Foundation for Ecological Research, Advocacy and Learning

Annual Report 2023 - 2024

Foundation for Ecological Research, Advocacy and Learning (FERAL)

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Listed as a Schedule I species under the Indian Wild Life Protection Act, 1972, the Gaur is increasingly found outside forest areas in plantations including coffee and tea in the Western Ghats.

Mandate

FERAL is a public charitable trust founded in 1997 with a mandate to develop sustainable and community centred solutions to address the pressing challenges that affect our natural ecosystems and the services they provide. We rely on interdisciplinary and quantitative methods to understand these systems and provide practical, participatory and gender responsive strategies toward their restoration and management. Our programmes invest in rigorous field studies to track and measure ecological processes over sustained periods. We adopt an evidence-based approach to identify problems, provide frameworks for their resolution and monitor the effectiveness of our interventions. We develop scientific and educational material, technical know–how, provide training, employment and skilling of stakeholders. We believe that addressing the seemingly intractable challenges we face in finding solutions to ecological and environmental problems today is only possible through meaningful collaborations with multiple stakeholders.

The population of little ringed plover, a species of least concern, found on river banks, tidal mudflats, estuaries and lake edges, is rapidly declining.

The Year That Was

In the year gone by, we continued our efforts to find solutions based on innovative data-driven research and conservation to address challenges that affect nature, natural ecosystems and their services. We continued our work in the four core programme areas–Wildlife Biology and Conservation, Frontier Elephant Programme, Natural Resource Management, and the Marine Science programme. Four projects were initiated this year, and work on seven earlier initiatives were continued.

For our work in restoring the catchment of the Tuivang River in Manipur, we identified locations for restoration, identified local species that could be used for restoration, and along with the local community, established nurseries for these species. Additionally, awareness programmes on the importance of the catchment area were conducted for the local communities. All these were achieved under the tough back ground of ethnic violence in this remote region and would not have been possible without the help of our collaborator and the commitment of the local community. Fish conservation zones in Manipur that we helped establish in an earlier project were expanded, with additional areas being brought under the protection of the local community. This year too, our researchers engaged with the forest departments, grassroot organisations and other stakeholders to advise and steer various conservation initiatives being proposed in the Western Ghats.

The frontier elephant programme saw the start of a project to further our knowledge of the ecology and behaviour of bull elephants to aid conservation. The work in the Brahmagiri-Nilgiris-Eastern Ghats landscape focused on data collection to create the first perspective plan for human-elephant conflict mitigation, utilizing the Capabilities Approach proposed by Amartya Sen. Along with the Forest Department, the team helped communities in setting up mitigation structures to protect their crops. The team also conducted two training programmes on elephant ecology and behaviour and human-elephant conflict for the Karnataka Forest Department.

Furthering our efforts towards better management of natural resources, this year, for the study to understand the changes in downstream estuarine productivity due to hydropower operations in the Western Ghats, field data collection was completed and analysis of the data was started. A new project in the Nilgiris, our long term hydrology–meteorology monitoring site, was initiated. This work aims to assess the hydrological impacts of wattle to inform the Tamil Nadu invasive species management plan.

We continued our efforts in the realm of sustainable fishing, focusing on elasmobranchs. The study on the widenose guitarfish, a critically endangered species, was completed, and the findings were used to identify the Galgibag beach in Goa as an Important Shark and Ray Area by the IUCN Species Survival Commission Shark Specialist Group. The team conducted awareness programmes on the east and west coast to aid conservation of marine species.
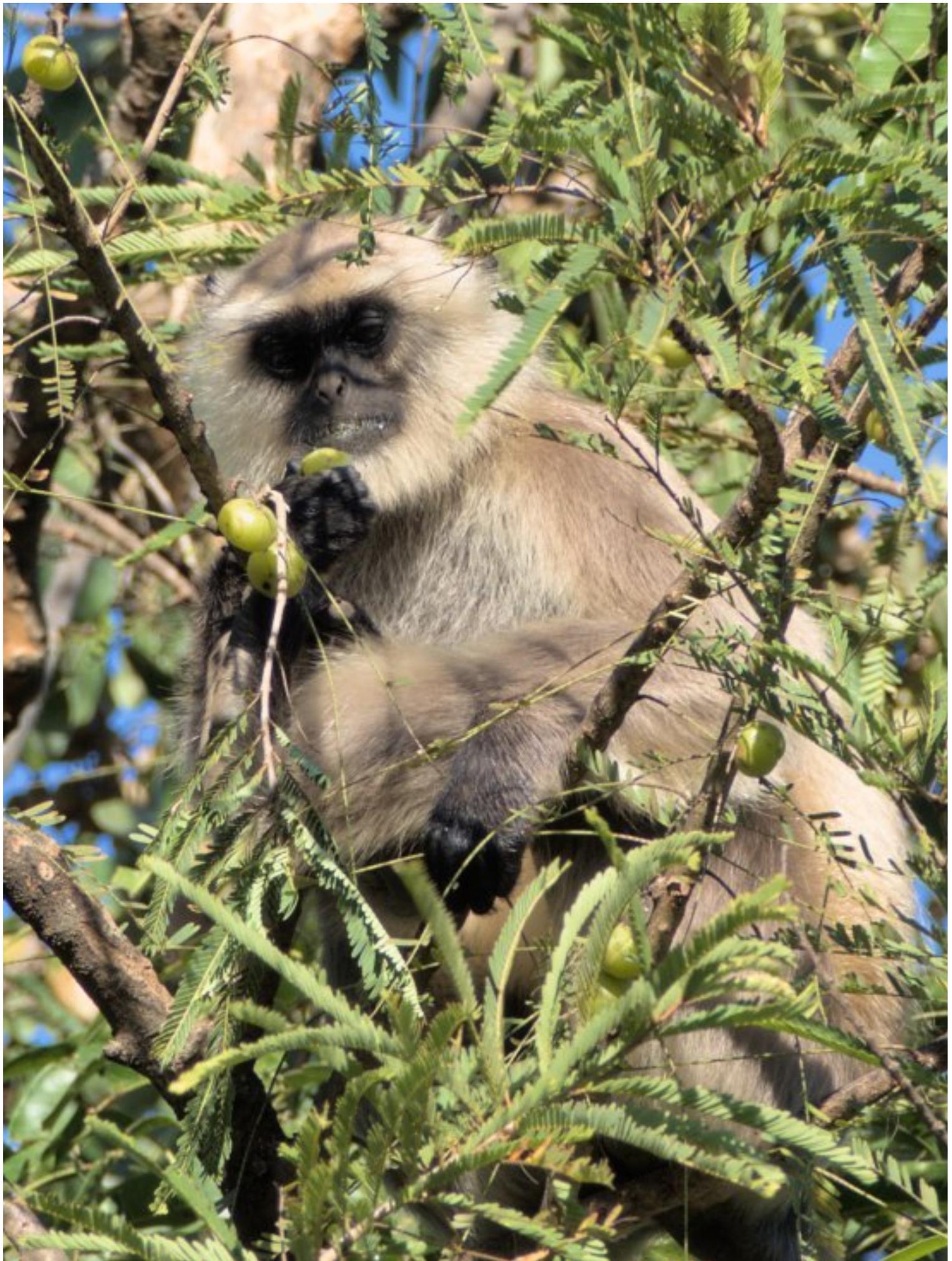
Many forest produce are important for people and wildlife. Ensuring their sustainable harvest in forest areas where collection is permitted is important to ensure availability for wildlife and forest regeneration.

Wildlife Biology and Conservation

The Wildlife Biology and Conservation Programme at FERAL carries out scientific research on wildlife and their habitats and uses evidence from the research and field knowledge to steer on-ground conservation efforts.

This year the focus of this programme has largely been on the North-East states. We furthered our earlier work of establishing community managed fish conservation zones in North-East India with a new project. The project to restore the catchment of the Tuivang river in Manipur was continued and in spite of setbacks caused by the local political situation, we managed to complete the objectives that we set out to meet with this project.

Our researchers continued to contribute data, knowledge and experience–gathered over years on wildlife corridors in India to advise and support various Government conservation initiatives. One student was mentored for her Master's thesis this year.

The programme since its inception has greatly contributed to the conservation of various biodiversity rich zones in the Western Ghats, an area that has been our main focus, geographically. The field-oriented work in this region was put on a hiatus last year for strategic planning to meaningfully evolve our efforts for a bigger impact on wildlife conservation. In the past year, brainstorming sessions both internally and with other conservation professionals has helped us to evaluate and identify themes that urgently need attention to steer conservation initiatives. Additionally, short-term research projects on the impacts of human activities on wildlife habitats and on the ecology and behaviour of species are being explored.

The painted sandgrouse is found in open grasslands and semi-arid regions of India. These habitats are often the focus of carbon-centric tree planting projects, which are a potential threat to these poorly conserved ecosystems and their wildlife.

Highlights

– Our floristic surveys in the Tuivang river catchment recorded 63 tree species including three species of bamboo and one cane species. Two species recorded are known to be threatened, while the global status of more than 15% of the species recorded is not known.

– The community identified seven tree species that have become rare in the region, reported a possible extinction of four tree species in two villages, and attributed the forest degradation and loss in the landscape to mechanised logging and introduction of saw mills.

– We raised around 2000 seedlings of nine different plant species in the village nursery in Manipur.

– Around 78 people, including 28 women and 35 students, attended our awareness and education programme on the importance of forests in the catchment areas. A handbook detailing the methods and protocols for raising local plant species in the nurseries was shared with the local community.

– Along with our collaborators, we established a community-managed Fish Conservation Zone (FCZ) in Manipur, covering an area of 1.9 ha. The aim of this initiative was to promote community managed conservation of fresh water aquatic biodiversity in regions with strong local governance institutions.

– Our study recorded improved fish stocks in the community-managed FCZs that we established suggesting that this is an effective approach for the protection and conservation of rivers and their resources in regions that are governed largely by local people.

– Our project on the FCZ in North-East India provided two key lessons:

– First, we learnt that for the success of such community-managed projects, a strong leadership at the village level that is both open-minded and farsighted for the welfare of the people is crucial. The second key take away was the indispensability of local collaborators for successfully implementing community-managed projects.

Training of local communities in field methods is a key thrust of projects. Training on recording stream profiles and monitoring stream velocity and levels at River Tuivang between L. Bongjoi and Moljol villages in Manipur.

Replicating community managed fish conservation zones in free flowing rivers

Project Period: February 2023–December 2023
Budget: INR 8,98,309
Supporting Agency: Indian Institute for Human Settlements, India
Principal Investigator: Srinivas Vaidyanathan
Co-principal Investigator: Dr. James Haokip, Sikkim University, Gangtok
Collaborators and their Institutions: Dr. Jagdish Krishnaswamy, Indian Institute for Human Settlements, Bengaluru

A Fish Conservation Zone (FCZ) is an area that is demarcated along a stretch of the river for the conservation of fish and other aquatic biodiversity and is managed by local communities. In 2021, with the support of the Critical Ecosystems Partnership Fund (CEPF), along with our collaborators, we established two FCZs in Khengjang and Yangoulen villages in Manipur and in Lapalang village in Meghalaya. The establishment of FCZs has helped in the protection and recovery of the fish population in these two sites and has also raised awareness among local communities about the importance of conserving freshwater ecosystems. This project was envisioned to use the experience and lessons learned from our previous work to further fish conservation in this region.

Objectives

1. Generate baseline data on aquatic biodiversity of the Tuivang River in Manipur.

2. Demarcate and establish community managed FCZs in additional stretches of the Tuivang river in Manipur.

3. Build capacities of local communities and researchers to aid conservation efforts.

4. Enable learning and experience of fish conservation to be shared across two global biodiversity hotspots.

5. Sensitise regional and central government officials about community-managed fish conservation zones in free-flowing rivers through workshops and articles in social media and newspapers.

6. Help raise the profile of sustainable capture fisheries as an alternative use of free-flowing rivers that can support livelihoods rather than the existing paradigm of abstraction of water from rivers or regulation for hydropower.

Status

An FCZ of 1.9 ha was established along the Tuivang River in Manipur covering a 750 m stretch between L. Bongjoi and Moljol villages. Field work in Manipur was conducted along with local

Dialogues with local community members are key to the success of community-based conservation initiatives. Pictured here, our field team is talking to villagers about the importance of FCZs for the conservation of rivers and their biodiversity.
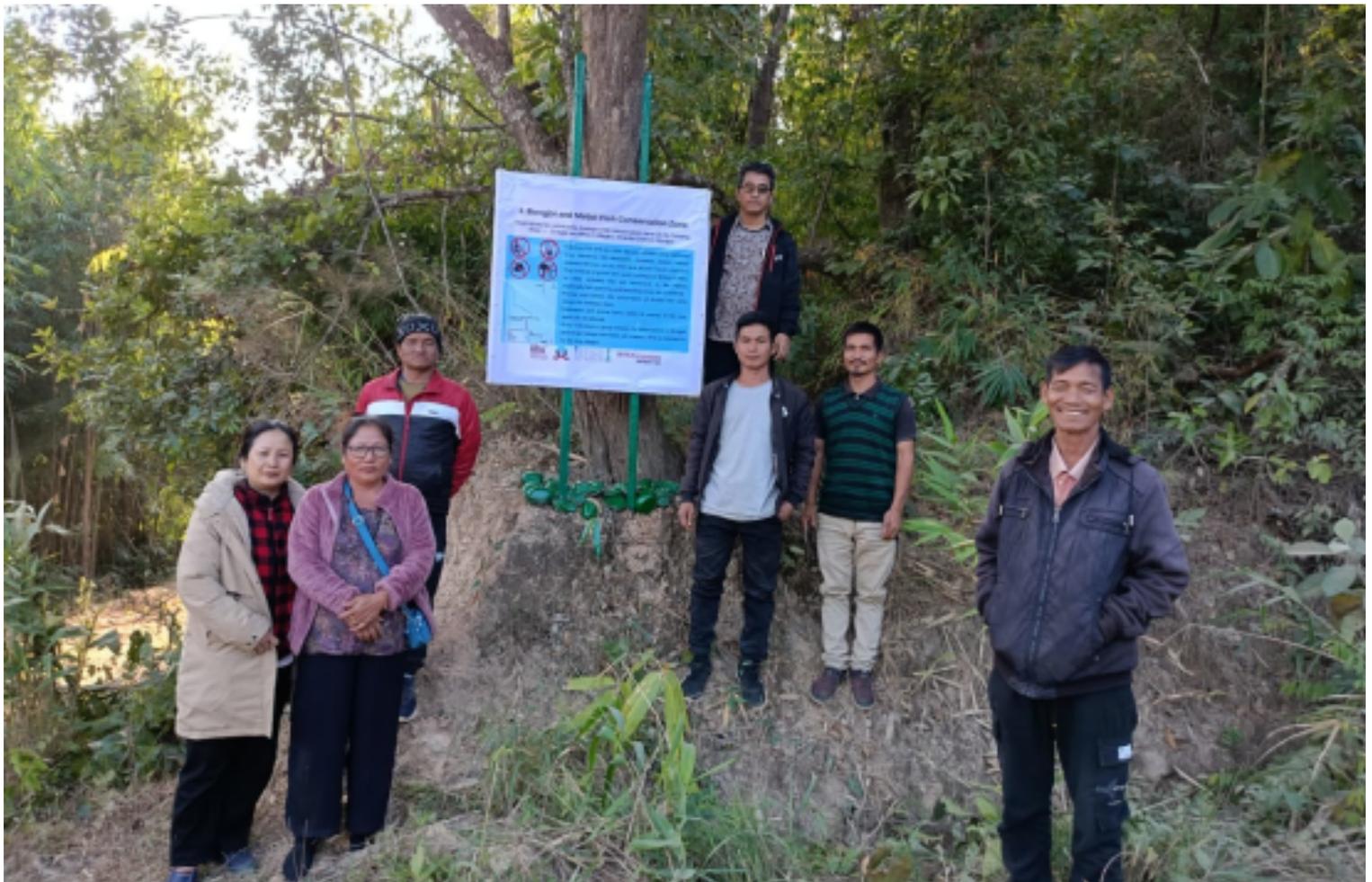
To enforce the protection of the FCZ, a signboard with description of the FCZ site and the rules and regulations drawn up by the community was installed at the site.

partners and communities. A committee consisting of village headmen and village council members has been formed to manage and monitor the FCZs.

A total of five fish species: *Macrognathus morehensis* (Nga-gul), *Rasbora ornatus*, *Schistura sp.*, *Barilius sp.*, and *Puntius sp.* were recorded within the FCZ. Of these, *R. ornatus* is a Vulnerable species as per the IUCN redlist.

We conducted a capacity-building workshop for researchers and communities at the FCZ to improve the knowledge and skills in the basics of fish taxonomy and biology. This was followed by another workshop on hydrology and fish sampling to enable them to undertake hydrological and fish monitoring on their own at these sites. Two meetings were conducted with local communities on conflict resolution and protocols for enforcement and monitoring of FCZs. These workshops and meetings empowered two villages in Manipur with knowledge on fish taxonomy and hydrology, and skills to monitor fish stocks, changes in river hydrology, and managing fish conservation zones.

Field visits to previously established FCZ sites helped villagers witness the dramatic changes in fish population achieved through the protection of a small stretch of a river. They were motivated and willing to replicate these conservation action plans in their villages and spread conservation awareness among other villagers.

To disseminate the FCZ model, along with our partners, a regional workshop in Shillong, Meghalaya and a two-day national-level workshop in Bengaluru, Karnataka were held. Nearly 35 researchers and policy-makers from across India, mainly the North Eastern Region, attended these workshops and learned about the establishment, management, strengths and challenges of community-managed FCZs.

The FCZ established in 2021 continued to be monitored. Increases in fish size and population were recorded. The locals also reported catching larger sized fish downstream of the FCZ. A similar improvement in fish population is expected at the newly established site in the coming years, thus benefiting the people. Our FCZ initiatives serve as an evidence-based conservation model to inform management, conservation and policy and can be adapted for other sites in India with strong local governance institutions.

Vegetation in the Tuivang River catchment area is characterised by secondary and degraded evergreen forests. A survey of these forests was conducted to document tree diversity and identify native species that can be planted at restoration sites.

Forest inventory and establishing nurseries for community-based restoration of a river catchment in North-East India

The focus of this study is the Tuivang River in Manipur, one of the few free-flowing rivers in India. The river and its catchment area are part of the Chindwin River Basin and are important for maintaining aquatic biodiversity and providing various ecosystem services in this region. However, this riverine ecosystem is facing threats in the form of habitat modifications due to logging.

Shifting cultivation and selective logging were widely practised by the local communities in the past. Currently, the number of shifting farmers has drastically decreased, whereas mechanized clear-felling of large tracts of forests has been replaced by selective logging. Anecdotal evidence suggests that this clear-felling on steep slopes has resulted in increased soil erosion and sediment loads in the river and increased flood events in recent years.

In this project we aim to document the floristic diversity in the remnant forest patches and improve the health of forests by facilitating community-initiated restoration activities in the catchment area of the Tuivang River.

Objectives
1. Increase awareness among local communities on the importance of forests in retaining rainfall and reducing landslides and flood risks in the area.

2. Identify potential sites for restoration.

3. Document species richness and diversity in the area.

4. Establish village nurseries to aid restoration efforts.

5. Grow Rare, Endangered, and Threatened (RET) plant species in village nurseries, which could be later planted in the restoration sites.

6. Restore denuded sites to help rejuvenate streams and the river, which will benefit conservation and the sustainable use of water resources in the long run.

Status
In spite of the ethnic violence in the study region affecting field activities, the project team

We established village nurseries where seedlings of native tree species were maintained. The seedlings raised in the nurseries were transplanted into large polyethylene bags before being planted at the restoration sites.

managed to achieve most of the objectives that the project set out to meet.

Using remotely sensed data we identified areas that have been degraded and turned barren over the years in the catchment area of Tuivang River. A six to eight years rotation period is followed for shifting cultivation in the area. To capture this rotation cycle we used decadal satellite images from 1990s–2020 to develop a forest degradation map showing eight different degradation categories in the study area. Based on this map and a barren area map that we developed, sites for restoration and sites for floristic surveys were identified.

We documented the native floristic diversity to identify the species to be planted in the restoration sites. We sampled a total of 35 plots and recorded 63 tree species. Only two of the recorded species, *Dipterocarpus turbinatus* and *Tectona grandis*, were categorised as threatened by the IUCN, whereas no information is available on the global status of several of these species.

We also interviewed 40 villagers covering nine villages to document traditional knowledge of tree species. The villagers identified 13 species that they preferred for planting in the restoration site and 11 species to grow in the nursery for restoration planting. They reported seven species, including *Melanorrhoea usitata* and *Michelia champaca*, that have become rare in the region. In two villages, Khengjang and Moldennom, a possible local extinction of four species (*Dipterocarpus tuberculatus*, *Dipterocarpus turbinatus*, *Michelia champaca* and Huisom thing (local name) were reported. All the respondents attributed mechanised logging and introduction of saw mills as the main reasons for the forest degradation and extinction of some tree species in the landscape.

To increase awareness among local communities on the importance of forests, we conducted a total of six awareness and education programs covering six villages. Of the 78 participants, 45% were students and 36% were women.

Approximately 2000 seedlings of different plant species collected in the previous year from nearby forests,were raised in the nurseries. The nurseries were monitored and the seedling survival rate was nearly 80%. Currently, seedlings of nine different tree species, *Dipterocarpus turbinatus*, *Dipterocarpus tuberculatus*, *Gmelina arborea*, *Schima wallichii*, *Baccaurea ramiflora*, *Rhus chinensis*, *Castanopsis indica*, *Melanorrhoea usitata*, and *Eugenia sp.* survive in the nursery. The maintenance and monitoring of the plants in the nursery will be continued. A barren site of 0.3 ha for experimental planting has been identified near L. Bongjoi village. We plan to plant around 600 saplings in this site during the monsoon.

To share our work and experience in establishing a nursery for species in this remote region, a document on preparing nursery beds, seed treatments and raising local plant species in the nurseries was prepared and shared with the local community.

Conducting interviews with the elephant keepers at a forest elephant camp in the study landscape.

Frontier Elephant Programme

The Frontier Elephant Programme (FEP) is a collaborative initiative set up in 2015 between the Foundation for Ecological Research, Advocacy and Learning (FERAL), Indian Institute of Science, Asian Nature Conservation Foundation, and National Institute of Advanced Studies.

The focus of FEP is on reducing conflicts and promoting peaceful coexistence between elephants and human communities in areas where their habitats overlap. Key studies undertaken by FEP address complex ecological and social aspects of human-elephant interactions, leveraging a multi-disciplinary approach for long-term conservation impact. Through these initiatives, FEP aims to develop sustainable solutions that benefit both elephants and the local populations who share their landscapes.

In the past year, the focus of the programme at FERAL has been on the following:

Capabilities, an innovative approach, was adopted to address the persistent challenge of mitigating human-elephant conflict. With an emphasis on understanding and enhancing the capabilities of individuals and communities in managing coexistence, we initiated extensive surveys in the Brahmagiri-Nilgiris-Eastern Ghats landscape. Landscape level mapping and data gathering included assessing current resource status, identifying vulnerability to elephant raiding, evaluating land use changes, and tracking elephant movement. The project goal is to build resilience within local populations by developing culturally appropriate frameworks. Additionally, we researched male elephant movement patterns and their interactions with humans, particularly during musth, to inform local communities about potential periods of heightened risk and to design preventive measures.

Estimating elephant age is essential to understand population demographics and designing effective management plans. Using images captured with camera traps, we assessed elephant age based on height measurements and other visual markers. This non-invasive data gathering method can be an extremely handy tool, especially in areas where directly observing elephants may be challenging. Our study investigating the affectual behaviour of elephants towards camera traps showed the behavioural response to camera trap presence was negligible, suggesting that they learn to ignore these objects in their habitat.

We continued our efforts in mitigating human-elephant conflict through setting up of hanging-wire fences, especially in the Ramanagara and Chennapatna districts in Karnataka. Effective conservation requires sustained efforts and can be strengthened through mentoring new entrants and building their skills and knowledge base. We provided hands-on experience in elephant ecology and conservation to young ecologists. We also conducted training for the staff of the Karnataka Forest Department.

Collecting data from direct observations of animals in the wild is often difficult, especially so with elephants.

Highlights

–　In the Brahmagiri-Nilgiris-Eastern Ghats landscape (BNEGL), our study indicated that semi-arid zones exhibited the highest elephant movement intensity, with 25.7% of the area classified as having very high or high movement frequency, compared to 16.5% and 15.6% in humid and per-humid zones, respectively.

–　Elephant raids were a significant cause of crop loss, especially for millets and paddy, which accounted for ~50% of the crops cultivated in the BNEGL.

–　In collaboration with the Ramanagara Forest Division, about 20 km of hanging wire fences in 15 farms were set up to protect crops from elephants. Regular monitoring along with the farmers showed no instance of elephants breaching this fence, proving the hanging wire fence to be more efficient than other conventional fences. Seeing this success, 30 other farms in this landscape have adopted this measure, with support from the forest department. This presents a promising model of an innovative approach that can minimize crop raiding by elephants.

–　Four young researchers were trained through hands-on fieldwork on data collection techniques and the use of technology such as camera traps to gather and analyse data on elephant populations. Three of them continue to work with FERAL on elephant research-related projects.

–　Two elephant task forces comprising about 150 staff of the Karnataka Forest Department were trained in conflict resolution strategies with a focus on promoting human-wildlife coexistence and on monitoring elephant movement.
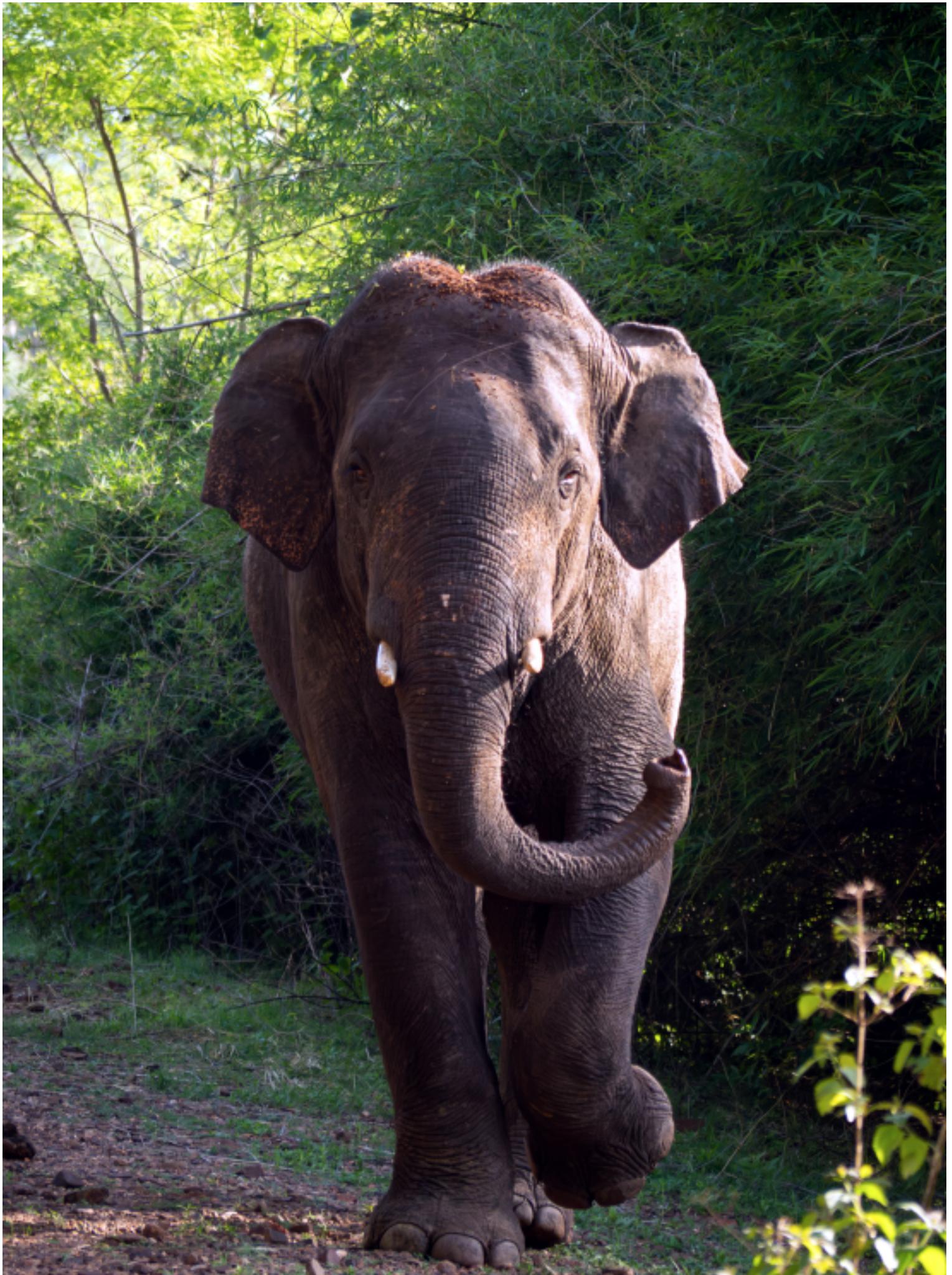
A young male elephant in the study landscape following the researchers during direct behavioural observations.

The study and conservation of male Asian elephants in a human dominated landscape in Southern India

Project Period: December 2023–November 2024
Budget: USD 5,000 (INR 4,12,500)
Supporting Agency: Katie Adamson Conservation Fund, USA
Principal Investigator: Nishant Srinivasaiah
Collaborators and their Institutions: Anindya Sinha, National Institute of Advanced Studies, India; Raman Sukumar, Indian Institute of Science, India

This study is a comprehensive, multi-faceted initiative aimed at advancing our understanding of male elephant behaviour and ecology while actively contributing to elephant conservation. Building upon a robust foundation of long-term data spanning over 14 years, this project integrates historical insights with current fieldwork efforts to inform evidence-based conservation strategies. Through a combination of direct observations, camera trap deployments, and data analysis, the project seeks to unravel the complexities of bull elephant behaviour, including their social dynamics, movements, and habitat use patterns. By leveraging existing long-term data, we can contextualize current observations within a broader temporal framework, facilitating a deeper understanding of how bull populations have evolved in response to changing environmental conditions and human pressures.

Objective

Our objective is to continue our studies on the bull elephants in southern India to better understand their ecology and behaviour to determine appropriate initiatives for their conservation. Specifically,

1. The project aims to generate new insights into male elephant behaviour and ecology through the integration of long-term data with current fieldwork efforts.

2. By synthesizing historical and current data, the project will provide a robust foundation for evidence-based conservation strategies aimed at protecting bull elephants and their habitats. These insights can inform land management practices, conservation planning, and policy decisions to ensure the long-term viability of elephant populations.

Status

In collaboration with the Karnataka Forest Department, a comprehensive Asian elephant action plan is being developed for the Ramanagara Forest Division. Based on historical and current evidence on elephant populations, land management practices, and habitat changes, the overarching goal of this action plan is to improve the conservation status of elephants in the region. Key components include habitat enrichment strategies that focus on maintaining and

Early career researchers were trained in camera trapping and acoustic recording data collection and field methods as part of the on-going projects.

restoring the natural environment that supports elephant populations. The plan also addresses conflict mitigation strategies to reduce human-elephant conflicts, often a source of tension between local communities and wildlife, through large-scale implementation of community fences. Monitoring and research activities have been outlined to gather continuous long-term data on elephant populations and their habitat use. Stakeholder engagement initiatives to promote collaboration among local communities, conservationists, and government agencies are also included.

Two elephant task forces within the Karnataka Forest Department were trained. The participants, about 150 in total, included Assistant Conservators of Forest, Range Forest Officers, Deputy Range Forest Officers, Beat Guards and Beat Watchers. The training focused on pivotal issues such as conflict resolution strategies understanding elephant behaviour, and best practices for monitoring elephant movements. Enhancing the skills and knowledge of task force members who are on the front lines of managing human-elephant interactions is crucial to address issues that arise from and respond effectively to human-elephant encounters. Such engagement is essential in promoting human-wildlife coexistence, in reducing conflicts, in encouraging a culture of conservation among local communities and forging collaborative approaches towards responsible stewardship that benefits both the elephants and the communities that share their habitat. This initiative further underscores the programmes' committent to strengthening conservation efforts at the community level.

To assess how factors such as musth and age influence male elephants' habitat use, social dynamics, and interactions with other elephants and with humans, we analysed data from four years of field observations. One key finding has been the empirical evidence for the avoidance of older musth bulls by younger males. Furthermore, estimating elephant age through camera trap-based height estimation has introduced a non-invasive method for understanding population demographics, which is essential for effective management and conservation. The investigation of the affectual behaviour of elephants in response to fences helped understand how elephants interact with their environment and the impacts of human activities on their behaviour. The results from this study, for example, understanding how elephants overcome fences, are important for informing conflict mitigation strategies.

Our findings from these studies are being compiled in four manuscripts. To foster the next generation to contribute significantly to elephant conservation, we mentored four emerging elephant researchers, three of whom have continued their work with us. Their training, spread over two months, encompassed topics essential for understanding elephant ecology, behaviour, and challenges they face due to human activities, hands-on data collection techniques and the use of technology such as camera traps.

Interviewing a small-holder farmer in Wayanad District of Kerala as part of the socio-economic survey conducted for the "capable and functional elephants" project.

Capable and functional elephants: A capabilities approach for mitigating human and elephant conflict in the Brahmagiri-Nilgiris-Eastern Ghats landscape of Southern India

A landscape-level approach is required for the conservation of the Asian elephant in India as it ranges beyond and across Protected Areas. The Brahmagiri-Nilgiris-Eastern Ghats Landscape (BNEGL) is one such Elephant Landscape proposed by the Elephant Task Force. Spanning across Karnataka, Tamil Nadu, and Kerala, BNEGL includes two Elephant Reserves and hosts the single largest Asian elephant population in the world of about 8000 elephants. Conflict between humans and elephants arise owing to habitat loss, human population growth, poaching, and infrastructure development. Lack of available data, predictive models, and perspectives hinder efficient conservation. This project seeks to create the first perspective plan for human-elephant conflict mitigation in BNEGL, utilizing the Capability Approach (CA) proposed by Amartya Sen. The CA assesses well-being based on capabilities and functioning, emphasizing freedoms of choice. Implementing the CA could enhance human-elephant relationships, thus addressing conflict holistically, paralleling its use in agrarian crisis contexts.

Objectives

1. Mapping the current set of basic capabilities and functioning of agriculturists and elephants.

2. Modelling future sets of basic capabilities and functioning of agriculturists and elephants.

3. Identifying sets of unrealized functioning of agriculturists and elephants due to human and elephant conflict, both present and future.

4. Identifying appropriate human and elephant conflict mitigation measures that minimize unrealized functioning of agriculturists and elephants.

5. Capacity building and information dissemination.

Status

We developed a fine-scale Land Use and Land Cover (LULC) and infrastructure map for the study area with eight categories relevant to elephants. Approximately 75% of the BNEGL

Field work involved undertaking socio-economic surveys (Top) and field surveys to record elephant distribution (Bottom) across the Brahmagiri-Nilgiris-Eastern Ghats Landscape.

remains under forest cover. We assessed the contiguity of each land use type across the landscape and gathered elephant location data through direct sightings, camera traps, and from crop-compensation claim records. Using these datasets, we created decision rules for individual elephant movements across three climatic zones (semi-arid, humid, and per-humid) and identified the probabilities of elephants selecting different land-use classes. Simulation of elephant movement within these zones indicated that semi-arid zones exhibited the highest elephant movement intensity, with 25.7% of the area classified as very high or high in movement frequency, compared to 16.5% and 15.6% in humid and per-humid zones, respectively. These findings suggest heightened human-elephant interactions, especially in semi-arid areas.

Analysing LULC changes over 16 years (2016–2022) revealed an 82% increase in built-up areas, a small rise in agriculture (6%) and negligible increases in plantations (0.7%) and scrub/savanna areas (0.5%). Forest cover remained constant, and barren/fallow areas decreased significantly by 33.8%. During this period, our results show that ~ 4.5% of barren/fallow land had been converted into built-up areas and 30% of barren/fallow land had been converted into agriculture. Around 7.5% of grasslands and 12.3% of water bodies have been converted into agriculture.

Socio-economic surveys to evaluate farmer capabilities and vulnerability to elephant raids were conducted in three agro-ecological zones (arid, semi-arid, and humid). A total of 1135 households were surveyed, spread equally across the three zones. In the arid zone, over 50% of the farmers were marginal landholders (<1 ha) who grew crops like millets (38.8%), paddy (11.6%), and bananas (11.3%). They reported elephant raids as a significant cause of crop loss, especially for millets and paddy. Excessive use of chemical fertilizers and dependence on borewell irrigation, despite its high costs and limited effectiveness in arid conditions, exacerbated not only environmental stress, but also their financial burdens. With an annual income averaging just Rs. 30,000, the financial strain of elephant raids is considerable. Compounding these challenges, they faced barriers to accessing crop compensation because of complex procedures and limited departmental support.

Elephant population dynamics and behaviour, especially the spatial choices of elephants based on maturity, resource availability, and proximity to human settlements were explored using camera trap data (20,124 elephant records gathered over 10,705 camera-trap days). Notably, we found that male elephants preferred high forage availability areas irrespective of it being natural forage or crops. In contrast, female elephants chose areas with least variability in forage availability. Currently, the five freedoms of the CA are being incorporated into the analysis to develop conservation strategies.

Our long-term collaborator, Gabe Kibe, of the Denver Zoo, USA and Katie Adamson Conservation Fund, USA interacting with farmers and forest staff in Ramangara during his visit to the study landscape.

Towards mitigation of human and elephant conflict through fence line expansion – Expansion of community fencing

The urgent need to enhance the capacities of local stakeholders in monitoring elephant populations and effectively mitigating human-elephant conflicts cannot be emphasized enough given the rapid urbanizing of landscapes with traditional forest and agrarian settings transitioning to peri-urban environments. This project, first initiated in 2021, sought to mitigate the vulnerabilities of crops at various stages of cultivation to elephant incursions through improved farm-based practices. The study area is in the state of Karnataka and activities have been carried out in collaboration with the Ramanagara Forest Division. An effective strategy showing promise was the installation of 'hanging-wire' electric fences. Designed to be farmer-friendly and acting as barriers to elephants without harming them, these fences help reduce the likelihood of elephant intrusion into agricultural fields and crop damage. The previous year saw three pilot fences successfully established leading to buy-in from farmers in the area to expand the program. The focus this year was on popularising these fences to foster coexistence between elephants and local communities while contributing to sustainable agricultural practices and conservation efforts.

Objectives
The goal of this project is to build the capacities of local stakeholders in monitoring elephants and mitigating human-elephant conflict in and around high human-use areas by establishing solar-powered 'hanging-wire' electric fences.

Status
The study area has undergone significant changes in land use driven by economic growth and development, leading to a shift in habitat dynamics. The innovative fencing solution that was proposed involved the installation of "hanging wire fences", which had promising results in safeguarding farms and enhancing coexistence between humans and elephants.

The fencing system consists of electrified wires suspended from poles, with no fixed components easily accessible to an elephant. This design makes it difficult for elephants to displace the fence, as they cannot make direct contact with any rigid elements. The wires drop

Mitigation structures—a railway barricade fortified with a hanging wire fence—to prevent elephants from going into the cropfields from the forests, constructed by the forest department in the study site.

from a height of 15 feet and are energized by a pulsating electric current that deters elephants from approaching without posing a threat to their safety. Additionally, this inexpensive (approximately 2–3 times cheaper than typically-used wildlife-targeted solar fence technology) and easy to install (4–5 days) system is powered by a solar-based battery, which is both sustainable and cost-effective, helping to minimize maintenance expenses while also supporting long-term functionality.

FEP set up a total of seven fences to demonstrate the efficacy of the hanging wire fence in deterring elephants from entering farmlands. Following the positive results of no breaching by elephants, many farmers expressed interest in adopting this solution leading to the set up of 15 fences, covering about 20 km. This was done in collaboration with the Karnataka Forest Department with support from FEP and the farmers themselves. This crucial assistance that provided essential components such as the solar sets—comprising a battery, energizer, solar panel, and necessary wiring, which account for nearly half of the total cost of fence installation —allowed more farmers to benefit from this initiative. After installation, detailed elephant visits were maintained by farmers at two locations. At the first, the elephants visited 98 times and at the second, 180 times in a year; and were not able to breach the fence. An additional 30 fences have been set up by the farmers in this landscape with help from the Forest Department.

Local farmer involvement enhanced the project's reach and fostered a sense of ownership and responsibility among the community members. Anand Ramu, one of the first to implement the hanging wire fence around his farm, was instrumental in expanding the initiative. Drawing on his experience, Anand, with support from our team, assisted in setting up these fences in farm holdings across the Ramanagara and Channapatna Districts, ensuring that other farmers could effectively protect their crops from elephant intrusions. This hands-on knowledge transfer has empowered local farmers to take control of their safety and the preservation of their livelihoods, while also reinforcing a cooperative spirit within the community.

Moving forward, there is significant potential for scaling this initiative to benefit more farmers affected by human-elephant conflicts. The collaborative approach, which combines government support, community involvement, and local expertise, serves as a model for replication in other areas where human-elephant conflicts are prevalent. As more farmers adopt the hanging wire fence, the likelihood of reducing crop damage and minimizing human-wildlife conflict increases, fostering safe and sustainable coexistence.

This work was featured online:
https://milletrevivalproject.in/2023/12/27/shared-with-elephants/
https://www.instagram.com/_masalalab/reel/C1j5nk5y24B/
https://www.youtube.com/watch?v=CtBlO6YdXyk)

The Nilgiris landscape is one of our long-term study sites where we focus on hydrologic services, under the natural resource management programme.

Natural Resource Management

Under this programme, we focus on studying, managing, and restoring landscapes that sustain communities and provide essential services. Understanding the impacts of climate change on these services and consequently on the vulnerabilities of communities is a crucial component of this work. To achieve these, we collaborate with other research institutions and individuals. We undertake action research and leverage the best available affordable technology coupled with low-cost environmental sensors for environmental monitoring.

The specific objectives of the programme are

1. To unravel and quantify ecological processes that deliver ecosystem goods and services using participatory and multidisciplinary approaches.

2. To demonstrate and develop research tools for decision support in the management of natural systems with a specific focus on scenario building for impacts of climate change and trade-offs between interventions.

3. To use this research to identify strategies and inform and influence policy which will reduce the vulnerabilities of stakeholders and the ecosystems to natural disasters and climate change, and help restore and sustainably manage ecosystem services through community action in habitat restoration, protection and management.

This year, we undertook two projects under this programme. In the Nilgiris, a biodiversity hotspot, we focused on the impacts of exotic invasive species on stream hydrology. We also continued our long-term monitoring of rainfall in the study area. In Karnataka, we focused on assessing the effects of hydropower operation on the river flow and sediment dynamics, and river-dependent livelihoods in four estuaries, two that were fed by rivers that were dammed and two that were fed by free-flowing rivers. All field data collection was completed on this project and data analysis has been started.

In the Aghanashini estuary, small-scale sand mining is a threat to the river ecosystem and bivalve population, an important source of livelihood for the local people.

Highlights

–   In the Aghanashini estuary, bivalves show a strong longitudinal gradient in their distribution driven by their tolerance to salinity. These bivalves constitute an important source of livelihood for people who co-produce this ecosystem service despite local pressures from shell mining, shrimp aquaculture and small-scale sand mining.

–   In the Sharavathi estuary, bivalve collections no longer constitute a significant source of livelihood. Here, those who used to collect bivalves are adapting by depending on local sources of income such as estuarine fisheries, aquaculture, tourism, or large-scale, mostly illicit sand mining of the estuary, or by migrating away from the estuary to find other income sources.

Monitoring seasonal variations in stream water levels is crucial for understanding stream dynamics, rainfall-runoff relationships, and for developing early warning systems for floods and droughts. We used low-cost acoustic and capacitance probe-based water level loggers to monitor stream levels in the Nilgiris.

Assessing the hydrological impacts of invasive wattle across a gradient of invasion in the Nilgiris

Project Period: November 2023–December 2025
Supporting Agency: Self funded
Principal Investigator: Srinivas Vaidyanathan
Co-Principal Investigator: Jagdish Krishnaswamy, Indian Institute for Human Settlements, Bengaluru

The Nilgiris is an important catchment for several perennial rivers including the Cauvery and Bhavani, on which, large human populations are dependent downstream. The natural vegetation in the Nilgiris, which is composed of a mosaic of high-altitude grasslands and forests, helps in interception and retention of rainwater and thereby regulates water-flow in the streams and rivers throughout the year. However, these natural vegetations are facing a threat of invasion by exotic plants, which can affect ecosystem processes and services. Exotic tree species such as wattles, *Acacia mearnsii* and *Acacia dealbata*, and woody shrubs like broom grasses, *Cytisus scoparius* and gorse, *Ulex europaeus*, have invaded natural grasslands in the Nilgiris. Our earlier study in this landscape has shown a reduction in stream-flows as a result of excessive transpiration water-losses by woody invasives during drier periods. Similarly, we observed increased run-off in invaded catchments as they were unable to retain much of the rainwater. Reduced stream-flows has greater impact on availability of fresh water for wildlife and natural ecosystem functioning. It also impacts the availability of drinking water and water for power-generation in the drier periods, while increased run-off is associated with increased flood-risks downstream. In this study, we will monitor and generate baseline data on stream-flows, run-off, evapotranspiration, and soil-properties across catchments with different levels of wattle coverage. This study will provide benchmark data on ecosystem function indicators and physical condition indicators at reference grassland sites, which would help in assessing the impact of wattle invasion and for monitoring the success of grassland restoration activities in the future.

Objectives

1. Monitor stream discharges across different catchments with varying densities of wattle.

2. Monitor stream discharges from grassland and shola catchments.

3. Assess the impacts of wattle invasion on stream flow by comparing it with flows from natural catchments of grassland and shola forests.

4. Understanding the impact of wattle on soil physical (soil moisture, water holding capacity, infiltration rate) and chemical properties (nutrient status) across seasons.

The research team measured stream profile and velocity of flow at each of our water level monitoring sites to estimate the volume of water flowing in the stream.

5. Generating long-term, reference hydrology and soil data with grasslands and shola forests as benchmark sites.

6. Generating soil-loss models that could help in developing Invasive Removal and Restoration Planning (IRRP) to minimise soil loss.

Status

We have instrumented eight catchments with varying intensities of wattle invasion. In each selected catchment, the extent of native vegetation (grassland and shola) and exotic invasives (wattle and broom grasses—gorse and scotch broom) were quantified using high resolution satellite images. There are two catchments with high density of wattle (> 50% wattle cover), three catchments with low to medium wattle density (20–30% wattle cover), two grassland catchments (> 79% grassland cover), and one shola catchments (> 50% shola cover) that are being instrumented for monitoring stream levels. On-ground we have collected data on stream levels for the dry season in all the eight catchments. Along with this, stream profile and velocity are being collected at each of the instrumented sites to estimate stream flows. Additionally, as part of the field work, we continue to manage and collect rainfall data from the rain gauges that were installed in the landscape in our previous projects. In the upcoming dry season, we will be collecting stream flow data using flumes and acoustic and capacitance probe-based water level recorders. We will also be analysing the influence of different vegetation covers on stream dynamics in the coming days.

Diverse bivalves collected from the estuary are sold in the street market.

Assessing the effects of hydropower operation on flow and sediment dynamics and river-dependent livelihoods in the tropical estuaries of Karnataka, India

Estuaries are transition zones between freshwater and marine environments and their ecosystem functioning depends critically on the timing, quality, and quantity of upstream inputs such as freshwater and sediments carried by the river. Hydropower dams built across large rivers drastically alter downstream flow and sediment regimes, thus affecting the ecology and functioning of estuaries that these rivers feed into. Therefore, there is a need to understand flow and sediment alteration effects on estuarine salinity and suspended sediment concentration—two key physical parameters that influence estuarine ecosystem functioning. Additionally, in tropical estuaries, millions of people generate their livelihoods through reliance on artisanal fisheries and bivalve collection. However, hydropower dams—despite benefiting people in distant urban and industrial areas—are known to disproportionately affect local, downstream fisheries-based livelihoods. This project aims to understand how natural resource-dependent communities living downstream of hydropower dams adapt their livelihoods to ecological changes.

Objectives

The specific objectives of this project are to understand:

1. How freshwater and sediment inputs to the estuary are modified by hydropower dams.

2. How fisherfolk and bivalve collectors adapt to hydropower dam-induced changes to the estuary.

Status

Continuing the work from the previous year, we completed data collection in the field and analysis of this data is ongoing. We are in the process of preparing a participatory GIS map of bivalves created from the data collected during interviews.

The study site included four estuaries, two that were dammed (Sharavati and Kali) and two that were free flowing (Aghanashini and Gangavali). For each estuary, data on freshwater level, salinity and suspended sediment concentration (SSC) were collected for the period February 2023–February 2024. Freshwater levels were recorded at an interval of 15 minutes by installing pressure transducers. These were installed upstream of the estuary in the free-flowing rivers

Some ex-bivalve collectors have turned to cage fisheries as an alternate source of livelihood.

and downstream of the lowermost dam in the dammed river. To record salinity, a conductivity logger was installed in each estuary. This recorded the salinity at an interval of 15 minutes. The data highlighted that undammed rivers showed a natural flow regime with the characteristic monsoon flood pulse, whereas dammed rivers showed hydropeaking, i.e., changes in water flow corresponding to the frequency and quantity of water released from the dams. Estuarine salinity data of free-flowing rivers is driven by natural flow and tide and was found to range between 0 during monsoon to 35 during summer. Salinity of the Sharavathi estuary was driven by hydropower releases. Limited data suggests that hydropeaking does not affect the salinity of the Kali estuary, which is likely due to the lower percentage of the watershed under the reservoir.

To measure freshwater suspended sediment concentration (SSC), water samples were collected bi-weekly and were analysed in a lab. The free-flowing rivers showed a marked increase in SSC during the monsoon period. SSC is subdued in the Sharavathi because the reservoir captures the monsoon flood pulse. Kali river, on the other hand, showed a peak in SSC that corresponds to the period when the reservoir released a part of the monsoon flows. The SSC values collected on field will be linked to the reflectance of the Landsat bands sensitive to SSC in water to derive long term trends (1990–present) in SSC.

Artisanal bivalve collectors in the Aghanashini and Sharavathi estuaries (30 each) were interviewed to understand how they adapt their livelihoods in response to changes in bivalve distribution and availability. In the Aghanashini estuary, bivalves show a strong longitudinal gradient in their distribution driven by their tolerance to salinity. These bivalves constitute an important source of livelihood for people who co-produce this ecosystem service despite local pressures from shell mining, shrimp aquaculture, and small-scale sand mining. In Sharavathi, bivalve collections no longer constitute a significant source of livelihood. Here, locals who were previously dependent on bivalves for their livelihood are now depending on other local sources of income such as estuarine fisheries, aquaculture, tourism, or large-scale, mostly illicit sand mining of the estuary, or by migrating away from the estuary to find other income sources.
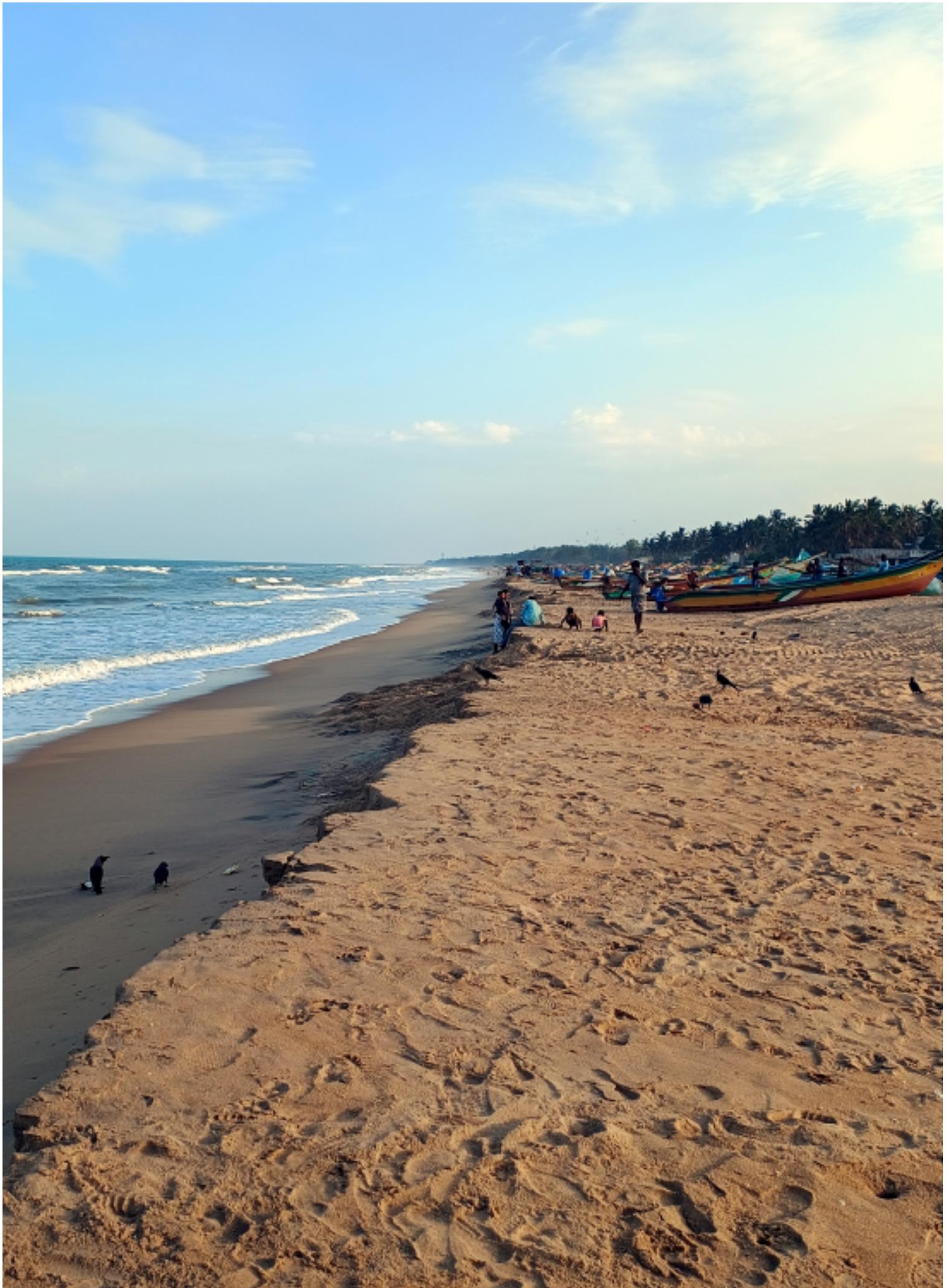
Many of our initiatives under the Marine Science Programme are along the Coromandel Coast. This is a view of the beach at Sadras, a fishing village located close to the Kalpakkam atomic power plant.

Marine Science Programme

The marine science programme at FERAL focuses on protection and conservation of marine and coastal ecosystems and the biodiversity found therein, by using scientifically and rigorously collected data to inform conservation actions and policy. In addition to collaborations with policy makers, over the years, our approach has been to include the human dimension into our work by not only studying the interaction of local communities with the marine ecosystem, but also involving them in developing long-term sustainable programmes for marine conservation.

This year, we continued our focus on sustainable fishing with emphasis on conservation of sharks, rays and skates. A new project initiated this year focuses on reducing the fishing of the critically endangered hammerhead sharks by increasing awareness on shark conservation among the general public and through educating seafood eaters on appropriate seafood choices to support shark conservation.

Two multi-year projects along the Coromandel coast were continued—one assesses the diversity of fish caught and consumed along this coast and using this data to develop tools for consumers to identify species that they buy and provide information on sustainable choices while buying fish. The second focused on incidental elasmobranch catches using selective and non-selective fishing gears, and assessing their impacts. The study along the west coast of India that aimed to understand the impacts of fisheries on populations of the critically endangered widenose guitarfish and to develop locally-appropriate solutions for their conservation, was completed.

In the coming year, the programme will be completing five years of the current research thrust and we will be taking stock of interventions and assessing the impacts of our work. The learning from these projects will help us forge ahead with a renewed and more impactful programme in future.

Snappers are reef fishes found in the Andaman and Nicobar Islands. As many as 42 species have been recorded in these waters.

Highlights

–   Documenting the diversity of elasmobranchs on the east coast, we identified 27 species of sharks and 32 species of rays at Kasimedu, but only 5 species of sharks and 11 species of rays at Pattinapakkam.

–   The intensive and unsustainable fishing practices employed at Kasimedu is likely to have a negative impact on elasmobranch population numbers.

–   We completed the first abundance estimate for the widenose guitarfish, a Critically Endangered species, at an Indian site—approximately 539 juveniles are likely found in the Canacona waters of Goa.

–   We developed a simple, low-cost and effective method—the walking survey—to monitor guitarfish abundance and habitat use, which can be easily adopted for research in other developing countries.

–   Galgibag beach was notified as an Important Shark and Ray Area, a valuable tool going forward to guide sustainable development, tourism and fisheries management in this region.

–   We developed a Marine Conservation Curriculum for school students of Grades 6–9.

–   We conducted education workshops for government school children at two after-school centres.

Giant devil ray being landed at the Kasimedu harbour, Tamil Nadu.

Saving sharks with InSeason Fish

All parts of the seafood supply chain need to align to support sustainable fishing to achieve marine sustainability. This project aims to identify key gaps and interventions needed to ensure that fisheries can begin to reduce their impact on the marine environment with a focus on the conservation of elasmobranchs and teleost fishes, many of which are threatened.

In the first part of the project, we focussed on the domestic supply chains with a specific focus on domestic seafood consumption and unsustainable fishing and on helping Indian seafood eaters diversify their seafood consumption and avoid eating threatened marine species. A critical need for a practical tool to aid the general public in identifying the various species of fish caught in India's marine fisheries was seen. Recognizing the potential of machine learning models in fulfilling this need, in the second part of the project, that is ongoing, we planned to use our data of fish catches spanning multiple years, to develop a tool that can identify the most commonly caught fish species in India's marine fisheries. This application is being designed to facilitate near real-time fish species identification. Given the enormity of data required for training machine learning models effectively, we are establishing a collaborative program that includes a citizen science component. Creating an application as a tool to bring together not only scientists, but also citizen scientists will enhance the volume and speed of data collection, as well as foster public engagement and awareness about the diverse marine species found in Indian waters.

Objectives

1. Assess fish catches for species diversity along the Coromandel Coast.

2. Document relative differences in species diversity and create a rubric to help consumers identify what they are eating

3. Create a technology based tool to help seafood eaters choose diverse seafood and the most sustainable choices among the options available to them.

Status

The images of elasmobranchs (901 images of sharks, 809 images of rays, 112 images of rhino rays, and 89 images of teleost fish) that had previously been collected by us and sorted was

Widenose guitarfish at the main harbour in Kasimedu, Tamil Nadu.

processed further. To facilitate efficient image identification, we had established 18 categories with the goal of classifying images down to the genus or species level. However, in response to challenges related to sample size and data availability, we made the pragmatic decision to condense these categories first into three broader ones, and currently into 10 groups, focusing on family-level identification. We had earlier used the Computer Vision Annotation Tool (CVAT) platform for classification; however, this platform shut down. Hence, our current activities involved testing several alternate platforms before settling on Labelbox. Using this platform, each image was systematically labelled and tagged, allowing for precise identification and classification during subsequent stages of analysis.

Along with Dr. Debayan Gupta, we developed a specialized program designed to automate the identification process. In the meantime, we have continued collecting images to add to the database to facilitate the inclusion of more species.

Furthermore, we are forging new collaborations with individuals and organisations (in India and abroad) to bolster our image data and software. The project in the next phase, is committed to advancing this work, refining our automation program, and broadening our image dataset. By doing so, we aim to contribute to the conservation and management of these vital marine species and further our understanding of the intricate ecosystems they inhabit.

School students learning to identify different species of sharks as part of our education workshop.

Saving sharks through transparent seafood supply chains

Project Period: September 2023–August 2024
Budget: Euros 19,995 (INR 17,46,363)
Supporting Agency: Prince Bernhard Nature Fund, Netherlands
Principal Investigator: Divya Karnad

Sharks are one of the most threatened group of species in the world. India is the third largest shark catching nation in the world. Hence, preventing the capture of sharks in India is crucial to global shark conservation. Policy has proved relatively ineffective in protecting India's sharks, owing to the lack of effective monitoring and enforcement. In contrast, grassroot approaches that are inclusive of fishing communities have seen better results as pilot programmes. Earlier initiatives under the marine sciences programme worked with fishing communities to identify the most sustainable and shark-friendly indigenous fishing practices. This project aims to reduce the fishing of critically endangered hammerhead sharks by promoting education among the general public and specific stakeholders as well as the use of market-based incentives to support fishermen in using sustainable fishing practices. In this project, we focus on increasing awareness on shark conservation among the general public and on educating the seafood consumers on how to choose seafood to support shark conservation.

Objectives
In this project we focus on

1. Increasing the footprint of our engagement with restaurants.

2. Expanding our experiential awareness programmes for the general public.

3. Create a focused sustainable seafood curriculum for secondary school students and culinary institutions.

Status
In this year, we focused on developing a marine conservation curriculum for schools. We have developed a six-week curriculum for students of Grades 6–9. The road to curriculum development took three months and included an extensive review of the current school syllabus (Grades 6–8) across three educational boards in India. Despite India's extensive coastline and reliance on the ocean for ecosystem services, trade and fisheries (to name a few), none of the children of this age group were being exposed to any marine-related topics, except in physiology where the marine adaptations and osmoregulation of fish were considered. We modelled the curriculum around shark biology and conservation and ensured alignment with existing curricular topics in the geography, physics, chemistry and biology syllabi. To get children with no exposure to understand and love sharks, we had to start with

Students making group presentations on what they learned during the education workshops that we conducted.

the basics. Through games, interactive story-telling and art workshops, we delved into topics such as, the water cycle, ocean currents, introductions to marine species, food webs and more. This curriculum, and the assessment strategy that we devised to evaluate its effectiveness in improving students' knowledge and attitudes, were vetted by a certified psychologist.

We conducted six-week long education workshops for government school children at two after-school centres. Over the duration of our engagement with the students at each after-school centre, we noticed the children gradually growing curious and confident enough to participate and ask questions. The shark module was the central component that sparked interest in the species found along the Chennai coast, their behaviour, habitat, and ecological importance. We used the online tool that we had developed earlier—our website Sharks of India—to bring the ocean into classrooms. This allowed students to explore the various species and their unique adaptations at their own pace. We chose to deep-dive using key species that were the gateways for discussions about diverse marine ecosystems, from coral reefs to the deep ocean and mangroves. It was interesting to note how children reacted to sharks once we debunked the myth about their being mindless predators that attack humans.

Bengal whipray caught in a crab net at the small-scale fishing site (Pattinapakkam) in Tamil Nadu.

Beyond fins: Monitoring elasmobranch landings and consumption

Project Period: November 2021–March 2024
Budget: USD 28,940 (INR 21,70,934)
Supporting Agency: Stichting Burgers Zoo Conservation, Netherlands
Principal Investigator: Divya Karnad

Elasmobranchs (sharks, rays, and skates) play critical roles in marine ecosystems, serving as top predators. The Indian waters are home to a number of elasmobranch species. Despite their ecological importance, elasmobranchs face numerous threats, including overfishing, habitat destruction, and climate change and many of these species are currently classified as vulnerable or endangered. Conservation efforts backed by an understanding of their biology, ecology and threats faced are vital to protect these species and their habitats.

We monitored elasmobranchs at two landing sites in Chennai, Tamil Nadu—Kasimedu and Pattinapakkam—with distinct and contrasting characteristics and fishing practices. With ~600 vessels, including 250 deep-sea vessels using bottom trawl gear, Kasimedu Harbour is a major fish landing site in Chennai. The fish catch includes a large diversity of elasmobranch species (especially sharks and rays) in significant numbers. In addition to being consumed locally in residences and restaurants, elasmobranch products are transported to different states across India, and also exported. In contrast, Pattinapakkam is a small-scale fishing village where fishermen predominantly use gill-nets and manual fishing gear. The elasmobranch diversity in the catch at this site is lower and the catch is primarily sold within the local community.

Objectives
1. Monitoring incidental shark and ray catches from non selective fishing gear at a major fishing harbour

2. Monitoring incidental shark and ray catches from more selective fishing gear at a small scale fishing site

3. Assessing the impact of these fisheries, by comparing with targeted fisheries for sharks and rays

Status
In this final year of the project, the focus has been on data analysis, and the completion of outreach efforts, all of which contribute to a comprehensive understanding of elasmobranch ecosystems and their interplay with human activities. The data was first cleaned-up, which involved confirming the identity of species found, quantities, and patterns of elasmobranch catches. This data has been analysed and offers insights into the variations and trends in elasmobranch populations in the Chennai region.

We studied the fish landings at two contrasting sites in Tamil Nadu, a major fish landing harbour (Kasimedu, Top) and a small-scale fishing village (Pattinapakkam, Bottom).

In contrast to records of previous years obtained from government databases, such as those maintained by ICAR- Central Marine Fisheries Research Institute, currently, more rays are being landed than sharks. Altogether, we identified 27 species of sharks and 32 species of rays from Kasimedu, but only five species of sharks and 11 species of rays from Pattinapakkam. The difference in the number of elasmobranchs landed and diversity across both the sites is largely governed by the differences in fishing pressures, gears used, and the scale of operation, with Kasimedu reporting high on both catch number and diversity of species. Fishing trips at Kasimedu, on average, last 14 days, whereas fishing trips at the small-scale site last only a couple of hours (8–10 hours on average), which also contributes to the difference in catch numbers and diversity. Fishermen at Pattinapakkam use nets that are specific for catching rays; yet, the catch numbers are less than those reported from Kasimedu. Female sharks were caught in higher numbers than males at both the landing sites. For the top five shark and rays species, those caught from Kasimedu included a mix of adults, juveniles and neonates in higher numbers than those from Pattinapakkam. This points to more intensive and unsustainable fishing practices employed at Kasimedu, which has a direct impact on elasmobranch population numbers.

During our interactions as part of the outreach programme, fishermen at both study sites cited the increasing costs of fishing, despite subsidies, and lower incomes owing to decreasing catches as being a key challenge. Eating and selling sharks and rays helps them to overcome these challenges to an extent. Unfortunately, fishermen are often unaware of which elasmobranch species are protected or endangered.

We followed up on our initial visits to expand our work at the sites of Kakinada and Vishakhapatnam in Andhra Pradesh. We also hosted five students from the M.Sc. Conservation Practice programme at ATREE, Bengaluru for a week and provided them training and insight on how to run a conservation programme. We also trained two interns to help with the landing surveys and improve their field identification and data collection skills.

Distribution of video and other outreach materials to local fishers.

Strum with care: understanding fisheries impacts on threatened guitarfish in India to inform their conservation

Over exploitation by coastal fisheries is a major threat to many marine species. The giant guitarfishes found in tropical nearshore waters, are highly vulnerable to this threat. In this study, we focus on the widenose guitarfish (*Glaucostegus obtusus*), a Critically Endangered species, protected under CITES (Schedule II) and listed under Schedule I of India's Wildlife Protection Act (WPA). This species is severely understudied and there is an urgent need to fill this knowledge gap to find effective solutions to address the threats that they face.

In Goa, the widenose guitarfish is found in shallow coastal waters, where human activity including fishing, tourism, and other disturbances are common. Juveniles and pups are often caught incidentally, indicating the presence of nursery grounds. To protect the most vulnerable life-stages, it is important to identify these nursery grounds and to understand the spatio-temporal use of habitats at different life history stages. One approach to protect this species is by adopting an avoidance strategy, for which fine-scale data on guitarfish habitats is essential. Live release has been proposed as a bycatch mitigation measure. Although this has been successfully implemented in some regions, survival rate of these individuals post-capture needs to be assessed. The aim of this project was to understand the impacts of fisheries on guitarfish populations along the coast of Goa and develop locally-appropriate solutions, such as area-based strategies and live-release measures, which can support the on-ground implementation of India's WPA.

Objectives
Specific objectives of the project are to assess

1. Habitat use and overlap with small-scale fisheries.

2. Biological and population characteristics in nearshore habitats.

3. Post-capture stress and survival, and

4. Establish a baseline for guitarfish to develop monitoring and conservation measures.

Fishers voluntarily releasing guitarfish back into the water.

Status

We estimated around 539 juvenile widenose guitarfish are likely found in Canacona waters, which is the first abundance estimate for this Critically Endangered species in an Indian site. We explored the variation in guitarfish abundance across sites, seasons and with environmental factors, finding the highest guitarfish numbers in Galgibag, and in the month of November.

Guitarfish habitats showed significant overlap with nearshore fishing grounds, but catch rates of this species in the local artisanal nets were relatively low. Galgibag emerged as a potential nursery ground for widenose guitarfish, with pupping likely occurring in December. The walking survey method we used proved to be simple, low-cost and effective for monitoring guitarfish abundance and habitat use, providing a feasible method for research in other developing countries.

Outreach activities with fishing communities appeared to perform well, and laid the groundwork for community engagement and live release conservation initiatives. Protecting critical habitats like Galgibag through spatio-temporal regulations may be essential to mitigate the impacts of fisheries as well as other threats like coastal development and tourism. Through our work, Galgibag beach was identified as an Important Shark and Ray Area (ISRA) by the IUCN shark specialist group. This ISRA notification can be a valuable tool in guiding the sustainable development, tourism and fisheries management in this region.

The project brought out a short outreach film on guitarfish. This was primarily distributed to the local community as well as a wider audience. The film has 456 views on YouTube, and has been shared and distributed in-person to at least 50 fishers in Goa. The film was also shortlisted for the Conservation Optimism Short Film Festival. Outreach posters (50 in number) were put up on shacks, restaurants and hotels at our study sites for tourists—informing them of the presence of threatened guitarfish in the nearshore spaces.

A popular article educating the public about the guitarfish and a newspaper report sharing findings from this project were published. Additionally, posts on the guitarfish were shared on social media and blogs. Findings from this project were presented to the Marine Conservation Society of Oxford, virtually shared at the UN Ocean Decade Conference in Barcelona, Spain.

Baseline information from this project—on abundances and nursery grounds—has been used to initiate a larger project on guitarfish in Goa. Future research efforts will focus on confirming nursery grounds, better understanding habitat use, and expanding the study across India's coastline. We also aim to develop a robust monitoring network involving local stakeholders, including fishing communities, the state fisheries and forest departments. Live release programmes can be implemented through long-term community engagement, provision of appropriate training, and non-economic incentives for successful guitarfish conservation.

The villagers enthusiastically participated in the workshop on fish taxonomy and biology conducted in L. Bongjoi, Manipur.

Regional workshop conducted at St. Anthony's College, Shillong, Meghalaya to create awareness among researchers and policy makers on community managed Fish Conservation Zones.

Learning and Events

Our learning programme comprises formal and informal courses which often overlap with other events. FERAL also conducts workshops in collaboration with other organisations. Many of these courses and workshops are part of projects that we undertake, while others are stand-alone events.

Fish Taxonomy and Biology

Date: 17 April 2023
Venue: L. Bongjoi village, Manipur
Project: Replicating community managed fish conservation zones in free-flowing rivers

As part of the capacity-building exercise, a workshop on the basics of fish taxonomy and biology was conducted in L. Bongjoi village, Manipur. This workshop was part of our effort to enable the local researchers and communities at the Fish Conservation Zones, that have been created here, to undertake fish sampling and hydrological monitoring on their own at these sites. This workshop was attended by around 25 villagers from L. Bongjoi and Moljol villages, three local field assistants, one field biologist and five local fishermen.

Community-Based Fish Conservation Models in North-East India

Date: 09 October 2023
Venue: St. Anthony's College, Shillong
Project: Replicating community managed fish conservation zones in free-flowing rivers

This regional workshop focusing on community-based fish conservation models in North-East India was attended by 21 participants that included faculty and researchers from Sikkim University, Gangtok, St. Anthony's College, Shillong, policy makers from the Fisheries Department, Government of Meghalaya, conservation practitioners from the Mahseer Trust, village communities from Garo Hills, Meghalaya, students from St. Anthony's College, Meghalaya, in addition to researchers from IIHS and FERAL. There were eight presentations by different researchers, conservationists, and policy makers that highlighted the importance of community managed fish conservation zones in North-East India, the success stories, challenges and way forward. One of the key aspect for the success of Community Reserves in this region was the Chieftainship, where a village is administered by a Chief and his council of ministers. We discussed the importance of strong Chieftainship for the success of community-based models, and how this can be replicated in other parts of India where Chieftainship is still followed. The participants suggested that the Community Conservation Models can be perpetuated by creating a working group and that the first one should be created in Meghalaya.

Participants of the National Workshop on community-based approaches for the conservation of freshwater ecosystems at the mahseer repository facility in Bheemeshwari.

Farmer Anand with the Millet Revival Team at the Serendipity Arts Festival, Goa.

Conservation of freshwater ecosystems: A workshop on community-based approaches for the protection and management of free-flowing river systems in India

Date: 01 December 2023–02 December 2023
Venue: Indian Institute for Human Settlements (IIHS), Bengaluru
Project: Replicating community managed fish conservation zones in free-flowing rivers

IIHS and FERAL organised a two-day National workshop on community-based fish conservation models in India. This workshop was attended by 20 participants that included researchers from Wildlife Conservation Trust, Mumbai, Foundation for Rivers and Ecosystems, Bengaluru, The Nature Conservancy, USA, fishery professionals from Tata Trust, Pune, conservation practitioners from Jeevitnadi, Pune, students from Christ University, Bengaluru, our project collaborators and our team. The participants presented and discussed the challenges of conserving freshwater ecosystems, the role of civil society in conserving rivers and wetlands, policies related to freshwater fishery and conservation opportunities, the community conservation models of Western Ghats and North-East India, the success stories and keys to successful implementation of community-based freshwater conservation models. We discussed the use of citizen science approaches for monitoring rivers and water quality, the impacts of climate change on freshwater systems, and how community-based conservation models could be integrated into national and state level water policies. During a field trip to Bheemeshwari Mahseer Repository Facility, in the Cauvery Wildlife Sanctuary and the Forbes Sagar Fish Sanctuary in the Shivanasamudram Bluff area, Karnataka we discussed issues of invasives in freshwater systems, how catch-and-release methods could help in conservation, scientific monitoring and further research for the conservation of Mahseer and aquatic biota.

The Food Lab: Solutions for Human-Animal Conflict

Date: 22 December 2023
Venue: Serendipity Art Festival, Goa

As part of the Frontier Elephants Programme (FEP), a workshop on solutions for human-animal conflict was conducted. This was a ticketed event attended by 50 participants. During the workshop, the attendees delved into the inspiring story of Anandram Nagareddy, a millet and mango farmer from Tamil Nadu who has emerged as a peacemaker amid increasing human-animal encounters. In collaboration with behavioural ecologist Nishant Srinivasaiah, Anand, who is one of the first farmers we have worked with under this programme, has implemented innovative strategies to establish harmony between humans and elephants, demonstrating that coexistence is achievable through creative solutions. This interactive talk offered a unique opportunity for urban audiences to hear directly from Anand about the challenges he faced and the practical steps he took to effectively mitigate conflict. Participants gained insights into the importance of community-driven approaches in wildlife conservation.

Indian Yellow Tit is commonly found in Central and South India between the elevation range of 500–1000 m.

Publications

Journal Articles

– Srinivasaiah, N. M., Jayadevan, A., Vaidyanathan, S., Sinha, A., & Raman, S. (In Review). Elephas flexibilis: Behavioural plasticity in Asian elephants of an all-male group persisting in a high-risk production landscape. Journal of Animal Ecology.

– Karnad, D., Narayani, S., Kottillil, S., Kottillil, S., Gupta, T., Barnes, A., Diaz, A., & Krishna, Y. C. (2024). Regional hotspots and drivers of shark meat consumption in India. Conservation Science and Practice, 6(1), e13069. https://doi.org/10.1111/csp2.13069

– Shivakumar, S., Carricondo-Sánchez, D., Athreya, V., Odden, M., Dhiman, S. P., Vaidyanathan, S., & Karanth, K. K. (2023). Examining leopard attacks: spatio-temporal clustering of human injuries and deaths in Western Himalayas, India. Frontiers in Conservation Science, 4. https://doi.org/10.3389/fcosc.2023.1157067

Reports

– Jayadevan, A., Nayak, R., Srinivasaiah, N., & Vaidyanathan, S. (2024). Elephant on the Zebra Crossing: Predicting human-elephant conflict to inform urban development in and around Bengaluru city. Final report submitted to the Bengaluru Sustainability Forum.

– Gupta, T., Miranda, B., Das, D., & Karnad, D. (2024). Strum with care: understanding fisheries impacts on threatened guitarfish in India to inform their conservation. Final Report submitted to Save our Seas Foundation.

– Anand Ramu, Srinivasaiah, N., Gangaraju, S., Vaidyanathan, S. & Venetia Sharanya. (2023). Towards Mitigation of Human and Elephant Conflict through Fence Line Expansion – Expansion of Community Fencing. Final Report. Foundation for Ecological Research, Advocacy and Learning (FERAL).

Popular Articles, Blogs and Videos

– Gupta, T. (2024). Guitarfish: The Threatened Coastal Cruisers of South Goa. Roundglass Sustain. https://roundglasssustain.com/species/guitarfish

– Miranda, B. & Gupta, T. (2024). Blog: Field tales: Juvenile guitarfish, stray dogs and unsuccessful camera surveys. https://saveourseas.com/update/field-tales-juvenile-guitarfish-stray-dogs-and-unsuccessful-camera-surveys/

– Gupta, T. (Aug 2024). Blog: Guitarfish conservation with local communities. https://saveourseas.com/update/guitarfish-conservation-with-local-communities/

– Working with fishing communities to save guitarfishes in Goa. (2024). https://www.youtube.com/watch?v=1xo629cc_68&t=8s

– Gupta, T. (Dec 2023). Blog: The elusive guitarfish of Goa. https://saveourseas.com/update/the-elusive-guitarfish-of-goa/

– Vaidyanathan, S. (2023). Restoration of the critical elephant corridor in the Shengottah Gap of the Western Ghats. 2023. Trumpet. A Quarterly Newsletter of the Project Elephant Division., 3(1–2), 27–31.
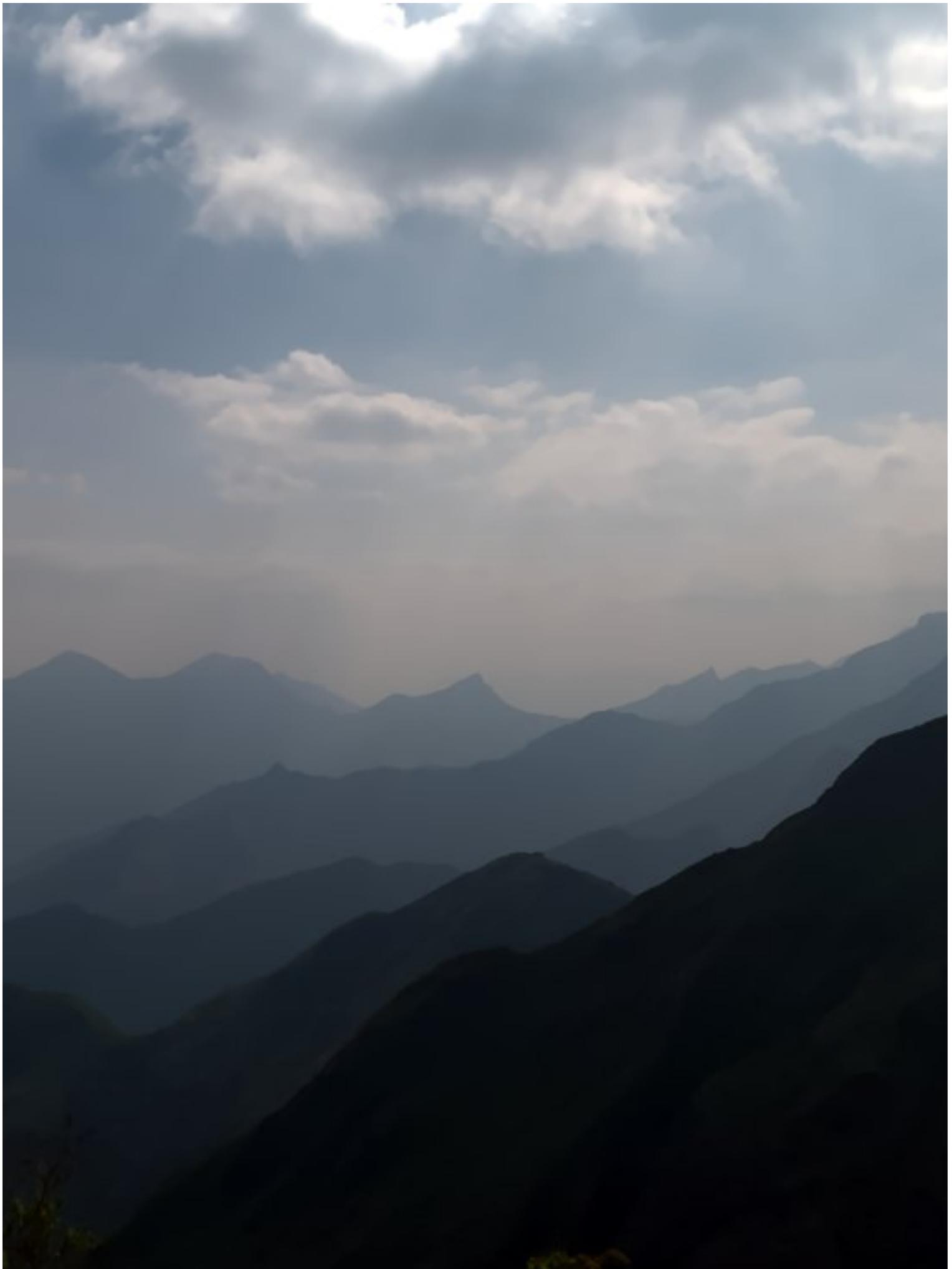
The steep slopes and elevation from 1000 m to 2600 m in the Western Ghats is the only habitat for the endangered Nilgiri Thar.

Balance Sheet

FOUNDATION FOR ECOLOGICAL RESEARCH ADVOCACY AND LEARNING
No .170/3, Morattandi Village, Auroville Post, Tamilnadu - 605101

Balance Sheet as at 31ˢᵗ March 2024

Particulars	Sch.Ref	As at 31.03.2024	As at 31.03.2023
SOURCES			
Corpus	1	8,89,075	12,30,928
Project Asset Reserve account	2	2,01,015	2,01,015
Projects Account (Cr)	3	34,89,116	55,28,384
		45,79,206	69,60,327
APPLICATION			
Fixed Assets *(Less)* Depreciation	4	3,81,937	4,19,390
CURRENT ASSETS, LOANS AND ADVANCES			
Cash and bank balances	5	39,80,670	60,38,713
Loans and advances	6	1,79,921	51,626
Projects Account (Dr)	3	-	3,99,921
Interest accrued but not due	7	42,347	50,677
(i)		42,02,938	65,40,937
Less: Current liabilities	8	5,669	-
(ii)		5,669	-
Net Current Assets (i) - (ii)		41,97,269	65,40,937
		45,79,206	69,60,327
Notes on Accounts	13		

As per our report of even date attached
For ASA & Associates LLP
Chartered Accountants
Firm Reg No

Y Ramakrishnan
Partner
Membership No : 208866

Place : Chennai
Date : 30.04.2024

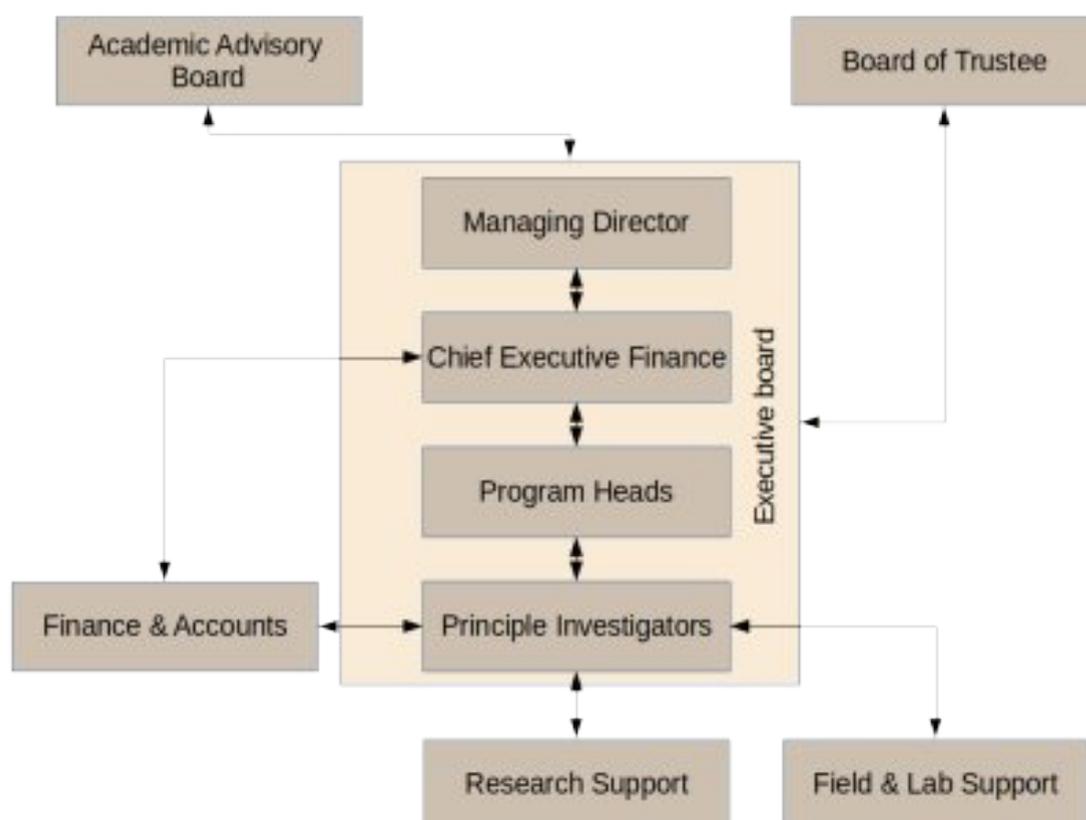For Foundation for Ecological Research
Advocacy and Learning

Srinivas Vaidyanathan
Trustee

Administrative Information

FERAL is a non-profit trust founded under the Indian Trusts Act (1882), in July 1997. We are certified as a Scientific and Industrial Research Organisation (SIRO) by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, New Delhi. Donations made to FERAL attract deduction under section 80G of the Income Tax Act, 1961 and we are registered and authorised to receive foreign funds under the foreign contribution regulation act (FCRA) 2010.

We have a simple organisational structure which provides a supportive framework for our researchers while ensuring them functional autonomy. As per the DSIR and Trust Act rules, we are advised by an academic advisory board for all scientific matters and governed by a board of trustees for overall administration and organisational policy.

Partners

FERAL's work is made possible through grants from the Government of India and international agencies. Often these grants are made to multi-institutional consortia of two or more partner organisations. The agencies who have supported our work and those who have collaborated in project implementation are listed below.

Supporting partners

Denver Zoological Foundation (USA), Future for Nature Foundation (Netherlands), Ruffords Foundation (UK), Save Our Seas Foundation, Switzerland, Stichting Burger Zoo Conservation (Netherlands), The Wild Heart Trust (UK) and United States Fish and Wildlife Services (USA).

Individual donors

Dr. R. S. Bhalla, Ms. Anupama Pai, Srinivs Vaidyanathan, Benevity UK Online Giving, Global Remittance

Collaborating Institutions

Ashoka University (India), Asian Nature Conservation Foundation (India), Indian Institute for Human Settlements (India), Indian Institute of Science (India), National Institute for Advanced Studies (India), Nature Conservation Foundation (India), Sikkim University (India), University of Azores (Portugal).

The FERAL Team

Feral's team is a mix of researchers and professionals from various disciplines who are supported by a small but competent and highly trained team. Below is a short introduction to the people who make FERAL tic (arranged alphabetically).

Research team

Abhishek Gerald

Abhishek Gerald has an Integrated Masters degree in Marine Science from the Centre for Marine Science and Technology, Manonmaniam Sunderanar University. He is interested in the conservation of marine mammals and elasmobranchs found along the East and West coasts of India.

Anamika Ajay

Anamika is a social scientist with a PhD in Development Studies. Her research interests lie at the intersection of political economy of livelihoods and local governance.

Aryaman Tiwari

Aryaman is moved by any and all world's wildlife, and harbours a love for literature, long-distance running, and chess. He has a Masters' in Policy. He hopes to someday contribute to fostering human-elephant coexistence in his maternal home region of North-East India.

Bryan Miranda

Bryan Miranda has an MSc in Marine Biology from Ghent University, Belgium and is interested in studying ecology of various marine species.

Dhanush C S

Dhanush holds a deep admiration for nature and wildlife, with a particular fondness for elephants and birds. He has a master degree in wildlife management.

Divya Karnad

Divya holds a Ph.D. in geography with a focus on marine fisheries management. She works on sustainable fisheries, sustainable seafood trade and the conservation of threatened marine species. She is a member of the IUCN's Shark Specialist Group.

Kumaran K

Kumaran has a Masters degree in Ecology and Environmental Science. His interests include understanding the impact of changes in land use and land cover, esepcially due to exotic invasive species, on natural habitats and ecosystem services.

Letkhosei Baite

Letkhosei has a Masters degree in Botany from Manipur University. He has worked as a biologist in the fish conservation zone, Manipur since 2020. He is keen on conserving riparian forests and currently handling a catchment restoration project in Manipur.

Narayani Subramaniam

Narayani has a PhD in Marine Biology from Pondicherry University. She is interested in studying fish biology, fish feeding ecology and ecomorphology. A nature writer, she has a lot of experience in conducting science programmes for school children.

Neha Maria Babu

Neha has her master's degree in Wildlife studies and has worked on Human-Bat conflicts before she joined us. She believes in in the 'One health' approach and is interested in community conservation of wildlife especially the less charismatic species.

Nishant Srinivasaiah

Nishant is instrumental in starting a multi-institution, multi-disciplinary collaboration to manage Asian elephants in India. Over the last decade he has been monitoring elephants, understanding their behaviour and interactions with humans to find solutions to conserve elephants.

Rajat Ramakant Nayak

Rajat has completed his Masters in Wildlife Biology and Conservation. He is interested in understanding the influence of anthropogenic activities and climate change on ecosystem processes and services. He currently works on forest fragmentation and its influence on wildlife movement and ecosystem services.

Shishir Thantya Rao
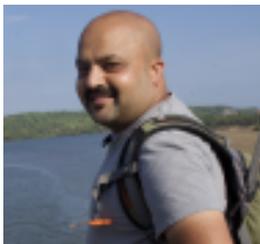
Shishir is an engineer-turned-ecologist interested in studying and conserving the tropical rivers of the Western Ghats of India. He is pursuing his PhD at the Odum School of Ecology, University of Georgia.

Shruthi Kottillil

Shruthi has completed her Masters in Environmental Studies and Resource Management from TERI SAS. She is interested in finding a balance between marine species conservation and community livelihoods by focusing on sustainable fisheries and policy.

Shruthi Suresh

Shruthi is a multidisciplinary researcher motivated to understand the complexities of interactions between people and wildlife through a combination of ecological, sociological, and psychological methods.

Srinivas Vaidyanathan

Srinivas is an ecologist with an interest in understanding changes in landscape-level processes and structure and how they affect large mammal populations. Srinivas uses spatial approaches for finding innovative and practical solutions to conservation problems.

Sudha Kottillil

Sudha has an MSc. in Environmental Studies and Natural Resource Management from TERI SAS. She is interested in elasmobranch conservation, sustainable fisheries, fisheries management and marine policy.

Sunita Ram

Sunita has worked extensively on the ecology and distribution of primates in the southern Western Ghats. Her interests lie in contributing to long term strategies for the conservation of wildlife and their habitats.

Trisha Gupta

Trisha Gupta is a PhD student at the University of Oxford. Her research focuses on the fisheries and conservation of sharks and rays in India.

Venetia Sharanya

Venetia has completed her Masters in Environmental Studies and Resource Management. She is interested in animal behaviour, social structures and human-animal interactions.

Vidisha Hate

Vidisha's keen interest in animal behavior focuses on human-animal interactions, aiming to bridge the gap between scientific research and real-world solutions. Through her work in behavioral ecology, she seeks to foster improved understanding and sustainable relationships between humans and wildlife.

Research support

Geethika Basappa

Geetika holds a BBM degree with a diploma in Human Resources from Jain University CMS, along with a PADI OWSI certification from Gili Trawangan, Indonesia. She has earlier worked on community-based projects, in hospitality, adventure sports, and management sectors.

Kamalraj S

Kamal has been working with FERAL as a field assistant for more than a decade. He is adept at handling a range of equipments and data loggers. He is a reliable driver in tough forest terrain and is good with managing field staff and taking over running of field stations at a pinch.

Ngamsei Philip

Philip is a farmer by profession, but also assists our field team in Manipur.

Saravanan S

Saravanan holds a masters in human resources development and is very experienced in undertaking social surveys and in coordinating field activities. He is also a resource person for GIS and GPS workshops conducted at FERAL.

Utkarsh Pagi

Utkarsh Pagi is a fisher from Galgibag Goa who works with us in our project along the West Coast of India.

Administrative support

Anupama Pai

Anupama has been associated with FERAL since inception and has wide interests ranging from gender and development, natural resource management and developing study abroad programs. She is the Chief Executive Finance and supports project management.

Shanthi R

Shanthi is our finance manager handling the day-to-day accounting responsibilities of the organisation. She has a postgraduate degree in commerce and is versatile in the use of a range of accounting softwares.

Foundation for Ecological Research, Advocacy and Learning (FERAL)

Web Page: https://www.feralindia.org

Email: feral@feralindia.org