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Nature Climate Solutions Pathways in Sikkim



Farm-Forest based Agroforestry in Yuksam

Nature Climate Solution (NCS) pathways are identified as effective tools for climate change mitigation and also to deliver on our National Determined Contributions (NDCs). For the state of Sikkim, we studied 'Trees in cropland (Agroforestry)' and 'Reforestation' as NCS pathways. We conducted the study in Yuksam, located in the buffer zone of the Kanchendzonga National Park (KNP). This article contemplates the nature of the selected pathways and implications of those pathways on the local communities.

Agroforestry, is traditionally practised by the local communities, in Sikkim. Two major forms of agroforestry practices were found in Yuksam-Farm-i) Forest based Agroforestry primarily for sustenance, and ii) High Value Crop based Traditional Agroforestry particularly Large Cardamom based agroforestry. These practices have contributed to household economy, food security and even employment to a large part of the population. These are traditionally evolved systems and were not introduced by the government. This knowledge on these traditional practices has been passed on through generations and is primarily shaped by the needs of the local communities with regards to its benefits and related ecosystem services.

It is undisputed that there is a lack of acknowledgement and comprehensive government policy to support and promote aaroforestry practices in Sikkim. This coupled with low productivity, crop damage and lesser financial returns have drastically reduced the practice and consequently the areas under trees in cropland, particularly in the case of cardamom based practice where the decline is almost by 50%. In order to tackle the financial crux, the government has been encouraging farming communities to opt for alternative income generating options like Kiwi cultivation bee-keeping, piggery, etc. Agroforestry offers potential for financial benefits to the communities but the significance of agroforestry as an NCS pathway is inimitable in terms of the climate change discourse.

Owing to low productivity and high labour demand, the farmers are demotivated to remain engaged in cardamom based agroforestry. This has also increased the risk of losing the practice of generational transfer of traditional knowledge. Nevertheless, since the agroforestry practices are led by the communities themselves, there is still a great scope of agroforestry as an NCS pathway in Sikkim provided that the government and other stakeholders acknowledge and take meaningful initiatives to address the existing constraints.

With regards to the next NCS pathway, the government in Sikkim has rigorously promoted reforestation and afforestation programmes throughout the state. The government has also designated days and events for tree plantation to encourage participation from all sections of the community. The Gram Panchayat Units (GPUs) also play a role in promoting plantation in the rural corners of Sikkim. In the case of the Yuksam GPU, plantations were done periodically with more emphasis on aesthetically valuable species. In fact, the state programmes on plantation similarly reflect prioritisation of aesthetically valuable species over others on account of promoting tourism. There is a need to develop a Sikkim specific Plan for NCS pathways that would be appropriate to the biodiversity and the diverse ecosystems of the state.

The Eco-Development Committees (EDCs) and the Joint Forest Management Committees (JFMCs) were introduced with an intention to involve communities in co-management of the forest and forest resources. Among others, reforestation and afforestation are major activities assigned to these committees. However, their efficiency has been constrained due to lack of ownership and real power to influence the decisions when it comes to their sphere of work. Their participation is majorly reflected while providing labour rather than on collective decision making.

It can be understood that the Sikkim government has undoubtedly acknowledged the significance of reforestation and afforestation through their programmes and policies, however, lack of regular incentives and lack of definite institutional set up have definitely limited their scope. Moreover these two approaches are rarely linked to nature climate solutions for the state of Sikkim.

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Life in the shadows: small mammals & bats

The mammalian Order Rodentia and Order Chiroptera combined make up about 60% of all classified mammal species worldwide. In Darjeeling-Sikkim Himalaya (DSH) landscape, these two Orders comprise about 53% of all mammal species recorded from this landscape. Although mammals are the most studied taxa in the Eastern Himalaya, however research on small mammals (Order Rodentia and Order Eulipotyphia) and bats (Order Chiroptera) in the region is still lagging. This is perhaps due to the general perception of these species as pests, unlike their more charismatic mammalian cousins and in part due to their nocturnal activity, cryptic behaviour, and identity, the logistical as well as taxonomic workload that comes entailed with studying these species.

To better understand these species, ATREE in collaboration with Sikkim University has undertaken a study in the socio-ecological landscape of DSH



Measuring the hindfoot of a rodent specimen at Chisang, Todey-Tangta

since 2018 with focus on small mammals and bats. Sherman traps were used to capture small mammals, and mist nets were used for bats. In addition, we also used passive bat detectors for recording echolocation calls of insectivorous bats for setting up bat call directory in this region.

So far, we have recorded and identified 22 species, including three opportunistic sightings of small mammals and bats from ten sites, four in Sikkim and six in Darjeeling. Among small mammals, *Rattus rattus* was found to be the most widespread terrestrial species and *Calloscuirus pygerythrus* for arboreal species. The fruit-eating bat *Cynopterus sphinx* was found to be the most common bat species in the socio-ecological landscape. Our study showed that the socio-ecological landscape is a host to a diverse variety of small mammals and bats. On a good night, as many as six or more species of bats can be seen hovering above a stream to relinquish their thirst and to forage for prey.

Besides documenting species presence, our study also provides insights into less documented human-wildlife interaction vis-à-vis small mammals and bats through discussions with the local communities. In our recent visit to a large cardamom dominated agroecosystem at Chisang, Kalimpong, farmers were complaining of rats, locally called "musa", foraging on the seeds of standing cardamom plants. Unless due cognizance of the issue is taken, this could eventually lead to economic stress for the farmers. Bats, on the other hand, are unwitting victims due to lack of awareness. We have encountered C. sphinx denied taking shelter under banana leaves or killed for partaking a guava fruit. Besides these, bats also roost near human habitation, crevices on the roof, uninhabited buildings and inside bamboo poles which further exposed these animals to anthropogenic elements.

The ecological role of bats as pollinators and for pest control is a well-documented

phenomenon. The role of small mammals in the food web and their potential as indicators for changes in climate, land use and habitat also need further exploration. As such, it is pertinent to look at the bigger picture and the role they play in the ecosystem before considering these mystic creatures of the night as simply pests. Partnership local communities is paramount with documenting species occurrence and distribution, with sensitization and engagement of local communities for future conservation action.

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Tourism Assessment of Sittong III

compete to make their homestays larger, better and functional. Untrained hosts and tourism operators in the area run the enterprise more for profits and overlook sustainable ethical practices which could bring in higher paying tourists with lower footprint.

ATREE Eastern Himalayas further plans to develop and conduct training programs and modules for tourism operators and hosts in the area on best tourism practices that could lead the enterprise to grow and evolve into a sustainable enterprise.

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Awareness Program on Pangolins



One of the inherent parts of the project titled "Strengthening resilience and reducing vulnerabilities of rural communities of Africa and Asia" funded by the Norwegian Cooperation Exchange program (NOREC) is to build skills of partners on developing and initiating Community based tourism projects. As a part of the project, a team from ATREE conducted an assessment of Sittong III to understand the current tourism trends, the operations and functioning of the tourism enterprise, the offerings as well as the capacity and training needs through community interactions and site visits.

Tourism which started as an alternative livelihood activity in Sittong III across the Riyang river valley has been substantially shifting towards a primary activity with many people (30%) abandoning agri-based activities. With the growing popularity of tourism in the area many community members have opted for loans to build homestays with all the modern amenities. The home owners prefer keeping a larger number of tourists to maximise gains and pay off debts. There have been instances where homeowners were unable to pay off the debt and had to sell off their land or lease off the property to outsiders. Nonetheless, replication and duplication of the enterprise is rampant and people

Teams at the Finals of the quiz competition

An Inter-school Quiz competition was organised by ATREE EH on 20th July 2022 for the students of Class IX-X at Pokhriabona, Darieeling to build awareness on the Critically Endangered Chinese Pangolin. The event was conducted under the project "Conservation of Chinese Pangolin in the Tea Plantations of Darjeeling Himalaya" 'supported by Save Pangolins, USA.

The theme of the contest was "Pangolins and the Wildlife of Darjeeling". Eleven schools from Rangbhang Valley participated in the quiz contest. For the elimination round, two separate preliminary rounds were conducted on 5th and 6th July 2022 after which six schools were shortlisted. For the final round, six schools competed against each other. This guiz consisted of 7 rounds covering different topics on wildlife with special focus on Pangolins. At the end of this exciting and thrilling battle the trophy was won by Sacred Heart School. A total of 61 attendees including Students, Teachers, Pangolin Guardians, and ATREE staff were present at the event.

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The Rural Evidence and Learning (REAL) Water Project

Natural history observations: Cavity on a snag made by Greater Yellownape used by a Great Barbet

Monitoring of water supply infrastructure by Assistant Engineer from the Rural Development Department at Yuksam

Ashoka Trust for Research in Ecology and Environment (ATREE) - Centre for Social & Environmental Innovation (CSEI) is a part of a seven member consortium under the REAL-Water project funded by the United States Agency for International Development (USAID). The project's aim is to carry out an implementation research in India. In the first year of the project's implementation ATREE worked on the "State of Planning in the rural drinking water sector in India" and focussed on four states- Bihar, Karnataka, Maharashtra and Sikkim.

ATREE Eastern Himalaya conducted the research in Sikkim where three sites- Mellidara, Sumbuk, and Yuksam were covered from the Namchi and Gyalshing districts respectively. A total of 28 in-depth interviews were conducted with cross scale stakeholders- Engineers, Fitters, Beneficiaries, Panchayats- to carry out the Journey Mapping exercise.

Through this project Sikkim's rural drinking water supply was studied with a focus on the Jal Jeevan Mission (JJM) from its planning to implementation phase. The state's water policies for the sector, the current institutional map and the planning process were documented in minute details. It was discovered that as a way forward there is a need to consider the network of actors in both the government and private sectors, and the interconnectedness of these sectors to achieve the outcomes of missions. An overarching framework is also needed to address the whole institutional, socio-economic and governance related issues to overcome the barriers for sustaining drinking water security in rural areas of Sikkim. Greater Yellownape preparing a cavity in a snag in Badamtam, Darjeeling

At about 07h35 on 7 April 2022, in Badamtam Forest (27.1032°N 88.3162°E, elev. 568m), Darjeeling, we observed an adult Greater Yellownape, Chrysophleama flavinucha drilling and cleaning a cavity on a dead Albizia tree. Two cavities could be seen on the same snag, but during our observation, the woodpecker only focused on the lower smaller cavity. The woodpecker would peck and scrape the cavity on the inside repeatedly, spending 2-3 seconds inside the cavity each time. As we needed to continue our monitoring routine for the day, we observed this activity of the woodpecker only for about 4 minutes. During the entire duration of the observation, the Greater Yellownape did not seem to be disturbed by the presence of other birds in vicinity, and continued its pursuit of preparing the cavity. Greater Yellownapes are known to breed during the March-June pre-monsoon season, and our observation may have captured it performing an early breeding activity of preparing a nest.

At about 05h55 on 16 September 2022, we again observed some activity on the same tree cavity in Badamtam Forest, Darjeeling, but this time the cavity was being used by an adult Great Barbet *Psilopogon virens*. The adult barbet could be seen entering and exiting the cavity that was previously prepared by the Greater Yellownape. Great Barbets breed two-three times a year between February to September, and are considered facultative excavators, meaning although capable of excavating their own cavities in trees, they mostly use burrows excavated by other birds like woodpeckers. Our observations thus provide evidence of Great Barbets using the tree-cavities prepared by Greater Yellownapes in Darjeeling.

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Endangered species in changing landscapes: Case of White-bellied Heron in Arunachal Pradesh

Namdapha Tiger Reserve, is considered the stronghold for the Critically Endangered White-bellied Heron population in India. This too is not an exception to the ongoing developmental activities in its vicinity. This has affected the bird's habitat enormously due to resources being extracted from the river for constructing the Miao-Vijaynagar road; hence reducing the sheer number of suitable habitat for WBH along the Noa-dehing. Reduction of suitable river habitat could impact the bird's ecology and behaviour in the different seasons. Threats like land conversion and infrastructure development both related to local livelihoods appear to be impacting the species habitat. There needs to be a concerted effort with the participation of all stakeholders to conserve the species and its remaining habitat.

> — · — · — · — Yumlam Benjamin Bida (benjamin.bida@atree.org)

Documenting the impact of sand and



Resource extraction manually at Rangpo, Sikkim

Rivers of Life is an initiative of Azim Premji University, the first of a series that aims to depict nature in all its forms depicting the splendour of our rivers through the vivid imaginations of young interns. The objective is to explore prominent and smaller river ecosystems in India and discuss the specific threats, including anthropogenic threats such as mining, encroachment, climate change, release of pollutants, illegal extraction etc.

I applied for this internship and submitted a proposal to document 2 rivers - Rongyong River and

Runanyu (Teesta River). There have been a number of studies and stories about the impacts of hydropower projects on these rivers from Dzongu. However the impacts of exploiting the river ecosystem through sand and boulder mining seldom reach the public. There are certainly severe impacts of sand and boulder mining in the Rungnyu (Teesta) and Rongyong (Tholungchu) Rivers of Sikkim. Since, the topography of this region is steep and very prone to erosion causing landslides and collapse of riverbanks as a result of removal of sediments of the river. To meet the ever-increasing demand of the construction sector there is widespread unsustainable mining on river banks using heavy machines. These have negative impacts on the aquatic biodiversity found in these riverine/riparian ecosystems as well as the livelihoods of marginalised communities.

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Restoration of degraded sites in Tea Gardens of Rangbang valley, Darjeeling



Plantation of saplings by community members

Plantation of saplings of indigenous tree species in degraded, landslide prone, potential wildlife habitat, water catchments sites identified by Tea Garden management and community is one of the major activities of the project "Transforming lives through Efficient Energy Technologies & Restoration of Degraded lands in Tea Landscape of Darjeeling", funded by Norton LifeLock. ATREE staff interacted with the local community members and Tea Garden management in the Rangbhang Valley, Darjeeling. We were able to identify degraded patches of land in Chamong TG and Selimbong TG for restoration activities. The identified patches were degraded with no tea bushes, heavily infested with bamboo thickets and invasive species. Weeding, cleaning of the sites was initiated as a pre plantation activity. A total of 4600 saplings of 11 different species were planted in an area of 3.56 ha (approx.) at four sites in 2 TGs.

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Training on Briquettes making techniques from Invasive Alien Plant **Species**

Training on Improved Cook Stoves (ICS) Bricks making & Installation conducted at Tea Gardens of Rangbang valley, Darjeeling



Preparing briguettes from the moulding machine

ATREE Darjeeling organised two training workshops (2 days each) on briquettes making from Invasive Alien Plant Species in two villages of Kalimpong district of West Bengal. The training was conducted under the project "Value-Added products from Invasive Plant Species for improving Livelihoods of Marginalized communities in Indian Himalaya" supported Department by of Biotechnology under Himalayan Bioresource Mission. The training involved women Self-Help Groups from Lolay Khasmahal Kalimpong-II and Yok Khasmahal Kalimpong-I. The training was attended by 47 participants belonging to 24 SHGs. The training included techniques to make bio-briquettes from key invasive alien species infesting agricultural land. These included Lantana camara, Eupatorium adenophorum, Ageratum conyzoides. The training explained the concept of briquettes, also importance of briquettes and its contribution to reduction in spread of Invasive Plant Species. The training mainly focused on practical demonstration which included a series of interactive technical and hand-on practical sessions. Activities included collection of raw materials, preparation of charcoal, charcoal grinding, mixing charcoal powder and clay soil into a paste and the production of beehive-type briquettes. During the training each participant made at least 5 ATREE briquettes. also provided sets of biomass-based briquettes moulding machines to both the women's cooperative societies during the training.

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Installing an Improved Cook Stove

Under the project "Transforming lives through Efficient Energy **Technologies** and restoration of degraded lands in the Tea landscape of Rangbang valley Darjeeling", funded by Norton LifeLock through its CSR initiative, ATREE conducted 3 events of ICS bricks making trainings for 53 participants (29 female and 24 male) from 6 different TGs. Further, ATREE also conducted 2 events of ICS construction and installation training for 48 participants (29 female and 19 male) who have taken two days ICS bricks making training earlier, from 9 different TGs (Chamong, Selimbong, Sumripani, Turzum, Sungma, Avongrove, Dhajey, Nagrifarm and Magarjung TGs). The training was organized to promote energy efficient technologies i.e., Improved Cook Stoves to reduce the use of firewood for cooking and to develop the capacity of local women and youth as ICS promoters and technicians within the project sites and beyond. The training was facilitated by Mr. Shantiram Ghimire, Senior Technician and ICS specialist from Nepal.

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Citizen Science Events

Over the last quarter, members of ATREE Eastern Himalaya Offices in Sikkim and Darjeeling participated in two nation wide citizen science events.

National Moth Week

First there was the National Moth Week 2022. This is a worldwide event to study and record the diversity of moths during the last full week of July. This year the event was from July 23rd to 31st. 2107 photos of 311 species of moths were recorded and uploaded from the region which makes up 24.03% and 32.22% of the total observations and species contributed from India this year.



Big Butterfly Month

Next there was the Big Butterfly Month 2022. This is an event where participants are encouraged document the butterflies around them to throughout the month of September. This event was initiated in 2020 during the COVID-19 lockdown as a way to increase public awareness on butterflies and citizen participation. promote science The contributions and participation has increased steadily over the past 3 years. This year 924 observations of 180 species were recorded and contributed from the Sikkim-Darjeeling region. Even though these observations comprise only 8.25% of

the total observations made from across the country on iNaturalist.org, participants were able to record 43.16% of the total 417 species recorded from across the country this year. Members of the ATREE offices also made a concerted effort to visit locations from where no citizen science records were previously recorded, and all districts in the region were covered



Grants

- 1. Conservation of the Critically Endangered White-bellied Heron, Ardea insignis in Arunachal Pradesh India. Synchronicity Earth, UK
- 2. Addressing trade of Chinese Pangolin, Manis pentadactyla in transboundary landscapes: Darjeeling, Eastern Himalaya, India Ocean Park Conservation Foundation Hong Kong Research Fund
- 3. Ms. Pema Yangden Lepcha got a one-month "Rivers of Life" internship from Azim Premji University

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 Programme has a direct presence in the Darjeeling and Sikkim Himalaya with a range of local partners in the other states of North East India.

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