

Eastern Himalaya

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Lake Teesta



Reservoir near Kalijhora with researchers.
Photo by Dr. Joydeep Bhattacharjee

Imagine for a moment, a river. Imagine a river in the Indian Himalaya. It is a fast-flowing body of water fed by glaciers high in the mountains of Sikkim. The literally ice-cold water trickles from its sources and gains momentum downhill as isolated streams. These streams on their downhill journey eventually meet on the path of least resistance. By this point the water volume and velocity of the emergent river causes it to cut a more direct path downhill. The water churns and foams as it slams into rock faces carving out its banks. The river flows around rocks not yet broken-down twisting erratically in the channel forming rapids of particularly violent waters. The river only picks up more speed as it descends the mountains and into the hills. The river picks up sediments as it erodes some banks and deposits sediments as it builds up others. The river continues this way until it reaches the base of the Himalaya and enters the plains. Once in the plains, the eroding force of the river is lost. Instead, the river drops all remaining sediments picked up along its course onto the nutrient-poor banks of the plains. Now, think of the river Teesta. The Teesta is no longer this river.

The description above used to describe the river Teesta, but after the construction of 5 dams along its reaches the Teesta has been permanently disfigured. The Teesta river is now dammed in Singtam, Dikchu, at the river Rangit which is a major tributary of the

Teesta, at Reang, and at Kalijhora. These dams are physical barriers to the movement of the waters and sediment of the Teesta. Five swollen reservoirs stand where there once were narrow free-flowing channels. The original banks and floodplain of the Teesta river are permanently inundated by up to 20 meters of water in some areas that historically a person could wade through unaided.

Today, the strong underwater currents of the Teesta make such activities unwise. The river's flow is stagnant at times. Water only moves between the dams at the behest of the dam operators to produce electricity. This has disturbed a river ecosystem that until recently was adapted to a predictable flood regime. Floodplain and upland terrain alike are now permanently inundated killing and displacing plant species that are ill-adapted for long periods of standing water. Without a floodplain, animals that lived in the floodplain have been displaced as well. New floodplains have not been established in many reaches of the Teesta, because the stagnated flow has failed to cut new banks. Instead, the Teesta river canyon walls simply slope into the water without interruption.

It is hard to imagine that people once swam and bathed in this river. It is hard to imagine this as a river at all. However, it is easy to imagine it as a lake. When the dams are all closed that's exactly what the still, mirror like surface of the water implies. This means that the river Teesta has been changed on a fundamental level. Can the animals and plants of the Teesta river valley that are adapted to the Teesta that once was a river adapt to the Teesta of now that is a man made lake?

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Mapping biodiversity & bio-resources in Sikkim and Darjeeling Himalayas



Vegetation Survey. Photo by Sonam Bhutia

Bio-resources and Sustainable Livelihoods in Northeast India is a large multi-institutional network project funded by Department of Biotechnology, Government of India. It primarily deals with the mapping, and quantification of plants, animals and biological resources of North East India while exploring entrepreneurship opportunities and product development of selected bio-resources. Our work is focused on quantifying flowering plants and bio-resources in Sikkim, Darjeeling, North-Bengal and Western Assam.

For inventory and mapping of flowering plants we are using 1 km x 10 m belt transects within each of the 6.3 x 6.3 sq km grids that the whole northeast region has been divided into. For Sikkim alone, we will be sampling 240 grids. Additionally, we are quantifying trade and use of biological resources by people through pre-tested standardised questionnaires at market and household levels.

Our work has taken us across twenty three forest sites spanning from eastern Sikkim to Western Assam where we collected primary data on the basic structure and composition of forests. While surveying the markets in Sikkim to understand bio-resource trade, we found an amazing diversity of products being transacted, ranging from food, medicines, handicrafts, cooking and fermenting agents. The household surveys reflected a high prevalence of bio-resource use and knowledge that were inherently linked to numerous traditional and cultural elements and food security of the local communities. We were strongly moved and inspired by the way such age-old traditions and cultural practices are still maintained in Sikkim even while being part of a highly modern and commercialised world.

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Regeneration of Oak forests in Sikkim through direct Seeding A Pilot Project



Left: Germinated Oak seedling; Right: Monitoring plot of direct Oak seeding. Photos by Yojana Chhetri

ATREE Regional office is working with Khangchendzonga Conservation Committee (KCC), Yuksom in monitoring the outcomes of the direct seeding of Oak species pilot project. This was an initiative of GIZ Climate Change Adaptation-Northeast Region Project and is being implemented in collaboration with the Forests Environment and Wildlife Management Department, Government of Sikkim.

The monitoring team over the course of this project managed and monitored the 8 sites where pilot seeding spots were established. 8194 individual seeds of *Quercus lamellosa*, *Quercus thomsoniana* and *Quercus pachyphylla* have been directly seeded in over 2 hectares of oak forests.

The preliminary data over a little more than a year, show that the mean germination percentage was 6.19%, of these the average survival rates of seeds was 73%. The average height of these seedlings was calculated to be 10.86 cm with an average of 2.61 leaves per seedlings and the average Root Collar Diameter of 2.65 mm.

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Camera trapping of mammals in socio-ecological landscapes of Darjeeling-Sikkim Himalaya



Left: Litter of wild boars; Right: Chinese Pangolin at Seeyok Tea Estate

Camera traps were placed at seven sites covering four tea plantation and three agro-ecosystems, in Darjeeling and Sikkim. 23 species of mammals were recorded during this field season.

Among large sized mammals, the most commonly recorded species was the Northern Red Muntjac *Muntiacus vaginalis*, followed by a Leopard *Panthera pardus* and Wild Boar *Sus scrofa*. Among medium sized mammals, the most commonly found species was the Leopard Cat *Prionailurus bengalensis*, followed by Malayan Procupine *Hystrix brachyura*. Others such as the Masked Palm Civet *Paguma larvata*, Large Indian Civet *Viverra zibetha* and Yellow throated Marten *Martes flavigula* were regular in occurrence in almost all sites. Arboreal mammals such as the Northern Tree shrew *Tupaia belangeri*, Malayan Giant Squirrel *Ratufa bicolor*, Irrawaddy Squirrel *Collosciurus pygerythrus* and Terai Gray Langur *Semnopithecus hector* were also captured. All these



Left: Leopard; Right: Himalayan Goral Makaibari Tea Estate

comprise of four Near Threatened species, four Threatened species including the Critically Endangered Chinese Pangolin *Manis pentadactyla* and Himalayan Black Bear *Ursus thibetanus*. All these species are found in different farming systems across the landscape.

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Experimental Design and Data Analyses (using R)



Participants at the workshop

The Regional Office Eastern Himalaya -Northeast India hosted a weeklong workshop on "Experimental Design and Data Analyses (using R)". The workshop was attended by 9 participants including doctoral students from ATREE, Sikkim University, and the WWF. The workshop was lead by Dr. Joydeep Bhattacharjee, a Professor in the Department of Biology at the University of Louisiana, Monroe, USA. The workshop was split into a theoretical and a hands-on practical part. During the morning half, participants were introduced to the core concepts that guide most commonly used statistical procedures. Post-lunch sessions were dedicated to getting participants familiar in carrying out analyses using R. Most days began with Dr.

Bhattacharjee discussing the previous day's 'muddiest point' – anonymous notecards with topics/concepts/ questions that the participants were unclear about and wanted a revisit. An 'entry ticket' was also used to quiz participants on a reading assigned the previous day. A day was earmarked for BYOD – bring your own data. This was extremely beneficial to the participants since they were able to discuss their research projects one-on-one with Dr. Bhattacharjee and get insights on ways of analyzing their data going forward. Towards the end of the workshop, Dr. Bhattacharjee was able to introduce participants to more advanced and contemporary modeling techniques used by ecologists, such as AIC, BIC, etc. A pre-post workshop knowledge test was also administered. Dr. Bhattacharjee was able to share a gamut of resource material discussed during the workshop.

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Meeting on the importance of White-bellied Heron in Kamlang Tiger Reserve, Arunachal Pradesh



Kamlang River

A meeting was organised on the importance of White-bellied Heron and its status and threats at the Kamlang Forest Camp, Wakro on 08 May 2019. This was targeted at the forest staff of the Kamlang Tiger Reserve. On 14th of March 2019 for the first time a White-bellied Heron was documented from the Tiger Reserver when it was photographed on camera trap placed at the bank of the River Tawa which was specifically set up for the tigers as part of the All India Tiger Census 2018-19.

The workshop was attended by forest staff and 25 members of the Tiger Task Force. The key objective of the meeting was to sensitize the staff about the threat status of the species and the importance of surveying more areas in the Tiger Reserve so that the species can be conserved.

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Policy Consultation on High Altitude Grasslands



A workshop titled "Policy Consultation on Temperate Alpine Grasslands: Himalayan Perspectives" was held in Gangtok, Sikkim on April 29th and 30th, 2019. The workshop was attended by 47 participants from Arunachal Pradesh, Jammu and Kashmir, Sikkim and Uttarakhand, and included pastoralists/community members from rangelands Ladakh, J&K to Tawang, Arunachal Pradesh and Humla in the Kailash Landscape of Nepal. We also had experts from ICIMOD participate and give a Pan Himalaya perspective about the rangelands.

The policy consultation aimed to make a beginning in compiling information on the conservation & livelihood values of temperate-alpine grasslands that will feed into a national-level policy document on grasslands & promote their conservation, for sustainable use, biodiversity conservation, & climate change mitigation. The key outputs that emerged were related to policy guidelines on tourism & access to grazing in these landscapes.

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Raising awareness through butterfly walks in Makaibari Tea Estate, Darjeeling



Makaibari Tea Estate was established in 1859, and became the first tea estate to be certified organic in 1988. 70 % area of the tea estate is covered by forests. A butterfly walk and awareness

programme were organized involving local community members and village children.. The key objectives of the programme were – i) to promote conservation of biodiversity; ii) to involve community members in documenting the richness of butterflies in Makaibari Tea Estate.

28 community members participated in the workshop. A trail of approximately 3 km length was used for the butterfly walk. Participants mainly included students and tea garden workers living in one of the tea estate villages. 20 species belonging to 5 families (Pieridae, Nymphalidae, Hesperidae, Lycaenidae, Papilionidae) of butterflies were photographed and identified during the workshop. Of these, 11 species belonged to Nymphalidae.

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Engaging school students to document biodiversity, in Kalimpong District



We celebrated International Day of Biodiversity with students of St Stephen's Academy, Kaffer and Sadhu Sunder Singh High School, Dabbling from Kalimpong district, West Bengal.

Kafer and Dabbling villages are located in a remote corner of Kalimpong district and all the households are dependent on farming for their income and subsistence. 135 students and teachers from both the schools actively participated in the event. The programme objectives included the theme of the day- '**Our Biodiversity, Our Food, Our Health**'. We oriented the students on identifying, observing and documenting biodiversity elements around them specifically documenting pollinators, birds and medicinal plants. A tour of the nearby private forest, medicinal plants nursery and cardamom agroforestry was organised where 7 species of birds and 15 species of insect pollinators were documented by the students.

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ATREE's mission is to promote socially just environmental conservation and sustainable development by generating rigorous interdisciplinary knowledge that engages actively with academia, policy makers, practitioners, activists, students and wider public audiences. ATREE's Northeast/Eastern Himalayas Office has a direct presence in the Darjeeling and Sikkim Himalayas and works with a range of local partners in the other states of northeast India.

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