukdar Scientist-D (GIS)
	Dr. Bilal Habib, Scientist - D (Mammals)
	Dr. J. A. Johnson, Scientist – D (Fish)
	Sh. R. Suresh Kumar Scientist – D (Birds)
Project Scientists	- Nil
Project Associates	- Nil
Project Fellows	- Nil
Project Assistants	Ms. Amrita Laha (Socio-Economic)
	Ms. Vandana Rajput (Fish Taxa)
	Ms. Ankita Bhattacharya (Mammals Taxa)
	Ms. Soni Bisht (Plant Taxa)
Funding Agency	World Bank (IDA & GEF) and MoEFCC (GoI)
Duration	2011-2018

DISTRIBUTION OF TASKS/RESPONSIBILITIES

S.No	Name & Position	Theme / Faunal Group / Task(s)	Faculty Supervisor(s)
1	Ms. Amrita Laha Project Assistant	Socio-Economic	RB SA
2	Not in place	Insects Taxa	VPU
3	Ms. Soni Bisht Project Assistant	Plant Taxa	BSA
4	Not in place	GIS (Baseline mapping)	GT
5	Ms. Ankita Bhattacharya Project Assistant	Mammals Taxa	BH
6	Ms. Vandana Rajput Project Assistant	Fish Taxa	JAJ
7	Not in place	Birds Taxa	RSK

Space use and activity patterns of mammalian community in Askot landscape, Uttarakhand, India

-Ankita Bhattacharya

Different species of mammals exhibit different space use and temporal activity patterns. In montane habitats, it becomes difficult to assess these ecological patterns because of inaccessibility and logistics issues. Use of camera traps in Himalayan landscapes has helped gain better insights in the ecology of the mammals residing there. Our study aim is to understand the response of different mammals to habitat and disturbance factors and their effects on the spatial and temporal patterns of these mammal species.

The study was conducted in Askot Landscape in Uttarakhand, located in the eastern Kumaon region of the western Himalaya. The altitudinal range varies from about 600 to 7000 meters. The landscape is a physiographical mix of lower, mid and higher Himalaya and is an important site for species richness and biological distinctiveness. The landscape harbors around 40 species of mammals.

Camera trapping exercise for assessing mammalian community was conducted in one of the micro watersheds of Askot Landscape, which was a pilot site representing the overall vegetation types and elevation gradients of the landscape. 60 camera traps were deployed at an altitudinal range of 900 to 3500 meters in an 84 sq. km. area, divided into 1.42 X 1.42 km grids. We used occupancy to evaluate space use and Kernel density estimates to assess activity patterns.

18 species of mammals were photo captured during the study period in 2100 trap nights out of which 8 were carnivores, 4 ungulates and 6 omnivores. Indian Muntjac was the most photo captured species (956) followed by Himalayan langur (1055), Himalayan Goral (755) and Sambar (312). Occupancy estimates for Muntjac is Ø=0.453 ± .05, for Goral is Ø=0.64 ± .06, for Sambar is Ø=0.76 ± .06 and for Porcupine is Ø=0.28 ± 0.07. Peak activity period of Goral is between 8 a.m. to 9 a.m. Muntjac and Sambar have activity periods throughout the day. Leopard cat and Leopard were the most recorded carnivore species. A female tiger was also recorded at an elevation of 3274 meters which is the highest elevation record of tiger occurrence in India. Application of camera trapping to study space use and activity pattern shall be discussed in detail.

Camera trap studies for mammals in mountainous landscape can be an important tool to study community structure, spatial and temporal use of landscape to aid management and conservation.

Keywords: Askot, camera trap, occupancy, spatial use, temporal activity

Stream health assessment using ecological indicators: A case study from Askot landscape, Uttarakhand

-Vandana Rajput

The ecological health of streams is a fundamental and increasingly important water management issue for the survival of life in water. This fragile ecosystem is facing severe threats from anthropogenic activities such as destructive fishing, removal of riparian vegetation etc. The present study aims to assess the current stream health conditions based on Riparian Vegetation Index (RVI) and ecological threat index. This assessment can be used as an important tool for conservation and monitoring of aquatic resources.

Askot landscape of eastern Kumaon region lies in the Pithoragarh district of Uttarakhand at the tri-junction of the borders of Nepal, India and Tibet with three rivers-Gori, Kali and Dhauli.

The study was conducted in tributaries of Gori, Kali and Dhauli rivers during 2015-2016. Sampling and field observations were done in 14 streams covering all three drainages. The identified threats were measured for the level of influence, which were given the weightage in accordance to the published ecological impact and for frequency, occurrence of threat by the presence/absence of the stress in each stream. The index values were generated for each stream based on the riparian quality in 1km stretch. At every 250m, 5m radius circular plot were laid within 1 km of sampling stretch in each stream.

RVI reveals Askot landscape to come in the range class of 4-9. Based on RVI score, the site Dhauli was rated as Class F (4.6) of low quality and less disturbed stream Khet was observed in class D (9.3) of medium quality. Based on threat index, the disturbance sand mining was very high in streams indicating a severe threat.

Based on RVI and Ecological threat index, it was observed that streams in Askot are the health of rated as moderate quality. With the information gathered through this exercise would be useful for monitoring the aquatic habitat in future.

Keywords: Ecological threat index, disturbances, impact, monitoring, Askot landscape

Structural attributes of vegetation communities along elevational gradient in Askot Landscape, Uttarakhand, India

-Soni Bisht

The present study deals with the structure and composition of forest communities in Gori and Darma catchments in Askot landscape in Pithoragarh district of Uttarakhand, India.

The sites (*ca.* 1 ha) were randomly selected along elevation range between 1100 to 3900 m in various forest types. In each site 3 random circular plots (10 m radius each) were laid to assess vegetation structure, composition and regeneration pattern along with anthropogenic activities.

A total of 12 and 14 forest communities were identified in Gori and Darma catchments, respectively in Askot landscape. The tree density was highest in Mixed oak forest (509 tree ha^{-1}) and total basal area was in Rianj oak forest (26.5 m^2 ha^{-1}) in Gori catchment, whereas density was highest in Mixed-broadleaved forest (292 tree ha^{-1}) and total basal area was in Hemlock forest (40.1 m^2 ha^{-1}) in Darma catchment. The species richness was highest in Banj oak and Phaliyat oak forests (7.1) in Gori catchment, while in Kharsu mixed forest (5.0) in Darma catchment. In both the catchments the ß-diversity was highest in warm temperate zone. Population structure of all the species indicated proper regeneration, whereas *Q. floribunda* facing problem due to anthropogenic activity. Among 23 tree species *Castanopsis tribuloides* (>85%) and *Boehmeria rugulosa* (>33%) in Gori catchment, whereas *Q. semecarpifolia* (>24%) and *Symplocos chinensis* (50%) in Darma catchments were highly lopped and cut species, respectively.

Most of the forest communities in both the catchments are similar, except blue pine and Hemlock forests in Darma catchment and Chir pine and Rianj oak forests in Gori catchment. The regeneration pattern of all the species is quite similar, except *Quercus glauca* and *Q. floribunda*. The findings of the study will contribute to biodiversity conservation and sustainable management of various forests of Askot landscape.

Keywords: ß-diversity, IVI, elevation gradient, conservation

Can a stitch in time save nine: Potential strategy to mitigate future human wildlife conflict in Askot Conservation landscape

-Amrita Laha

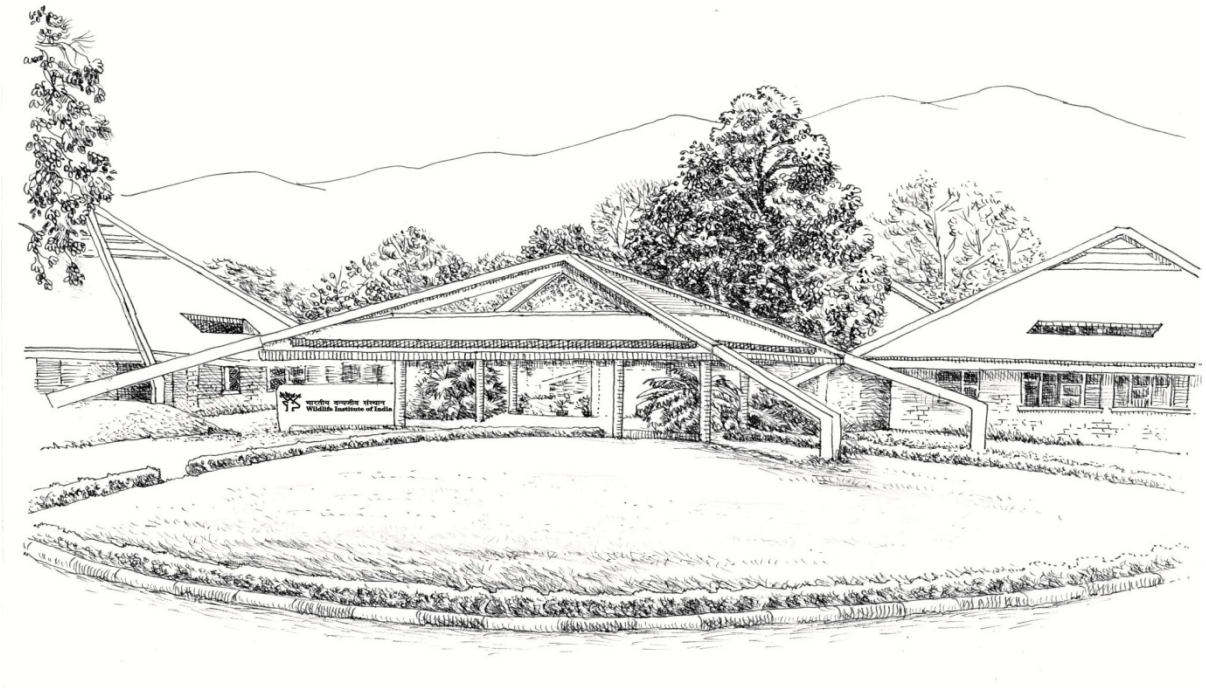
Most marginal forest dwelling communities depend primarily on agriculture and livestock rearing for subsistence living. Crop or livestock loss in such societies can be critical setback. There can be many factors of crop and livestock loss and predation by wildlife is just one amongst them. In juxtaposition to the parochial sense of crop and livestock depredation by wildlife, in this study we aim to provide a fuller understanding of crop and livestock loss in higher Himalayas.

The study was conducted in Askot Conservation Landscape. Forty Van Panchayats were surveyed and 500 interviews were conducted using an in-depth mixed questionnaire. Amongst varied socio-demographic aspects, different factors of crop and livestock loss were identified and assessed. Weighted response of people about perceived factors of crop loss was used to assess factors of crop loss. Likewise, data about livestock death due to diseases besides predation by wild animals and types of diseases in livestock was collected.

Findings show that wild animals, drought, birds, hail storm and feral cattle are some of the prime factors of crop loss in the study area. Majority (65%) of livestock were lost to diseases annually in which 75% were lost to foot and mouth disease, whereas 35% was lost due to wildlife predation.

Crop depredation and livestock predation by wildlife is often identified as more overpowering but seemingly controllable in comparison to loss of the same due to environmental factors or disease. Consequently, the chances of being negative towards wildlife are higher than the stochastic natural causes. This perspective can provide managers a strategy to minimize this loss by establishing synergies with other developmental agencies so as to mitigate potential human wildlife conflict.

Keywords: Agro-pastoral community, crop and livestock loss, disease, conflict mitigation, interagency synergy



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