ANNUAL REPORT 2017–18

ASHOKA TRUST FOR RESEARCH IN ECOLOGY AND THE ENVIRONMENT

Cover Photo: River Dawki, India-Bangladesh border.
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Silver Fir Tree covered in frost in Sandakphu, Singalila National Park, Darjeeling, West Bengal. *© Rohit George*

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President's Message

Making ATREE More Relevant

As is evident from the pages of this report, ATREE continues to address major environmental challenges in three broad areas of climate change, biodiversity, and water. In addition, the doctoral students at ATREE's Academy for Conservation and Sustainability Studies continue to advance knowledge on several fronts at the intersection of society and the environment. Similarly, engagement with society at the community conservation centres is breaking new ground. The work on such important issues as the livelihood options and diversification, and the Forest Rights Act is particularly noteworthy.

Despite progress on several fronts by ATREE and other organizations, our environmental challenges continue to mount. A critical issue for all environmental centres engaged in research, policy and action is how to deploy and mobilize limited resources for more effective and impactful outcomes. The choices are limited and hard when the resources are scarce.

At ATREE we will create two additional centres, one on policy research and action, and the other on socio-environmental innovation and leadership. Synergizing with existing centres and Academy, the two centres will undertake new initiatives, and further, apply research outputs to transform policy and action and engage society. We expect new innovations in our programs to significantly upscale our impact on new knowledge, people, and places.

It is the support and enthusiasm of our donors combined with the imagination and creativity of our faculty and staff that allows us to constantly push boundaries and seek new frontiers. We are fortunate to have many supporters, who are listed at the end of this report. We are thankful to all, particularly to those who have consistently provided unflinching, unconditional, and generous support: Rohini Nilekani, the Shibulal Family, Chitra Phadnis, and Vasu Rao.

Kamaljit S Bawa
President, ATREE and
Distinguished Professor
University of Massachusetts, Boston

From the Director's Desk

When ATREE turned 20 last year, we celebrated our achievements. Justifiably so. In the two decades, the institution is one of the few non-governmental organisations to have made the kind of impact it has, building rigorous and meaningful long-term programmes in biodiversity conservation, forests and governance, water and society, and climate change. We were amongst the first conservation NGOs in India to recognize the need to incorporate human wellbeing and environmental justice into our core values and programmes, and helped change the discourse in the country. We took pride in being at the vanguard of a new interdisciplinary conservation science, bringing together the natural and social sciences. ATREE hired economists and sociologists in the early 2000s, long before it was considered fashionable, and has fully supported the production of Conservation and Society, one of the leading conservation social science journals in the world. Last, but not the least, we took joy in our flagship, the interdisciplinary PhD programme – one of the few of its kind in the global South.

However, it was also a time for reflection and critique. ATREE is pretty much unique amongst institutions (probably globally) in trying to address the three dimensions of knowledge generation (traditionally the domain of universities and like institutions), policy impact (the work of think tanks) and social change on the ground (a typically non-profit space). While we have made progress in all three domains, we have emphasized some more than others, and much of the effort has been in the knowledge generation through our existing research centres and the Academy. There has been on-ground work through our many Community Conservation Centres, but these efforts have been largely local.

Recognising that the two other pillars of our mission need to be strengthened, we decided to establish two new centres, the Centre for Policy Design and the Centre for Social-Environmental Innovation. While these centres will create opportunities to bringing in the human resources with the necessary skillsets and mindsets needed in these fields, their linkages to the research centres under one umbrella can create the necessary synergy for impact at scale.

While much of philanthropy focusses on immediate problems such as health, nutrition, education, and poverty (as it should continue to do), many of these are inextricably linked to underlying environmental causes and these need adequate support from the government and civil society. ATREE has thus been broadening its engagement with philanthropists and donors through a series of events, the first of which were hosted in Bangalore by Rohini Nilekani, and in Cupertino, California by Aruna and Nat Natraj. We deeply appreciate their support and that of new friends, supporters and well-wishers. Through these interactions, we hope to increase the reach of and support for ATREE's work, as well as for the environmental sector in general.

The environmental challenges we face are unprecedented (and frankly, scary). Though there might be little limit to human ingenuity and creativity, solutions to these wicked problems are mired in political, economic and social complexities. We can only bring about lasting change by addressing root causes and by working together within and across sectors. ATREE welcomes collaborative design and action to tackle these challenges in the coming years.

Kartik Shanker, Director, ATREE

Recognitions and Achievements

2017-18

ATREE was ranked 22nd among the top environment policy think tank in the world by the University of Pennsylvania's 2017 Global Go To Think Tank Index Report released by the Think Tanks and Civil Societies Program (TTCSP) of the University of Pennsylvania, Philadelphia, USA.

ATREE's Governing Board member Mrs. Rohini Nilekani was elected as a Foreign Honorary Member of the American Academy of Arts and Sciences. She was recognised for her philanthropic work.

ATREE's PhD student Vikram Aditya received the Wildlife Conservation Trust – WCT Small Grant to study hunting practices and impacts on wildlife in the northern Eastern Ghats. His research focuses on the population status of the endangered Indian Pangolin in the region.

ATREE's Distinguished Fellow, Sharachchandra Lele was appointed to the editorial board of the journal Sustainability Science, published by Springer.

ATREE's Senior Fellow Jagdish Krishnaswamy was selected by the Intergovernmental Panel on Climate Change (IPCC) as the Coordinating Lead Author for 'Climate Change and Land,' an IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security and greenhouse gas fluxes in terrestrial ecosystems. He was selected from a pool of 640 nominations. He was also an Expert Reviewer on IPCC's Special Report on Global Warming of 1.5C (SR15).

ATREE's Fellow Veena Srinivasan was nominated to the Leadership Team of International Association of Hydrological Sciences' Panta Rhei Initiative. This initiative aims to arrive towards an interpretation of the processes governing the water cycle by focusing on their changing dynamics in connection to the rapidly changing human systems.

Aniruddha Marathe, a research scholar at ATREE, bagged the second prize in the Conservation theme at Student Presentations on Ecology, Evolution and Conservation (SPEEC-UP) Bangalore. SPEEC-Up is a one-day event created to encourage and promote interactions among students of ecology, evolution and conservation working in Bangalore. The event features a competition in a speed-talk format (3 minute talks) and includes interactive sessions with peers and faculty.

Sharachchandra Lele, Distinguished Fellow at ATREE, was appointed to the newly constituted Water Policy Task Group of the Karnataka Jnana Aayogo (Karnataka Knowledge Commission) and the Advisory Committee for Urban Studies set up by the Bengaluru Central University.

ATREE's Fellow Veena Srinivasan was appointed to the Strategic Advisory Group to the UN Water Integrated Monitoring Initiative for SDG 6.

Research Highlights

ATREE's research spans across two centres, each housing three programmes

Centre for Environment and Development

WATER, LAND AND SOCIETY

The programme aims to generate valuable insights that can help identify social, technological and governance solutions to India's water problems.

Faculty: Dr. Veena Srinivasan (Programme Leader), Dr. Bejoy Thomas, Dr. Durba Biswas, Dr. Priyanka Jamwal and Dr. Shrinivas Badiger

FORESTS AND GOVERNANCE

The programme aims to influence the forest policy debate by incorporating the changing socio-economic contexts of local communities, the importance of historically-situated and locally nuanced forest rights arrangements, and the need for institutional arrangements that fairly link local and global stakeholders.

FACULTY: Dr. Siddappa Setty (Programme Leader), Dr. Sharachchandra Lele.

CLIMATE CHANGE MITIGATION AND DEVELOPMENT

The programme aims to decouple economic growth and greenhouse gas emissions and harness co-benefits for the local environment, health, and energy security.

FACULTY: Dr. Sharachchandra Lele (Programme Leader), Dr. Shikha Lakhanpal and Dr. Megha Shenoy (Adjunct Faculty).

Centre for Biodiversity and Conservation

BIODIVERSITY MONITORING AND CONSERVATION PLANNING

The programme aims to describe, assess and monitor biodiversity across scales, taxa, and landscapes. It applies broad interdisciplinary approaches to conservation planning and adaptive management practices to further ecological sustainability.

FACULTY: Dr. R. Ganesan (Programme Leader), Dr. Priyadarsanan Dharma Rajan, Dr. G. Ravikanth and Dr. N.A. Aravind.

LANDSCAPES, LIVELIHOODS AND CONSERVATION

The programme aims to examine the contrasting and synergistic strengths of natural and social drivers of environmental change at the landscape level and and at the same time find solutions to enhance both conservation and livelihoods.

FACULTY: Dr. T. Ganesh (Programme Leader), Dr. Ankila Hiremath, Dr. Abi Tamim Vanak and Dr. Nitin Rai.

ECOSYSTEM SERVICES AND HUMAN WELLBEING

The programme aims to understand the various dimensions of ecosystem services and mainstream them into societal and policy discussions.

FACULTY: Dr. Jagdish Krishnawamy (Programme Leader), Dr. Soubadra Devy, Dr. Nirmalya Chatterjee and Dr. Siddhartha Krishnan.

Centre for Environment and Development

Water, Land and Society

The programme's faculty members are engaged in several large research projects. One major interdisciplinary research project on urbanising watersheds is nearing completion and several new projects have been launched. The projects involved training dozens of young researchers who worked as research associates and interns.

2035 VISION FOR SUSTAINABLE, EQUITABLE WATER AND WASTEWATER MANAGEMENT IN BENGALURU (COMPLETED, DECEMBER 2017)

The goal of this project funded by the Royal Norwegian Embassy was to evaluate a range of options for sustainable and equitable water and wastewater management in Bengaluru for the Year 2035. The project, in particular, analysed Bengaluru's ability to sustain itself without the need for expensive inter-basin projects by using local sources (wastewater, storm water, groundwater, and efficiency improvement). The project focused on lakes as the central component of Bengaluru's water system and undertook intensive monitoring and modeling efforts. The results were presented to an audience of over 100 stakeholders in December 2017.

Left: Analyzing water quality at Nelamangala in Bangalore Rural. *© Kumar DS.*

Above: Collecting information on toilet construction under Swachh Bharat Abhiyan in slums from a junior engineer, Town Municipal Corporation, Nelamangala in Bangalore Rural. *© Kumar DS.*

Project Outcomes:

The study proposed an "integrated urban water management approach" that involves reduced dependency on long-distance, inter-basin transfers. The model of Bengaluru's water, wastewater and lakes suggests that external dependence on Cauvery could be limited by treating wastewater and storing it in lakes. This would entail a "win-win" for Bengaluru's lakes and overall resilience while minimising the need for destructive projects. The study also offered insights on specific aspects of Bengaluru's water system:

Domestic Water Use: Current water supply is not equitably distributed. Half of Bengaluru's population is at a level of consumption below 90 litres per capita per day, while 10% of the population consumes 225 lpcd or more. But the latter constitute the wealthy households and therefore do not respond (or affected by) to price signals. Rainwater harvesting, on the other hand, does contribute to water savings, but its adoption is only 20%.

Commercial, Industrial and Institutional (CII) Water Use: CII water use in Bangalore is heavily skewed towards groundwater exploitation. But the study also revealed severe deficiencies in the way water data is reported in public records as well as annual reports. This in turn makes estimation of CII water use extremely challenging. The study recommended the need for standardised reporting formats.

Wastewater Treatment: Bengaluru faces the paradox of too little Sewage Treatment Plant (STP) capacity, yet the existing capacity is under-utilized. Creation of new centralised wastewater treatment infrastructure should go hand in hand with laying of underground drainage network. The study highlighted the problems with decentralised wastewater treatment infrastructure. First, most of the treated wastewater is not reused because there is still no market for the treated effluent. Second, compliance levels are low because of high costs.

Above: Downloading of pressure sensor data from CGWB well at Bangalore University campus. *© Manjunatha G.*

Below: Ground water quality analysis at Ekashipura village, Aralumallige milli-watershed, Doddaballapura *© Manjunatha G.*

GROUNDWATER AND SANITATION NEXUS IN PERI-URBAN SMALL TOWNS OF BANGALORE (COMPLETED, JANUARY 2018)

The Sustainable Development Goal (SDG) 6, commits universal and equitable access to safe drinking water and sanitation for all by 2030. In most peri-urban habitations in India, in the absence of sewers, households have on-site sanitation systems. Many studies have shown that the disposal of faecal matter locally could lead to chemical and biological contamination of groundwater. In most peri-urban areas, where groundwater is the only source of domestic water, contamination of groundwater can have an adverse impact on the public health.

The specific aim of the field study completed with support from Arghyam in April 2018, conducted in Nelamangala town in Bangalore Rural District, was to assess the current status of groundwater-sanitation nexus and identify policy interventions to mitigate the problem. The study was critical in terms of understanding and achieving the long-term sustainability of the current system.

Key Findings:

Soak pits contribute to groundwater contamination in the Nelamangala town.

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As compared to surrounding villages, high Nitrates and Fecal Coliform (FC) levels were found in groundwater samples within the town. Chemical analyses of groundwater indicated that the origin of the Nitrate contamination within the city was human in origin as compared to the surrounding villages where animal waste was the primary source of contamination.

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The study revealed a complete lack of adequate information and knowledge about septic tanks and soak pits among the general population.

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The findings of the study were presented to Arghyam and will inform their groundwater-sanitation advocacy programme.

Measuring water flow at Kaikondrahalli Lake, Bangalore. *© Shankar Venkatraman.*

UPSCALING CATCHMENT PROCESSES FOR SUSTAINABLE WATER MANAGEMENT IN PENINSULAR INDIA (UPSCAPE) (ONGOING)

Focusing on the highly contentious inter-state Cauvery River basin (with an area of c.80,000 km2) the ongoing project supported by the Ministry of Earth Sciences, addresses the key scientific challenge of representing the many local, small-scale interventions in Peninsular India at larger scales. Using observations from established experimental catchments in both rural and urban settings, the project explores how changes in land-use, land-cover, irrigation practices and small-scale water management interventions locally affect hydrological processes. The impact of local-scale interventions will further be modeled alongside projections of population growth, climate-and land-use-change and water demand to assess future impacts on water security across the basin. By developing novel upscaling techniques, the project demonstrates the capability to generically represent the cumulative impact of abundant small-scale changes in basin-wide integrated water resources management models.

CITIZEN'S DASHBOARD FOR BENGALURU'S LAKES (ONGOING)

Bengaluru is grappling with issues of an imminent water crisis, inequitable access to water supply, and public health hazards. There have been growing concerns amongst citizens about the health of the city's lakes. This has in fact been acknowledged by the government who has now appointed citizen's groups as 'Lake Watchdogs'. However, despite years of research, both the government agencies and the citizens are ill-equipped to handle the management of these lakes as information is neither consolidated nor made usable to facilitate easy and informed decision making.

The ongoing Citizen Lake Dashboard project, sponsored by a CSR grant from Oracle Corporation, aims to make relevant data available to all those citizens' groups who are actively responsible for maintenance of their lakes, and to ensure that the correct use of data brings in the required social change. Using state-of-the-art sensors to measure dissolved oxygen, lake and inlet water levels,

temperature, and pH balance, the data is wirelessly stored on a cloud dashboard. Additionally, scientific data collected by citizens on the biodiversity around lakes and measurements on water quality are also uploaded. Simple analytics in the form of graphs such as rainfall versus inflow, DO versus time of day/temperature etc. can be downloaded from the website. Through various outreach activities aimed at the community like simple videos and "interpretive blogs", the project brings together citizens' groups, agencies, researchers, innovators, and students, to facilitate exchange of views and ideas to keep the city's lakes healthy.

NEW PROJECTS INITIATED IN EARLY 2018.

DECENTRALISED WASTEWATER TREATMENT - GLOBAL INNOVATION FOR SUSTAINABLE RURAL COMMUNITIES.

The study funded by James Hutton Institute, University of Glasgow, aims to establish a modular decentralised wastewater treatment and recycling system that can be deployed across a range of rural communities regardless of the geography. Through this study we believe that demonstrating the efficacy and resilience of the innovative technologies at small-scale will assist in implementing change at a larger-scale; offering a real alternative to large scale capital intense urban and peri-urban systems.

The decentralised wastewater treatment system is being implemented in a school in Berambadi village in Karnataka. The project engages the community at all stages of the project and work with them throughout the duration of the study to ensure that the treatment system is sustained over time and well beyond the end date of the study. A key component of this project is evaluating the cost of the system which includes planning, construction, maintenance and replacement through a lifecycle assessment. A wetland has also been constructed and is being used to grow plants which can be used for fuel or other purposes agreed upon with the consent of the local community.

BIO-ELECTROCHEMICAL SYSTEM (BES) FOR TREATING OF WASTEWATER AND MONITORING OF EFFLUENT QUALITY.

A seed grant was received from University of Cambridge, Research Council UK. ATREE and Cambridge are collaborating to explore electricity generation from algae in Bangalore's water bodies. The technology, if proven, has the potential to transform environmental sensing in polluted, remote or inaccessible areas. The technology focuses on the physical integration of BES with the constructed wetland technology for wastewater treatment and monitoring. A laboratory-scale prototype system is currently under testing at the ATREE.

Facing Page: Meeting with school staff, IISC, ATREE and JHI on system design at Berambadi school, Gundlupet. *© Anu Karippal.*

Top: Fully setup Bio-Electrochemical System at ATREE with typha plants in the setup.

Above Right: Decentralized wastewater treatment plant with SBR technology at an apartment complex in Bangalore.

Centre for Environment and Development

Forests and Governance

The Forests and Governance programme contributes to enabling sustainable and equitable forest management in India by understanding the multiple benefits derived from forests and their long-term socio-ecological dynamics. It analyses the performance of community forestry institutions and proposes approaches to multi-layered democratic governance. The programme also conducts action-research on the enterprise-linked conservation of Non-Timber Forest Products (NTFP) and provisioning of community forest rights under the Forest Rights Act (2006).

Above: Amla harvest. © *Siddappa Setty*

Facing Page: Community meeting in BRT CCC. © *Jadeswamy*

MANAGING FORESTS FOR BIODIVERSITY AND HUMAN WELLBEING IN THE FACE OF GLOBAL CHANGE

This project, funded by the United States Agency for International Development (USAID), aims at promoting the sustainable use of Non-Timber Forest Products (NTFPs). The ongoing programme assists the forest-dwelling communities in improving incomes by adding value to NTFPs through the use of new techniques and improved processing and marketing strategies.

Additionally, it also provides an opportunity to monitor the forest resources with participation from local communities and generates interdisciplinary knowledge for conservation of these resources. With project sites located in the Eastern Himalaya and the Western Ghats, research load is shared by ATREE's Forests and Governance programme (which works on the Western Ghats component) and ATREE's Northeast India Initiative (which works on the Eastern Himalaya component). In the Western Ghats, the project has been implemented in the Malai Mahadeshwara (MM) Hills wildlife sanctuary, Biligiriranga Swamy Temple Tiger Reserve, and the Cauvery Wildlife Sanctuary.

Project Outcomes:

Increase in the income of forest-dependent communities like the Soligas through an enterprise based conservation model. The community has been able to generate more income by conserving and monitoring their own resources. The project has helped in reducing fuelwood dependency, promoted climate-smart agriculture, explored off-farm livelihoods for locals and is actively addressing crop-raids by wildlife.

With active community participation, three decentralised processing were established to better market honey, gooseberry, soapnut, soapberry and wild mango. These processing units have started generating income.

Participatory resource monitoring conducted in 35 villages elicited the participation of 700 individuals, who were trained on the sustainable use of forest resources. Through such monitoring activities, harvesters estimated the percentage of bee colonies, before and after the harvest and noted the amount of forest resource collected.

Over 285 people were trained by 20 master craftsmen/women in the use of the invasive weed Lantana camara for making household items and furniture. As many as 113 households are now involved in making Lantana furniture's and have witnessed a 42 percent increase in their income.

A `Corridor Conservation Committee' was formed to protect important wildlife corridors.

A one-day national workshop was organised on Innovations for Forest Resources Management (InFoRM) program. The objective of the workshop was to disseminate project learnings to a wide range of stakeholders and foster discussions leading to scaling up of strategies. As part of the workshop, a panel discussion was held to discuss innovations in fuelwood management, forest resources management, forest and forest-based livelihoods. A key highlight of the workshop was a special session by community representatives from all project landscapes on community perception on conservation and livelihood enhancement.

IMPROVING FOREST GOVERNANCE IN INDIA

Multiple shifts are taking place in the governance of forests in India. While Forest Rights Act (FRA) 2006 was a landmark law that gave forest-dwellers rights to access and manage forests, the commitments made by India in the Paris accord of 2015, the Compensatory Afforestation Fund Act 2017 and the Draft Forest Policy 2018 constitute significant shifts in forest policy objectives and mechanisms. The F&G programme has been working in multiple sites and at multiple levels to empower local communities to engage with the FRA and to analyse and contribute to policy-level and public discussions on the larger questions of forest governance.

Contributions Towards Forest Governance in India:

In the past year, the programme assisted many more Soliga villages in southern Karnataka in obtaining community forest rights under the FRA and initiated the process of formulating conservation plans.

In Maharashtra, where communities have already received the rights, the programme helped in developing guidelines for the development of community forest management plans. The programme also contributed to an analysis of the draft Forest Policy 2018 and review of the scientific understanding of the implications of India's carbon sequestration commitments under the Paris accord.

Centre for Environment and Development

Climate Change Mitigation and Development

The broad goals of Climate Change Mitigation and Development (CCMD) programme are to understand the social, environmental and equity implications of low carbon pathways for climate change mitigation and to explore synergies between them.

The programme studied environmental regulations for coal power generation, pollution impacts of coal power plants, integration of renewables in the electricity grid, residential electricity demand growth, decentralised renewable energy generation, biodiversity impacts of renewable energy projects, conspicuous consumption behavior and the connection between energy consumption, greenhouse gas emissions and the human development index (HDI).

POLICY DRIVERS OF RENEWABLE ENERGY EXPANSION IN INDIA

This study by Shikha Lakhanpal in collaboration with Indian School of Business, investigates the rapid increase in wind power investments in select Indian states during the period 2001–2010 and shows that it is a function of the interaction between the international Clean Development Mechanism and two domestic policy instruments. The findings highlight how multi-scalar policy pathways enable renewable energy outcomes.

BIODIVERSITY IMPACTS OF LARGE SCALE SOLAR AND WIND ENERGY PROJECTS

This is a collaborative research project between the Climate Change Mitigation and Development Programme (Shikha Lakhanpal) as well as fellows from the Center for Biodiversity and Conservation (Abi T. Vanak and T. Ganesan). The project examines the trade-offs between biodiversity and large scale solar and wind energy projects located in the states of Karnataka, Madhya Pradesh, Andhra Pradesh and Maharashtra. The project will analyse the impacts of these large-scale renewable energy projects on migratory species such as the Great Indian Bustard, Lesser Florican and the Harrier.

Policy drivers of renewable energy expansion in India.

Biodiversity impacts of Solar and Wind Energy.

Conflict between renewable energy and biodiversity protection.

CONFLICT BETWEEN SMALL HYDRO PROJECTS AND THE ENVIRONMENT

This study by Shikha Lakhanpal in collaboration with Indian School of Business analyses conflicts between small hydro projects in Himachal Pradesh and Karnataka and the environment. The conflict is manifested either as a clean energy versus local environment degradation or as an environment versus local development conflict, contingent on the scale of analysis. This research highlights the social and political consequences of "small scale" renewable energy development and the potential trade-offs between local biodiversity, livelihoods and renewable energy.

DRIVERS OF CONSUMPTION DECISIONS

Rising levels of consumption has significant environment impacts. This thesis by Soumyajit Bhar, analyses data from the India Human Development Survey to identify socio-cultural correlations of conspicuous consumption behaviour in the high income deciles of India. A mixed methods approach, which also uses interviews with some high income households, suggests that exposure to mass media and social networking, drive increase in consumption whereas education has an ameliorating effect.

ENGAGING WITH THE ENVIRONMENTAL REGULATION PROCESS

Sharachchandra Lele, as member of the Water Policy Task Group of the Karnataka Knowledge Commission, the Advisory Committee for Urban Studies, Bengaluru Central University and Expert Appraisal Committee (Thermal Power Projects & Coal Mining), Ministry of Environment, Forests & Climate Change, continues to engage with complex issues of environmental regulations, impact assessments and clearances for power plants and mines, and Bengaluru's water and urban policies. This engagement has improved the rigour of these processes by incorporating research and evidence based processes, and has also enabled other faculty members to contribute to, and learn from, the policy making and regulatory process.

ROLE OF INDIA'S FORESTS IN THE NATIONALLY DETERMINED CONTRIBUTIONS

Sharachchandra Lele, analysed the role of carbon sequestration in Indian forests, in meeting the 2030 Nationally Determined Commitment made at the UN Paris Conference of Parties in 2015. This is part of an invited review article submitted to Annual Reviews of Energy & Resources, in collaboration with Dr. Navroz Dubash of Centre for Policy Research, Delhi.

SOCIAL COST OF ELECTRICITY GENERATION AND THE POLLUTION IMPACT OF COAL

Shoibal Chakravarty of ATREE and E. Somanathan from the Indian Statistical Institute, analysed the true social cost of electricity from coal and renewable power. The environmental and health cost of coal makes it more expensive than any other renewable source of power in India. The study projects that coal use in electricity generation could peak in the next decade with declining cost of renewable power. Shoibal Chakravarty is also collaborating with Ashwini Chhatre and Madhulika Gurazada of the Indian School of Business, Hyderabad, to model the health and agricultural impacts of coal powered electricity using emission inventories for 2015, and a weather and atmospheric chemistry model.

MODELING THE ELECTRICITY SYSTEM AND RESIDENTIAL DEMAND

The Indian electricity system is going through a rapid transition with rapidly increasing share of renewable sources like wind and solar along with an equally rapid growth in residential electricity demand due to rising incomes and efforts towards universal electrification. Shoibal Chakravarty, and PhD scholars CS Vijay and C Sashikiran in the National Institute of Advanced Study, are using high resolution electricity generation and weather data, Indian Human Development Survey data, and primary surveys of residential electricity demand to analyse and model this transition.

AIR POLLUTION SCIENCE AND REGULATORY PROCESS

A brainstorming workshop on `Environmental Regulation with a Focus on Air Pollution' was organized on March 16, 2018. This unique workshop, for the first time, brought together a diverse group of environmental activists, lawyers, policymakers, scientists and economists with the goal of setting up a network for collaborative work in the air pollution field. The group's first collaborative output was a comment on the newly proposed "National Clean Air Programme" draft policy which was sent to the Ministry of Environment and Forests in May 2018.

Centre for Biodiversity and Conservation

Biodiversity Monitoring and Conservation Planning

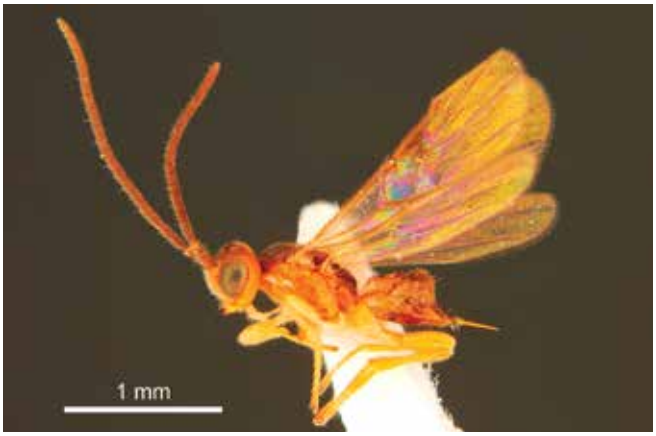
The Biodiversity Monitoring and Conservation Planning programme generates knowledge through applied research and outreach activities by using integrative taxonomy and by monitoring biodiversity and ecosystem changes. The programme aims to improve management of biodiversity and ecosystems through a variety of outputs that could potentially influence existing policies and conservation planning.

Over the last year, the programme has contributed towards description of new insect taxa, species recovery strategies for rare plants and animals and developing methods by using molecular and GIS tools to conserve economically important biological resources. Researchers also looked at long term biodiversity changes and the drivers, trends in phenology of trees and the possible climate driven trends.

THE WESTERN GHATS INSECT INVENTORY PROGRAMME:
The insect group, Hymenopterans, that includes bees, ants and wasps, plays an important role in the ecosystem. Some like fig wasps, help in the pollination of Ficus (Figs). Others, like the Braconidae family of parasitic wasps, help in the biological control of pests in agricultural ecosystems. Many specimens of this family were collected from the Western Ghats as part of the Western Ghats Insect Inventory Programme funded by Schlinger Foundation, using malaise traps set up in selected forests of the southern Western Ghats.

Apart from wasps, the spatial and seasonal variation of dung beetles (Scarabaeinae), across a grazing gradient from the semi- arid landscapes of southern Tamil Nadu were investigated. The study revealed 42 species of dung beetles belonging to 14 genera. A substantial finding was the addition of three new dung beetles to the fauna of Lakshadweep. Hitherto, only a single species had been reported in this archipelago.

Project Outcomes:
Dr. Priyadarsanan D.R. in collaboration with taxonomists at the University of Calicut recorded thirteen new species of wasps belonging to the family Braconidae, from these collections. These new species belonged to three genera, Centistidea, of which 8 new species were described; Cystomastacoides with two new species and Dolabraulax with three new species. These three genera were reported for the first time in the Indian Subcontinent. . The species Onitis lama was reported for the first time in south India. The diversity in the dung beetle species in both grazing and non- grazing landscapes shows the importance of the pasturelands in supporting ecologically important insect taxa.



Clockwise from Top: Centistidea crenulator, Cytomastacoides sachini and Dolabraulax athirae © *Ranjith*. Onitis lama © *Seena*.

APPROACHES TO THE RECOVERY OF CRITICALLY ENDANGERED PLANT SPECIES IN INDIA

In India, as in many parts of the world, there is a growing concern about the increasing number of species that are critically endangered. Large-scale developmental projects and increased extraction of resources is rendering many species rare, endangered and threatened. In India alone, more than 150 species are critically endangered.In addition to development, species are also threatened due to invasive species and climate change. Destructive extraction of medically important species from forests is an emerging threat.

In the light of increasing threats to critically endangered species this project funded by Department of Biotechnology aims to address the restoration and recovery efforts to save these species from extinction. Recovery is the process by which the decline of a red-listed species is arrested or reversed, and threats are eliminated so that the species can continue to survive in the wild.

Project Outcomes:

ATREE's work in the Western Ghats suggests a series of steps needed for successful recovery.

- Comprehensive scientific documentation of the red-listed species, assessing the threatened status, surveying and mapping all known locations of the species, identification of the extent and type of extrinsic and intrinsic factors driving species to threatened status and assessing the genetic variability within the species.
- Identification of genetic hot-spots of the species and possible places for re-introduction through niche modeling.
- Formulation of strategies for the restoration and recovery of the endangered species.
- Long-term monitoring programs to be developed to periodically assess the population changes of the species to potentially delist it from the red-list.

Above Left and Right: Rattans. *© Ravikanth G.*

HOTSPOTS OF ENDEMIC RATTAN DIVERSITY IN THE WESTERN GHATS, INDIA

Rattans or canes are one of the important non-timber forest produce supporting the livelihood of many forest dwelling communities in India. In recent years, there has been a huge demand for rattan products, which has resulted in indiscriminate extraction of rattans from forests. Additionally, loss of habitat and poor regeneration has also contributed to dwindling of rattan populations, necessitating the urgent need to conserve the existing rattan resources. This project funded by the Department of Biotechnology aims to highlight the causes of the dwindling rattan population.

Key Outcomes:

ATREE researchers used niche-modelling tools to identify three areas of high species richness of rattans in the Western Ghats. These could be prioritized for in situ conservation.

LONG-TERM MONITORING RESEARCH AT KMTR

In addition to site specific studies, the programme has been engaged in long-term monitoring studies at multiple sites throughout India. At plots in Kalakad Mundanthurai Tiger Reserve in Tamil Nadu, vegetation changes have been monitored through tree growth rate, recruitment and mortality rates in three 1-ha plots since 1994. Growth and mortality rates of 2116 tree stems >10 cm were monitored at five-year intervals.

The data collected from long-term vegetation monitoring plots at Kalakad Mundanthurai Tiger Reserve, southern Western Ghats show that despite the recruitment of stems, the mortality rate was high, ranging between 0.082 to 0.112 during 1999 to 2016. There was considerable inter-annual variability and inter-species variability. The inter-annual variability was linked to extreme climatic events and pest attacks.

The highest mortality rate of 0.239% occurred in 2004 and the lowest recruitment rate 1.34% was recorded during 1999-2004. The high mortality and low recruitment rates, particularly in the dominant species, could be attributed to the multi-year drought experienced by the Western Ghats during the period 2002-04. Endemic species showed least changes in stem density and basal area, whereas widely distributed, dominant species showed greater change in both.

The Okhi cyclone of Nov 2017 brought in heavy rains accompanied by very strong winds to the forests of KMTR, severe impacting the trees of these wet evergreen forests. 20% of the 70 species were affected by the cyclone. Again, the dominant species were disproportionately affected. Going forward, the gaps created by the cyclone provide will probably be colonized by pioneer species, inducing other changes in community structure.

In April 2016, almost every tree of wild nutmeg (Myristica dactyloides) experienced heavy leaf loss due to a severe leaf beetle (Sastroides besucheti) attack. This pest insect lays eggs on the leaves of the wild nutmeg tree so that the larvae can feed on the leaf tissue, causing damage (see picture). Almost 80% of the wild nutmeg trees were affected by the attack, which caused complete defoliation of the trees, no flower production and abortion of young fruits that year; an unprecedented event over ATREE's 23 year observations. Importantly, the monitoring data suggest that such events may have long term impacts; many trees are not flowering even two years after the attack.

Key Outcomes:
The study suggests that, stochastic events such as cyclones, droughts and pest attacks play an important role in forest structure and diversity. Impacts of catastrophic events can last for many years. The study reiterates the importance of long-term monitoring research, as these findings would not be realized in short-term project based research.

THE INDIA BIODIVERSITY PORTAL PROJECT

The India Biodiversity Portal (IBP) is an initiative supported by Royal Norwegian Embassy and a consortium of Institutions including ATREE. IBP is an open access biodiversity information platform for India to address the issue of biodiversity information not being openly available. The portal aims to establish a collaborative information system that aggregates and integrates an array of biodiversity knowledge available with fragmented entities in order to prioritize conservation of biodiversity in India.

Programme researchers have contributed 'Species Pages' and curated the information contributed by the public as part of citizen science outreach programmes. 'Species pages' include the accepted binomial name, followed by taxonomic hierarchy, detailed description of Genus and species, habitat, reproductive methods, diseases, Global and regional distribution. Endemic status if present, conservation status and important uses have been added. Images with Creative Common Licenses and from herbaria and museum collections from around the world have also been added.

Project Outcomes:
There are currently 400 Species Pages of flowering plants including many evolutionarily, ecologically and economically important plant groups.

Around 100 Species Pages for dung beetles (Scarabaeinae), one of the least documented group of insects in India, were contributed by ATREE researchers. This insect group is. Species Pages for 200 species of molluscs were contributed by ATREE.

Distribution maps for an invasive land snail (African Land Snail), an endemic land snail species Indrella ampulla and an endemic frog species Nasikabatrachus have been prepared.

Centre for Biodiversity and Conservation

Landscapes, Livelihoods and Conservation

The work of the Landscapes, Livelihoods and Conservation programme is focused on examining ecosystem processes across different types of landscapes (ranging from arid and semi-arid grasslands to savannah and moist forests). The programme is also involved in studying the different natural and social drivers that feed into and affect these processes.

COEXISTENCE OF MESO-CARNIVORES IN HUMAN-DOMINATED LANDSCAPES

This project in collaboration with the Centre for Ecological Sciences, Indian Institute of Science, Bengaluru, aims to identify patterns of resource use and movement for all meso-carnivore species across a landscape mosaic using a combination of very high-resolution Earth observation data and advanced GPS telemetry. The project aims to determine the ecological parameters and behavioural strategies that enable the occurrence of the Golden Jackal, Indian Fox and Jungle Cat in human-dominated systems. The data generated by the project allows researchers to model the fine-scaled movement strategies of meso-carnivores in modified landscapes, and determine the thresholds of tolerance to landscape change.

Project Outcomes:

Data from the various GPS collared animals is now greater than 110,000 locations, making it one of the largest telemetry datasets in India.

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A preliminary analysis of the data shows that, as expected, Indian foxes are the most habitat specialist, heavily dependent on native grasslands.

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Golden Jackals also show a high degree of habitat fidelity, but to heavily modified agricultural areas such as sugarcane plantations.

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The most adaptable of all the species seems to be the Jungle Cat which is found across all habitat types, including foraging on city roads.

ONEHEALTH TO RABIES RESEARCH IN INDIA

This Wellcome Trust/DBT India Alliance-funded project combines animal ecology, disease ecology and human health in a 'OneHealth' framework to understand rabies dynamics in India. With study sites spread across Karnataka, Maharashtra and Haryana, this project also aims to understand how rabies spills over or back from dogs to wild carnivores.

Project Outcomes:

As many as 750 dogs across the urban-rural gradient in Bangalore have been sampled. A total of 122 dogs have also been collared in Bangalore.

Large-scale quantification of dog population densities across the study sites in Bangalore has been initiated.

GPS collaring of 38 dogs was done in villages around Baramati and two dogs in the Solapur city in Maharashtra, where an ongoing project also monitors the movement of meso-carnivores to understand overlap and potential contact rates.

Rabies neutralizing antibody titres have been estimated for 371 canine (74 from Baramati, 67 from Solapur and 230 from Bangalore), 20 Fox, 07 Jackal and 08Ju ngle Cat samples to determine if the vaccination has resulted in sufficient immunity levels against rabies in dogs.

Working with ResQ Charitable Trust, Pune, tested over 120 dogs for rabies, of which 40 were confirmed positive. This indicates an ongoing epidemic of rabies in Pune city, which requires urgent action by civic and health authorities.

Above: Dr. Abi T. Vanak radio-collaring a Jungle Cat at his research site in Baramati. *© Abhijeet Kulkarni*

Left: Several free-ranging dogs have been radio-collared to study their movement and interactions with native mesocarnivores. *© Abhijeet Kulkarni*

Facing Page: A GPS-collared female Golden Jackal seen near its resting location in a Pomegranate farm. *© Anjan Katna*

DEADLY TICK-BORNE DISEASES IN INDIAN FOREST ECOSYSTEMS

This new research project, funded by a Medical Research Council (MRC) Foundation Award from the £1.5bn Global Challenges Research Fund takes a One Health approach to understand how and why a deadly tick-borne disease is spreading in forest ecosystems in India. This cross-disciplinary project brings together experts from multiple agencies in India and is being led by scientists from the Centre for Ecology & Hydrology (CEH). The project is focused on the potentially fatal Kyasanur Forest Disease (KFD). The geographical focus of the study will be the Western Ghats, a region of immense significance for both biological diversity and human livelihoods in India.

Project Outcomes:

First meeting held in November 2017. All team members have been vaccinated for KFD.

A pilot field visit is scheduled in March 2018 for which the requisite permits and necessary equipment and consumables are in the process of being purchased.

Potential sites for a field station are also being identified.

Above: Montague Harrier: Major determinants of Montagu's Harrier numbers are the availability of grasshoppers and rainfall. *© T Ganesh*

A POLITICAL ECOLOGY OF THE GREEN ECONOMY IN THE GLOBAL SOUTH

This collaborative project investigates green governmentality in ecotourism, carbon forestry, and climate-smart agriculture in selected cases from East Africa and India. The project develops a novel conceptual approach by combining Michel Foucault's notion of 'governmentality' (understood as the techniques and tactics of government) with theories of resistance, social agency and critical institutionalism.

This theoretical combination retains the potential to break new ground in environmental governance studies by combining a focus on power and authority with one on agency, rights, and institutions. The ambition is to develop an understanding of the interplay between structural power and individual agency as played out in the context of global economics and environmental change in the Global South. This project is being conducted in collaboration with the Norwegian University of Life Sciences (NMBU). Other collaborating institutions include University of Sheffield, UK, Institute of Research for Development, France, Institute of Development Studies, UK, University of Dar es Salaam, Tanzania, University of Wisconsin-Madison, USA, and the Oslo and Akershus University College of Applied Sciences, Norway.

Project Outcomes:

An assessment of the implications of the economic valuation of ecosystem services from tiger reserves was published in the Economic and Political Weekly in 2017. Tiger reserves are increasingly becoming sites for commodification through tourism and private investment in conservation.

A preliminary assessment suggests that the impact of economic valuation on people who live within protected areas is adverse due to the lack of institutional arrangements for participation in either the valuation or in accessing the benefits of commodification.

MIGRATING GRASSLAND RAPTORS: POPULATION CHANGE IN HARRIERS ACROSS SPACE AND TIME

Harriers are migratory raptors that roost on the ground in large numbers in tall grasslands. However, with the disappearance of grasslands in the country, the roosts of many of these birds are affected. The project, funded by the Department of Science and Technology, Government of India, attempts to identify such roosts from historical records and field visits, monitor their population in such roosts and track how the birds move at the individual and population level across the subcontinent. This information, which is expected to show how these birds use dynamic grasslands and scrub habitats in a human-dominated agriculture-grassland matrix, would have a bearing on conservation science.

The project has revealed a significant decline in the population of harriers in India, more significantly in the Rollapadu Bustard Sanctuary in Andhra Pradesh, which once had the second largest roost site in India. The project also identified lacunae in the monitoring of several ecological parameters which could help in understanding the impact of pesticide, grassland transformation, agriculture intensity, and what happens in their breeding grounds apart from socio-ecological drivers of change. In addition to its findings, the project also addressed the strict regulations in allowing advanced tracking devices to be fitted on animals to study migration.

Project Outcomes:

Completed documenting changes in Harrier counts across 6 sites, from Rajasthan to Tamil Nadu, over a period of 3 years.

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While the birds coming into western India seem to be fairly stable over the years, their dispersion across the Indian subcontinent is highly variable.

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The primary factors that appear to drive the movement of Harriers are rainfall at a regional scale and availability of roosting habitats at a local scale.

HUMAN-WILDLIFE INTERACTIONS IN DARJEELING-SIKKIM HIMALAYA

Human beings, in their environment, have always been interacting with the wildlife. These interactions are in the form of coexistence, subsistence, and recreation, or are bio-cultural in nature. However, some of these interactions take the form of conflicts. Additionally, the growing human population has consequences on human-wildlife interactions, which calls for changes in wildlife management. It is, therefore, important to document the historical and emerging human-wildlife interactions and understand and analyse them for creating informed interventions. ATREE's Eastern Himalaya offices, through three projects, have been working on human-wildlife interactions, focusing on the conservation of focal species and sustainable development in the human-dominated landscapes of Eastern Himalayas, specifically Darjeeling-Sikkim. The three projects in Darjeeling-Sikkim geographically cover three altitude zones comprising lowland subtropical forests, mid-hill temperate forests, and high-altitude temperate and subalpine forests. Representative species like the hornbills in the lowland forests, pangolins in the mid-hill forests, and the red panda in high altitude forests are being studied to understand the factors and dynamics influencing human-wildlife interactions in the region.

Project Outcomes:

Reported 65 species of wild edible fruits from Neora Valley National Park, Darjeeling, 45 of which made for dietary components of both the Hornbills (three species) and local communities. Five of these wild fruits species used by the Hornbills were reported to have high commercial value.

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Located three nest sites of the three Hornbill species, two of them outside protected area of Neora Valley National Park.

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Identified key challenges to sustainable nature tourism in Red Panda landscapes from the assessment of three protected areas in Darjeeling–Sikkim. Appropriate interventions, such as the capacity building of local nature guides and strengthening of interpretation, have been initiated in the Singhalila National Park. Project findings are being used in planning of tourism in Singhalila National Park by the Gorkha Territorial Administration, Darjeeling.

Project Outcomes Contd:

Assessed 11 tea plantations and private agroforests for Pangolin status, installed camera traps in three habitats comprising of private agroforests, tea plantations and forests in Darjeeling.

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Reported the abundance of Pangolins, burrow use patterns and burrow characteristics.

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Identified key threats to Pangolins including illegal trade and pocket areas for subsistence hunting and poaching. Mobilised and trained local community members as Pangolin guardians in tea plantations and private agroforests. These individuals monitor the species and raise awareness about conserving them in areas outside protected areas where the species do not afford legal protection.

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Initiated a policy dialogue with three key sectors of Forest Department, Tea Management and Block Division Administration to draft a `Conservation strategy for the critically endangered Chinese Pangolin in the human modified ecosystems of tea plantation and agroforests of Darjeeling Himalaya.

Above: Uprooting Prosopis juliflora to set up experimental plots. *© Chetan Misher*

Right: Field assistant collecting native fungi, eaten largely by the pastorals in the area. *© Chetan Misher*

THE BANNI GRASSLANDS IN A TIME OF CHANGE

The Banni grasslands of Kutch have been significantly transformed in the past few decades by *Prosopis juliflora*, an introduced nitrogen-fixing tree that has invaded almost half of Banni. To some, this exemplifies successful 'wasteland reclamation.' But *Prosopis* has replaced native trees and grassland, altered habitats for birds and animals, and reduced grazing areas for livestock. *Prosopis* has also spawned a parallel charcoal economy, profoundly affecting pastoralists' livelihoods and cultures.

In the process, it has created tradeoffs between charcoal-based livelihoods and pastoralist livelihoods, between carbon converted to charcoal and carbon sequestered, and between livestock and wildlife.

This project, funded by USAID's Partnership for Enhanced Engagement in Research (PEER) Programme, aims to develop a predictive understanding of the *Prosopis* spread with climate change and evaluate the extent to which it is possible to remove *Prosopis* and restore Banni's grasslands.

The project addresses questions such as whether it is ecologically feasible to restore these grasslands or has *Prosopis* transformed them irreversibly; also, whether it is socio-economically feasible to completely restore grasslands, or are charcoal-based livelihoods here to stay?To this end, the project is also developing a systems dynamics model of Banni that could serve as a decision support tool to share with stakeholders to evaluate alternative management options and their implications for the ecological and socioeconomic resilience of Banni.

Project Outcomes:

More than 50% of Banni has now been taken over by the introduced invasive tree, Prosopis juliflora, with consequences for people, livestock, and wildlife.

Charcoal from Prosopis has become a significant source of income, not just for Banni's non-pastoralists, but also for other communities from within and outside Banni.

There has been a shift in livestock composition over time, from herds dominated by Kankrej cows with a few buffalo, to herds dominated by Banni buffalo, with a few Kankrej cows. This is at least partly attributed to the animal's differential abilities to tolerate Prosopis juliflora.

Prosopis spread has also affected the distribution of wildlife—with generalist species such as the Golden Jackal better able to adapt to areas of dense Prosopis, with specialist species like the Desert Fox and Indian Fox restricted to the more saline, open habitats.

Above: Good rainfall induces good grass growth which supports a variety of migrant and resident birds in our grasslands. *© T Ganesh*

DELINEATING LINKAGES BETWEEN ECOSYSTEM SERVICES AND LIVELIHOODS

The vast rolling plains stretching to the East all the way to the Bay of Bengal from the foothills of the Western Ghats in Tamil Nadu's Tirunelveli district, comprises of hot and arid grasslands. Over the years, this landscape has shrunk because it is considered a wasteland, thereby easing its conversion into residential plots, industrial areas, tree plantations and paddy farms. There is growing evidence of how valuable grasslands are for local communities and how it supports biodiversity that provides ecosystem services, which in turn supports local livelihood.

The districts of Tirunelveli and Toothikudi are home to a community of traditional herders, Edaiyars— who now calls themselves Konars. They straddle between the two districts in search of pasture. This migration is significant for farmlands in the landscape too, since during the day while the sheep graze, their urine and pellets enrich the soil in fallow lands and reduce the usage of chemical fertilisers for cultivation. Farmers also pay for penning the sheep herds in their fields during nights.

Moreover, these grasslands house an astonishing diversity of plants that are typical to the semi-arid landscapes of southern India, and several large and small mammal species. These dry lands also support about 100 bird species, of which 65 are dependent on grasslands including several rare and migratory birds. Additionally, they also support several species of reptiles including the Scaly Gecko, rediscovered by ATREE researchers after 115 years, and the Fan Throated Lizard, a new species restricted to the dry lands south of Tamiraparani.

This study supported by the Royal Norwegian Embassy has the fallow field, dry farmland and grassland complex in the districts of Tirunelveli and Thoothukudi as its main area of focus. It comprises of a shrinking area of land that supports the livelihoods of grazing communities whose livestock depend on the grasslands for pasture. It also supports significant biodiversity that is unique to grasslands. These grasslands can be conserved by strengthening local communities to protect their grazing areas with governmental support. It is critical that these grasslands are notified as Meichalperamboke/ grazing lands and people are made aware of their legal rights over these areas.

Project Outcomes:

40% decrease in the extent of grasslands in Tiruchendur, Thoothukudi, and over 20% decrease in Radhapuram and Sathankulam taluks, in Tirunelveli and Thoothukudi respectively.

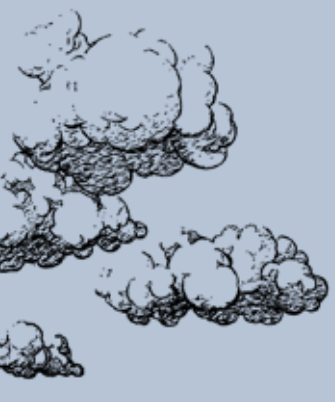
The drastic reduction of grasslands in some taluks of Tirunelveli and Thoothukudi is due to agricultural expansion, invasion of the exotic weed Prosopis juliflora, and urbanization.

In the Naguneri and Srivaikundam taluks, however there is a slight increase in grasslands which could be due to large expanses of land being converted to unoccupied housing plots by clearing Prosopis juliflora and other bushes.

Large expanses are also fenced off and not available for grazing to the Konars. It also prevents free movement of wildlife across the fenced off areas. There is a reduction in the grassland area, which has become small and patchy.

Most grasslands are now between 1 to 2 hectares (ha). There are very few large patches (> 10 ha) of grasslands left in the district.

The study recorded 10 mammal species and over 100 bird species. However, further fragmentation of the grasslands will in future affect the number of species recorded.
left in the district.



Centre for Biodiversity and Conservation

Ecosystem Services and Human Wellbeing

The programme focuses on understanding and communicating ecosystem services in regulated rivers and wetlands across India that are being managed for multiple uses. This programme also explores ecologically and culturally important ecosystem services in Sikkim that are sustained by plant-animal interactions and works towards a deeper understanding of ecosystem services from a human capability and identity dimension.

Above: Gharial in Gandak river floodplain. *© Tarun Nair.*

CHANSE: COUPLED HUMAN AND NATURAL SYSTEMS ENVIRONMENT FOR WATER MANAGEMENT UNDER UNCERTAINTY IN THE INDO-GANGETIC PLAIN

Rivers all over India are under pressure due to increasing water demands from agriculture, cities and industry. Climate change is expected to add to these stresses in complex ways. Until recently, water resources were managed without any explicit allocation for nature's needs, i.e. ecological flows in rivers for the survival of biodiversity, which in turn is linked to riverine ecosystem services such as fisheries. The field of 'ecological flows' is just emerging in India and there is an urgent need for well-defined measurable indicators that relate overall water management in regulated river basins to specific outcomes in terms of aquatic biodiversity and fisheries.

CHANSE is an Indo-UK collaborative project funded by the Ministry of Earth Sciences, Government of India, and the Natural Environment Research Council, United Kingdom. A major objective of the project is to link the management of the Gandak barrage (on the Gandak River, Bihar) and use of surface water (river and canal water) and ground-water use by farmers for irrigation, to the quality of habitat for endangered Gharial crocodiles, River dolphins and fisheries.

A first of its kind project in India, it combines rigorous hydrologic measurements and modeling with field ecological observations and measurements. It seeks to inform policy and management of similar barrages across the Ganga basin based on learnings from the Gandak River. ATREE's objective is to assess interactions between availability of ecological flows and water demand by multiple stakeholders.

Collaborating institutions in the CHANSE project include the Indian Institute of Technology (IIT-Bombay), Indian Institute of Science (IISc, Bengaluru), Indian Institute of Tropical Meteorology (IITM-Pune), T.M. Bhagalpur University (TMBU, Bhagalpur), the Imperial College of London (ICL), University of Exeter, UK and the British Geological Survey (BGS, UK). the Gandak river floodplain.

Above: Map of the Gandak basin.

Significant Project Findings:

Surveys were conducted in November 2017 and March 2018, for hydrological, fisheries and biodiversity data collection in two extreme flow conditions:

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In November 2017, all gates of the Gandak barrage were opened (canals were shut for maintenance) and the river water level was immediately upstream and downstream of the barrage. This was considered as a reference 'near-natural' condition for river flows

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In March 2018, nearly all gates of the barrage were closed, as water was let into the opened canals for irrigation. When the river had zero discharge from the Triveni barrage, specific sites of the river were surveyed. An assessment of the change in Gharial and Dolphin habitat availability and quality during this period was carried out.

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From November 2017 to March 2018, the reduction in river flow into the river translated into a net reduction of about 1.25 m in water levels. This altered the condition of alluvial sandbars, which are used by Gharials as nesting habitats.

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Nesting habitats appeared to have deteriorated in an important breeding site, which was correlated with river discharge reduction by almost 75% during this period.

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The response observed was an overall downstream shift in the distribution of both Gharials and River Dolphins barrage in March. Zero discharge from the barrage and intensive groundwater abstraction in March might have caused the deficit in discharge in spite of return flows from canals and groundwater contributions to river base flow.

ASSESSING ECOSYSTEM RESPONSES AND SOCIO-ECONOMIC IMPACTS OF ALTERED AND FREE-FLOWING RIVERS

India's rivers are being transformed and this transformation is likely to continue for the next few decades due to increasing demand for water abstraction and dams for agriculture, energy and drinking water requirements. The impact of these transformations on downstream ecology, biodiversity and ecosystem services was ignored while designing the projects. ATREE researchers, with support from the Royal Norwegian Embassy, have conducted studies in the Western Ghats and Gangetic plains to assess the impacts of altered river flows on biodiversity and ecosystem services.

Project Outcomes:

The project assessed and defined ecological flows for the Son river in Madhya Pradesh using experimental releases and measured downstream impacts on target endangered species.

The learning and knowledge gained from this pioneering pilot experiment helped raise awareness about the need to manage releases from dams and barrages to minimize ecological damage downstream.

The project generated evidence-based knowledge for future management of west flowing rivers in the Western Ghats based on monitoring of changing salinity and fresh-water regimes due to hydro-power dams and upstream abstraction in order to maintain biodiversity and ecosystem services of river-estuary ecosystems.

The project helped build a network of aquatic ecologists and conservationists in India, who were trained in the field of hydrology and river ecology. A post-doctoral scholar visited Norway for discussions and future collaboration.

Researchers associated with the project also raised awareness amongst the civil society and policy makers on the threat to aquatic biodiversity and ecosystem services arising from uninformed transformation of the rivers.

RHODODENDRON PHENOLOGY AND CLIMATE CHANGE IN THE SIKKIM HIMALAYA

Mountain floras are considered highly sensitive as its phenology is closely associated with ecological factors. There is an impetus to understand the role of phenology in ecology and evolution due to the growing concern around climate change. In particular, plant phenology has received enormous attention because of the potential for climate to alter the flowering timing and thereby the pollinator activity. This can have implications on the reproductive success of individuals and the long-term persistence of both the plant and pollinator populations. Impact of climate change can be profound in the Himalayan montane ecosystems, particularly the Eastern Himalayas, a world biodiversity hotspot. The rate of warming in the Eastern Himalayas and adjoining regions is reported to be significantly higher than the global average. Although phenology is one of the most reliable bio-indicators of climate change, so far there has been no attempt to study phenology in a systematic manner in this region.

In Sikkim Himalaya, Rhododendron species play a significant role as keystone species and form a dominant and speciose genus of different forest types across the elevation gradient. Rhododendron flowers are important ecosystem goods and are used by local communities for various purposes, including juice, wine etc. The Rhododendron festival in Sikkim is also a big tourist attraction and contributes

substantially to the regional and local economy. Therefore, it becomes critical to understand the implications of climate change on the species.

Rhododendron species show a variation in flowering timing and distribution along a large elevation gradient making it an ideal model species to understand climate change effects on phenology. This is the first time that the influence of phylogeny and abiotic factors on the reproductive phenology of the Rhododendron species is being studied. It is important to understand at what level the phenology of Rhododendrons is constrained by phylogeny, particularly to temperature and other abiotic factors.

Significant Project Findings:

Along the elevation gradient an overall decrease in the strength of the phylogenetic signal on various phenological events was observed.

It was observed that the strength of phylogenetic signaling of phenological traits sensitivity to the abiotic factors reduced from early events such as budding and flowering to later events such as fruits maturation and fruit dehiscence.

Later stages were more strongly associated with environmental variables and not constrained phylogenetically. This showed that the influence of abiotic factors and phylogeny tends to vary across different reproductive phenology

LIVING SPACES AS ENVIRONMENTALLY UNJUST PUBLIC GOODS: POLLUTION AND THE ASYMMETRICAL DISTRIBUTION OF PHYSIOLOGICAL AND PSYCHOLOGICAL AILMENT IN COASTAL-URBAN AND HILL-TOWN TAMIL NADU.

The project, funded by the Azim Premji University's Grants programme, is ATREE's first environmental justice study of Dalit and Adivasi well-being in polluted river contexts. Dalits and other working classes form a 'slum' precariat along Chennai's Cooum and Adyar rivers. These rivers suffer industrial, civic and domestic pollution. Living without

Above: ATREE researchers measuring flow velocity in the river. *© Tarun Nair*

Facing Page: Interviews with local fishermen to know about the impact of barrage operations on fisheries. *© Subhasis Dey.*

a land title near polluted rivers, the poor residents are disproportionately exposed to health and displacement risks. In the Nilgiris, the agro-pastoral Toda, though not a precariat (given land entitlements), are also affected by pollution of rivers that proximate their settlements. Factory effluence is the pollution source. This project sought to identify health risks and understand what it means to live near toxic waters in Chennai and Ooty.

Significant Project Findings:

The most significant outcome of social and ecological relief emerged in the Nilgiris.

Strategic collaboration with WWF (Coimbatore), who were also testing river samples.

Progressive coverage of the project and its final workshop by the print media, and a dedicated and dutiful district administration, together ensured that a recalcitrant gelatin factory treat its effluence.

The factory, Sterling Biotech, has for nearly two decades polluted with impunity. Grapevine has it that the factory may even shut down as waste treatment is expensive.

Gooseberry collection in Western Ghats.
© Jadeswamy

Community Conservation Centres

The Community Conservation Centres (CCCs) facilitate a two-way flow of knowledge between local stakeholders and researchers at ATREE. They act not only as field bases for doctoral research, but also provide a space for monitoring socio-ecological systems. The CCCs have been instrumental in reaching out to and building capacities of local community, community institutions, forest officials, environmental journalists and visiting students, including those participating in study abroad programmes.

The four Community Conservation Centres form an integral part of ATREE and conduct a host of activities with community participation, which include research, outreach, livelihood enhancing programmes, capacity building, education and building awareness. The CCCs have also been instrumental in providing policy-level interventions.

BILIGIRI AND MALAI MAHADESHWARA HILLS COMMUNITY CONSERVATION CENTRES

ATREE's first Community Conservation Centre (CCC) was established in the Biligiriranga Hills in 1992 by Prof. Kamaljit S. Bawa, a founding trustee of ATREE. One of the first projects in the region was the monitoring of Non-Timber Forest Products (NTFPs), an area of study that continues to be one of the mainstays of the Biligiri CCC (BCCC). Research on NTFPs and other forest fruits also led to a project in the Malai Mahadeshwara Hills, following which the Malai Mahadeshwara CCC (MMCCC) was established. Both these centres serve as forums for learning about the environment, which in turn enables the sustainable use of forest resources locally. The CCCs also conduct classes on alternate livelihood sources that can help in financially securing forest-dwelling communities. Other services offered by these CCCs include facilitating the implementation of the Forest Rights Act (2006), restoring critical wildlife corridors and providing scholarships to local students.

Lantana Craft Centre

The MMCCC established Lantana Craft Centres (LCC) as a response to the growing invasion of Lantana camara. The LCC conducted training at seven places and trained over 125 people in Tamil Nadu and Karnataka. As many as 60 families are gainfully employed and generating an income of Rs. 13 Lakh by making elephant statues out of Lantana.

Non-timber forest produce processing unit in Western Ghats. *© Siddappa Setty*

Implementation of Forest Rights Act

Joint efforts by BCCC, Zilla Budakattu Girijana Abhivrudhi Sangha, Taluk Soliga Abhivrudhi Sangha and Vivekanada Girijana Kalayana Kendra, helped obtain ten Community Forest Rights titles which were distributed in BRT Tiger reserve at Geerige Gadde village of Kollegal taluk in January.

The MMCCC team helped in securing individual rights and 25 Community Forest Rights approved by the District Level Committee (DLC) which benefitted around 800 families.

Marketing Forest Resources

Two decentralised Non-timber forest Products (NTFPs) value addition units were set up in BR Hills following the enterprise based conservation model. A Sangha was formed to sell products locally as well in the cities like Bangalore. To monitor the resources and estimate the production and extraction levels with participation from the community, a number of participatory resources monitoring methods were followed.

The NTFPs value addition unit in MMCCC, registered as a co-operative society, as part of the USAID project, now markets 15 NTFPs products. The MMCCC team also documented 123 species of wild edible plants and assessed the socio-economics, cultural importance, distribution pattern and conservation status of those species. Over five popular articles were published on Lantana crafts and wild edible plants The MMCCC team held two co-management meetings with the Soliga community and Soliga Abivrudhi Sangha, to develop a resource management plan.

AGASTHYAMALAI COMMUNITY CONSERVATION CENTRE

ATREE established the Agasthyamalai Community Conservation Centre (ACCC) in 2001 at the foothills of Agasthyamalai mountains in Tamil Nadu. ACCC follows a three- pronged strategy of environmental governance through relevant applied research, education and capacity building. ACCC conducts several research and outreach programmes inside the Kalakad Mundanthurai Tiger Reserve and in the human dominated landscapes outside the reserve.

Orientation Programme:

ACCC team conducted multiple orientation workshops for both national and international participants. Probationary officers from the Indian Forest Service and faculty from the Department of Environmental and Life Sciences, Sherubtse College, Royal University of Bhutan visited ACCC as part of the field visits organized by ATREE. The participants were informed about ATREE's long term interdisciplinary research and outreach work in KMTR, surrounding grassland and wetlands. As part of the program, the participants also learned about the role of community in conservation.

The participants were also informed about the successful multi-stakeholder managed religious tourism model developed by ACCC. Outside of the reserve, the participants were made to visit grasslands, rendered uninhabitable for several grassland dependent species and tribes like the Konars.

To demonstrate that conservation can be successful in `atypical' sites the participants were also taken to Thirupudaimaruthur Conservation Reserve, which has been established in a temple backyard to conserve fruiting bats and painted storks.

Significant Project Findings:

Landscape change analysis showed 40% decrease in the extent of grasslands in Tiruchendur, Thoothukudi districts and over 20% decrease in Radhapuram and Sathankulam taluks, in Tirunelveli and Thoothukudi respectively between 1991 to 2017.

Documented over 65 species of birds, 100 species of plants, 11 species of reptiles, 10 species of mammals and 57 species of dung beetles in the grassland.

The social survey revealed Proliferation of invasive species- The invasive species, Prosopis juliflora has been present in the region for as long as the interviewed herders can remember. However, in the past 10–15 years the herders witnessed an increase in Prosopis juliflora thereby creating a problem for animal grazing.

Physical obstacles on the migratory route and changing land use patterns - Fences have obstructed the migratory routes and rendered some seasonal grazing grounds unavailable to the sheep.

Roads, and in particular the national highways with heavy traffic, are also fragmenting the landscape and are seen by some herders as danger to their sheep.

The meichal peramboke (grazing commons) are being diverted to other land use. The herders not even aware about the meichal peramboke lands.

Temple lands which served as a main source for grazing have been given on lease to Tamil Nadu Newsprints and Paper Limited (TNPL) for raising pulpwood trees, posing severe threat to the herding profession and associated biodiversity in the grassland.

Faculty from Sherubtse College, Royal University of Bhutan. *© Mathivanan M*

Confluence of Arts and Ecology for Conservation – Workshop for Fine Arts College Students:

Agasthyamalai Community Conservation Centre (ACCC) and Field Learning Centre, along with KMTR, Tamil Nadu, Kalakad Mundanthurai Tiger Reserve, Tamil Nadu together organised a workshop on Confluence of Arts and Ecology for Conservation. Students from Mahabalipuram, Chennai and Kumbakonam fine art colleges attended the workshop which focused on how art can be used as a powerful medium for conservation. The participants were taken on a biodiversity trail following which they came up with nature themed artwork.

Workshop on Snakebite Avoidance and First Aid:

ACCC joined hands with Madras Crocodile Bank Trust (MCBT) and Tamil Nadu Forest Department to conduct a workshop on snakebite avoidance and first aid. Romulus Whitaker delivered a public talk at the District Science Centre, Tirunelveli. This was followed by a two-day workshop at the Kalakad Mundanthurai Tiger Reserve (KMTR) where 40 forest and fire department personnel involved in snake rescue along with NGOs from across the state were trained in effective outreach, public education and safe snake handling practices. One of the primary objectives of the workshop was to equip partner organizations with educational tools such as videos and

ATREE Researchers doing survey in forests in KMTR during Aadi amavasa festival. *© Ovee Thorat.*

Spot-billd duck with Chicks encounter during Tamiraparani Water Bird Count 2018. *© Dr. K.Muthu Narayanan.*

Romulus Whitaker delivering a public talk at the District Science Center, Tirunelveli on snake conservation and snakebite mitigation. *© Thamizhahagan*

Student with their leaf zoo art conducted durint World Environement Day 2017. *© Nellai Weekend Clickers.*

posters which they could integrate into their existing educational efforts.

Tamiraparani Waterbird Count 2018:

The 8th edition of the Tamiraparani Waterbird Count (TWC) was held in January. Over 70 volunteers participated in the annual event which was conducted across 50 tanks in Tirunelveli, Thoothukudi, Kanyakumari and Ramanathapuram districts. Local birds like Egrets, Cormorants, Coots, Stilts were spotted in good numbers as compared to the previous years. Birds like Spot-billed Duck, Common Coot, White Breasted Water Hen and Indian Moorhen were also spotted at various locations. Over the years, TWC has also become an annual citizen science event involving volunteers and members from the local communities. The data is collected by the participants, ATREE, and other conservation partners to assess the status of birds and habitats relevant to conservation of wetland birds.

World Environment Day 2017:

To celebrate World Environment Day 2017, ACCC, Manimutharu, Tamil Nadu Forest Department, Ambasamudram Division, District Science Centre, Tirunelveli and National Green Corps (NGC), Tirunelveli together organized a 'Leaf Zoo' competition for school students in Tirunelveli district. Around 750 students from 30 schools in Tirunelveli and Thoothukudi districts participated in the competition and collected a variety of leaves. As part of the competition the students were also able to learn about identification of plants, animal tracks and pug marks, scats and identification of butterflies.

On a Biodiversity Trail - Discover, Observe and Realize:

To celebrate Wildlife Week, ACCC, Manimutharu and Field Learning Centre of Kalakad Mundanthurai Tiger Reserve together organised a course titled `On a Biodiversity Trail: Discover, Observe and Realize' for school

Bellpins ATREE Conservation Leadership Awardee. *© P.C Thamizhazhagan*

students. In addition to a biodiversity walk, the students received hands-on training on butterfly watching, plant identification and tree climbing.

BELL PINS_ATREE Conservation Leadership Award 2017:
Bell Pins, a leading entrepreneur from the region, and ATREE together instituted a Conservation Leadership Award in 2016 to recognise the services of individuals, contributing to the conservation of the region's biodiversity and biological resources.

The 2017 BELL PINS _ ATREE Conservation Leadership Award was presented to Mr M. Segajothi, Secretary, Pasumai Iyakkam, Kovilpatti at the District Science Centre, Tirunelveli. The keynote address was delivered by Mr Kalidhasan from OSAI Trust, Coimbatore. Mr M. Segajothi, a retired school teacher turned conservationist, was awarded for the commendable work done by his organisation Pasumai Iyakkam in areas of conservation, awareness building, clean-up and plantation drives.

God Amidst Tigers - Campaign Towards Green Pilgrimage:
Of the numerous religious enclaves within Kalakad Mundanthurai Tiger Reserve (KMTR), the Sorimuthayan Temple (SMT) on the banks of River Karaiyar is the most famous. Every year, around the new moon day in July/ August, it attracts thousands of devotees. Since 2006, ATREE has been conducting studies on the impact of people on the ecosystem of the reserve and the social issues associated with the festival. In 2017 ATREE was invited to present its findings and recommendations in the planning meeting conducted by District Collectorate. Many of ATREE's recommendations were accepted by the District administration, Forest Department and Police Department. As part of implementation of ATREE's

Efficient service of public transport which reduced the private vehicles on the road during the Aadi Amavasa Festival at KMTR. *© Nayagam Kannan*

recommendations, private vehicles were restricted entry into the reserve on festival days and alternate public transport facilities were arranged by the Transport Department. This resulted in considerable reduction in road kills i.e., ten times lower than previous years.

Upscaling the Green Pilgrimage Campaign to Kurumalai Reserve Forest:

This initiative was based on the successful model developed for the Aadi Amavasai campaign at the Sorimuthianar temple festival in Kalakkad-Mundanthurai Tiger Reserve and marked ATREE's foray into the Kurumalai region as part of the upscaling the efforts. The Kurumalai reserve forest spans across a total forest cover of 12.48 kms. It was declared a reserve forest in 1980 and is an important habitat for Chital (Axis axis), Madras Hedgehog (Paraechinus nudiventris), Indian Peafowl (Pavo cristatus), Indian Monitor Lizard (Varanus bengalensis), several raptors and birds.

The annual Kurumalai Chithirai Vishu Festival at Poyyamozhi Ayyanar temple attracts several thousands of pilgrims every year. In 2017 alone, the festival attracted no less than 12,470 visitors, leading to an enormous burden on the local flora and fauna due to plastic littering, firewood collection from forests and open defecation in forests. ATREE conducted a survey on traffic, animal occupancy, vegetation and a social survey. Multiple awareness building activities were conducted for the visitors on impact of polythene and solid waste disposal. Polythene bags were replaced by cloth bags and were given to the visitors. This was the first ever initiative undertaken to reduce the adverse impact on the forest due to the festival at Kurumalai reserve forest.

VEMBANAD COMMUNITY ENVIRONMENTAL RESOURCE CENTRE

Vembanad Wetland Conservation Programme was initiated by ATREE in the year 2007 and led to the establishment of the Community Environmental Resource Centre (CERC) at Alappuzha, Kerala. Since its inception, CERC has identified and developed the capacity needs and institutional networks for participatory integrated management of heavily used landscapes. This CCC instils democratic principles in the conservation of the Vembanad wetland system through a multi-stakeholder, interdisciplinary approach. ATREE's conservation-oriented field interventions aim to mitigate pressures from unsustainable use of resources, invasive species, and climate change.

Upcycling Project to Address Waste Management:

CERC along with Muhamma Grama Panchayath organized an upcycling training programs for 40 women in Muhamma. The project aims to empower rural women by creating alternatives to plastic and helps them manage large amounts of cloth waste that is being generated. As part of the project, school students are involved in cloth collection and in return they are rewarded with a cloth bag. The participating women have formed a Self Help Group and started commercial production.

Clam Relaying for Enhancing Clam Resources:

The CERC, along with the State Fisheries Department, CMFRI, WWF, Clam Cooperatives, and the Samyuktha Kayal Samarakshna Samithi (Federation of Lake Protection Forums) implemented a project to secure baby clams and ensure their sustainable harvesting/collection. The Southern area of the lake faces illegal baby clam collection which adversely affects resources. The project aims to relocate the baby clams from the northern part of the wetland to southern areas. Around 30 tons of baby clams were re-laid last year. The evaluation showed positive results. Going forward, CERC expects to relay around 40 tons of baby clams.

Clam relaying. *© Ashish Mathew George*

Value Addition to Clams for Sustainable Livelihood:
Traditionally, the clam meat is sold to middle men and the clam collector gets paid a much lower price than the market rate. The value addition in clam sector is very low. The CERC team has been working towards changing this situation. A three-day training program was organised for the clam collector families at CIFT Kochi to make value added products like cutlets, meat rolls, vadas, and pickles. The group facilitated the formation of a SHG which is already engaged in making and selling the products at various events and plans to scale up operations. The CERC is also working towards promoting hygienic clam processing in this area.

Mandala Plastic Cleaning Campaign:
The 7th annual Mandala plastic cleaning campaign was held from November to February in four Panchayat areas around Vembanad Lake. A total of 76 sacks of plastic and other non-degradable waste was collected from the lake. The campaign was widely supported by clam collectors and fisher-folk who collected the plastic waste. Every year, plastic waste is used to lay Panchayat roads. The Directorate of Environment and Climate Change, Government of Kerala, has also extended its support to the campaign.

World Wetlands Day Celebration:
On World Wetlands Day, CERC organised a policy level panel discussion on Ramsar Convention's theme, 'Wetlands for Sustainable Urban Future' at Mangalavanam, Kochi. The panel discussion focused on conservation and sustainable management of Cochin's

Celebrating World Wetlands Day. *© Sanju Soman*

wetlands under the theme of 'Wetlands for Kochi's Sustainable Future'. The panel highlighted the services provided by wetlands to urban lives and stressed on the need to strengthen existing policies. The panel discussion was followed by a poster and a photo exhibition. The event was supported by the Department of Environment and Climate Change, Government of Kerala.

World Environment Day Celebration:
CERC, Institute for Climate Change Studies and Kerala Language Institute, together celebrated the World Environment Day in Alappuzha. The event was inaugurated by Dr. Thomas Issac, Minister of Finance, Government of Kerala. Jennifer Daubeny, Consul General of Canada, delivered the keynote address. A two-day exhibition and sale of books on environment was organized as part of the program. As many as 10,000 saplings were also planted by children and the fisher folk to mark the celebrations.

Conservation Education Program:
CERC in partnership with WIPRO, rolled out a new project on habitat learning across ten Jalapaadom schools in the Vembanad region. The program facilitates `learning about the environment, through the environment and for the environment'. A host of activities including teacher workshops, student workshops, summer camps, and student's wetland congress were conducted as part of the programme. Going forward the CERC aims to scale up the program and also include other Ramsar sites in Kerala.

Coursework on Environmental Governance:
ATREE CERC co-organised a course on 'State and civil

Noragric students interacting with fishermen. © *Ashish Mathew George*

societies in development and environmental governance in Vembanad, Kerala, for post-graduate students of Department of International Environment and Development Studies (NORAGRIC), Norwegian University of Life Sciences (NMBU). NORAGRIC has extended the MoU for three more years and CERC will continue to conduct this course.

Environmentally Conscious Tourism:

Recognizing the efforts of the community in Vembanad towards lake and resource conservation, the National Geographic Society (NGS) initiated responsible and inclusive tour packages in collaboration with the Samyuktha Kayal Samarakshna Samathy. As many as 14 groups visited Vembanad and witnessed the conservation initiatives practiced in the wetland. A share of the profits generated through this venture will be directed towards setting up fish sanctuaries in the lake.

World Water Day Celebration:

ATREE CERC celebrated the World Water Day at St. Joseph's College for Women, Alappuzha. The talks and panel discussion focused on the theme 'Nature for Water'. The technical session was led by Dr. Priyadarsanan Dharma Rajan, Senior Fellow ATREE who spoke on `Water!: Conserving the Elixir of Life for Sustaining Life on Earth'. Dr. K.V. Jayachandran, Convener Cochin Chapter, Indian Science Congress Association (ISCA) spoke on 'Towards Conservation and Water'. The panel discussion was moderated by Dr. K.V. Jayachandran.

Gorkhay Village. *© Rinzi Lama.*

ATREE Eastern Himalaya / Northeast India Initiative

FACULTY:

Dr. Sarala Khaling (Regional Director), Dr. Sunita Pradhan

An ATREE initiative to help the region of Eastern Himalaya/ Northeast India develop multi-functional landscapes where biodiversity is protected, ecosystem integrity is maintained and the wellbeing of its people is promoted.

INTEGRATED APPROACHES TO ENHANCE LIVELIHOODS SUSTAINABILITY OF COMMUNITIES IN THE FRINGE AREAS OF MANAS TIGER RESERVE (MTR), ASSAM

The project, funded by Karl Kubel Stiftung, is a step towards conserving the rich biodiversity of Manas, Assam, through positive community interactions and sustainable development. The project aims to enhance livelihood sustainability of local communities, dependent on the resources of Manas through institutional development, climate-smart sustainable agriculture practices, and mitigation of human wildlife conflicts. The project team has collaborated with universities, training institutions, government departments, local councils like Village Council Development Committee (VCDC), environmental organisations, local and regional NGOs, resource persons, and experts to work towards the sustainable development of local communities and conservation of Manas' rich biodiversity.

Various local institutions like Eco Development Committees (EDC), Self Help Groups (SHG), Farmer's Groups (FG) and local NGOs have been formed and/or strengthened by the project. These institutions provide local communities with a platform to plan and execute development and conservation interventions. The project has paved the way for the introduction of sustainable and climate friendly agricultural practices and the mitigation of crop depredation by wildlife, which leads to economic loss and food insecurity. The project also supports alternative livelihoods, such as horticulture (especially fruits), apiculture, mushroom and medicinal plants cultivation, for communities in areas with intense crop depredation by wildlife. Conservation volunteers and local unemployed youth were also supported by the project to be entrepreneurs, thereby sustaining their livelihoods.

Project Outcomes

Formed and strengthened eight Eco-Development Committees (EDC) that helped Manas National Park's administration materialise eco-development activities in the fringe villages of the protected area. With EDCs bringing villagers, Forest Department and other allied institutions together in efforts to conserve and sustainably develop Manas, incidents of poaching in forest areas have become rare. The relations between local communities and the park authorities have strengthened.

Supported the construction of 12 watch towers along the seven-km stretch of the forest-village boundary in the park's Bansbari Range. These watch towers allow villagers to monitor incoming wildlife from a safe distance and serve as a resting space for frontline forest staff during their patrols along the forest boundary.

Supported local communities to create a bio-fence by developing citrus and sijou (*Euphorbia splendens*) plantations along the park's boundary.

Supported the formation of community-based monitoring and redressal groups in the villages to monitor and pilot community-based strategies for addressing the damage caused by wildlife. These groups also advocate for timely compensations to those affected by wildlife raids.

Supported local youth for entrepreneurship development in areas of woodcraft and becoming nature guides.

Exchange of knowledge and experience betwen farmers of Senchel and Singalila. *© Amal Deka.*

MANAGING INDIA'S FORESTS FOR BIODIVERSITY AND HUMAN WELLBEING IN THE FACE OF GLOBAL CHANGE

This project focuses on forests in two contrasting biodiversity hotspots of India; the Western Ghats and the Eastern Himalayas. The project addresses three areas: (a) increasing incomes of the forest dependent communities through improved management of agriculture and Non-Timber Forest Product (NTFP) species, (b) introducing innovations in fuel wood management, and (c) strengthening systems of forest resources management. The work in the Eastern Himalayas is being carried out in two protected areas in Eastern Himalayas: Singalila National Park (SNP) and Senchel Wildlife Sanctuary (SWLS). Changes in forest cover in these two areas have been correlated to radical alterations in peoples' interactions with forests, including changes in land use and land cover; population growth and demographic change; technological developments; growing economic integration of rural and urbanizing areas and apparent changes in local and regional climate regimes.

In the current project, the Eastern Himalaya component has been focusing on documenting the changes in climate and land use pattern. The nature and magnitude of these changes has not been well understood since these changes are occurring rapidly in large and diverse area and the causal relationships and influences driving them have not been elucidated. With the aim of understanding the drivers, the project is focused on improving the resilience of agro-ecosystems to mitigate climate change and biodiversity loss by strengthening systems of forest resources management, enhancing and restoring biodiversity in agricultural systems, increasing carbon sequestration and carbon stocks, reducing inputs of chemicals in agro ecosystems, and decreasing use of fuelwood, and enhancing rural incomes through sustainable livelihood opportunities.

Understanding Improved Cooking Stove (ICS) as a climate change mitigation measure. *© Rinzi Lama*

Mr Nirmal Rai, a progressive farmer, explaining the climate smart agriculture interventions that he has adopted. *© Beauty Nazary.*

Project Outcomes:

Demand for fuel wood continues to be high, especially in SWLS and SNP which is surrounded by settlements and growing peri-urban areas. The villages have households that still use fuel wood. Fuelwood use assessment has been conducted in Forest and Revenue villages and peri-urban areas. As many as 418 Improved cooking stoves (ICS) have been installed in 2017-18, bringing the total number of ICS installed to 920. This has reduced fuelwood consumption by an average of 35% to 45%. A total of 242 households have benefitted from improved energy service due to USG assistance and organized into two micro-enterprise groups/promoters that have scaled up ICS in non-project sites (200 ICS).

There has been a significant improvement in the productivity of agricultural crop. Through agroforestry and plantation activity, forest cover has been increased and forest quality has improved in 10 ha of land. ATREE negotiated with the Forest Department to conduct plantation/restoration activity in 5 ha of degraded forest land which was completed in the month of June 2017.

Training the people in climate smart agriculture has enhanced agricultural practices and output. Multiple trainings have been conducted in crop rotation, composting, green manures, terrace management, and multi-cropping. This year, there has been an improvement in average productivity of potato by 8.45%, pea by 31% in four villages and radish and cabbage by 1.18% and 14.6% respectively. There has been a reduction in usage of chemical fertilizers in four villages by 50%-60% and usage of pesticides has gne down by 86%.

Community managed tourism has successfully extended to one more project village in SNP. Initial steps have been undertaken to institutionalise two more villages at SWLS engaged in individual home stays. Further, under off-farm livelihoods, 503 households have diversified agriculture products and there has been a 4% -20 % increases in the household income from livelihoods diversification.

To mitigate crop depredation by wild animals, ATREE mobilised the community of two villages at SNP to include fencing work in the Annual Action Plan and carried out MGNREGA convergence work with the Forest Department. The labor cost would be provided by MGNREGA and material cost like barbed wire and wooden posts for the fence would be provided by the Forest Department. This implementation work has been initiated since January 2018.

Various events were held for outreach and knowledge dissemination:

Aligning with 2017 International Day of Forest's theme, 'Forest and Energy', ATREE organized an orientation and demonstration fair for Improved Cook Stoves (ICS) at Simkuna Sai High School, Third Mile, Darjeeling.

Project Outcomes:

Over 30 farmers from seven villages located around Singalila National Park and Senchel Wildlife Sanctuary, Darjeeling, met in Sepi Village to share their knowledge and observe Earth Day 2017, focusing on the theme 'Environmental and Climate Literacy'.

Focusing on the theme of International Biodiversity Day 2017, 'Biodiversity and Sustainable Tourism', ATREE Darjeeling organised a perspective building panel discussion on 'Current trends of tourism and its impact on biodiversity in the Darjeeling Himalaya' in collaboration with the Tourism Department, Gorkhaland Territorial Administration (GTA), Darjeeling.

CAPACITY BUILDING AND CITIZEN SCIENCE INITIATIVES

Over the past year, the Eastern Himalaya Regional Office has continued to promote citizen science initiatives in the Northeast region. In May 2017, we began working on a project funded by "Assam Project on Forest and Biodiversity Conservation Society (APFBCS)" titled Assam Biodiversity Portal (assambiodiversity.in). The aim of this project was to build a biodiversity portal for the state of Assam. ATREE's role was to popularize the platform and conduct awareness programs to garner participation. This involved organising a state level inception meeting, five regional meetings, 17 district workshops, three `Explore with Experts' events and orientation programs in 35 colleges and universities in addition to a number of smaller events. The team also designed and distributed posters, banners and brochures, published a video on social media and placed an advertisement in a local newspaper. Over 5,000 people have participated in the outreach events, 3,000+ users signed up on ABP and 10,000+ individual observation records have been aggregated till date. We also supported the Northeast Butterfly meet in Dzongu and the Ziro Butterfly meet in Pange Valley.

SPECIES AND ECOSYSTEMS IN HUMAN DOMINATED LANDSCAPE

Protected Areas (PAs) are cornerstones for biodiversity. The role and importance of human modified and dominated landscapes such as agroecosystems, monoculture plantations remnant forests and water bodies, in biodiversity conservation and species persistence, are increasingly being highlighted. However, despite the importance of these landscapes in biodiversity conservation, they do not fall under any targeted conservation policies. The legal protection afforded by some of the threatened species is also inadequate. The human dominated landscapes are dynamic and complex, management of which require multiple strategies for innovative and appropriate conservation approaches. "Species and Ecosystem in Human Dominated Landscapes" is a developing program at ATREE, Eastern Himalaya (EH), which will contribute to the management of human modified and dominated landscape with conservation goals for species, their critical habitats and human welfare in EH. The program will operate under four broad themes of Research, Outreach, Implementation and Policy advocacy, Capacity Building and Partnership.

Project Outcomes:

Project Tourism in Red Panda Landscape: Identified key challenges to sustainable nature tourism in Red Panda landscapes and assessed three protected areas in Darjeeling–Sikkim. Appropriate interventions, such as the capacity building of local nature guides and strengthening of interpretation, were initiated in the Singalila National Park. The findings of the project are being used in building strategies and an action plan for sustainable tourism in Singalila National Park.

Strengthening Interpretation in Singalila National Park, Darjeeling: Developed interpretation material (photographs) which was shared with the Forest department for their Interpretation Center in Singalila National Park.

Conservation of the Chinese Pangolin in Areas Outside Protected Areas: Assessed 11 tea plantations and private agroforests for Pangolin status and installed camera traps in three habitats comprising of private agroforests, tea plantations and forests in Darjeeling.

ABP Workshop participants documenting biodiversity in Dhubri, Assam. *© Rohit George*

ABP workshop participants documenting biodiversity in Majuli, Assam. *© Rohit George*

Reported the abundance of the Pangolins, burrow use patterns, and burrow characteristics. Identified key threats to Pangolins including illegal trade and pocket areas for subsistence hunting and poaching. Mobilised and trained local community members as Pangolin guardians in tea plantations and private agroforests. These individuals monitor the species and raise awareness about conserving them in areas outside of protected areas where the species does not afford legal protection. Worked closely with the Forest Department and other line departments on training and empowering the Pangolin keepers and other local stewards for conservation initiatives and management.

Scaling new heights: students learnt the single rope technique to access and study forest canopies. *© S.Thalavaipandi*

Academy for Conservation Science and Sustainability Studies

ATREE's Academy for Conservation Science and Sustainability Studies offers a doctoral programme which is recognised by Manipal Academy for Higher Education (MAHE), Karnataka. The Academy generates interdisciplinary knowledge to address environmental concerns in a sustainable and socially just manner.

47 — PhD Students

20 — Faculty

02 — PhD Degrees Awarded

35 — Public & Internal Talks

14 — PhD Pre-submission/Synopsis Presentations

43 — Students from Forest Research Institute visited ATREE

51 — Interns

The Academy invited applications for the academic year 2017-18 and received 147 applications for the PhD programme. The applications were received from a wide gamut of disciplines and institutions including London University, Mumbai University, Tata Institute of Social Sciences, Mumbai, Delhi University, Kolkata University and Anna University among others. Out of the 147

candidates who applied for the programme, ten students were enrolled in the 2017 batch after being evaluated on various parameters and a two-stage interview process.

The doctoral programme integrates natural and social sciences in its teachings and provides a platform for innovative research which bridges links between the environment and society. The programme fosters critical thinking and leadership through a multidisciplinary coursework coupled with field studies. Research conducted by the PhD scholars at the Academy is diverse. Their research themes include identifying priority areas of conservation, analysing the responses of socio-ecological systems to climate change, understanding interactions between forests, soil and water in various ecosystems, the role of ecosystem services in livelihoods and human wellbeing, and analyses of conservation policies such as the REDD+ programme and India's Forest Rights Act (2006).

ATREE's PhD scholars conduct research at field sites spread across the country, covering the grasslands of Gujarat, river systems of Bihar, coastal regions of Odisha, Trans-Himalayan landscapes and the Deccan Plateau. Additionally, ATREE's four Community Conservation Centres and the Eastern Himalayan Initiative, along with RAMBLE (Research and Monitoring in the Banni Landscape), a field station in Kutch, Gujarat, anchor the research conducted by the scholars. The PhD scholars have received several awards and fellowships and have published numerous peer-reviewed and popular articles.

Introduction to filed equipments for PhD students by Dr. T Ganesh.
© S Thalavaipandi

Coursework and Training

Coursework at the Academy spans three semesters and includes courses that are structured to instill a sound understanding of various natural and social science disciplines. ATREE's multidisciplinary Fellows mentor the PhD scholars and together they have made significant contributions in the field of conservation science and sustainable development.

PhD Scholars

ATREE's PhD scholars have an academic grounding in a range of disciplines including climate science, economics, sociology, wildlife science and ecology. The Academy provides its PhD scholars a five-year fellowship and a contingency grant.

Awards, Grants and Recognitions

Madhuri Ramesh received RNE and Edda Sehgal travel grants to attend conferences and interact with the faculty in Norway and Netherlands.

Venkat Ramanujam received a six-month funding support from the DST Centre for Policy Research, Indian Institute of Technology, Delhi, for the project titled Monocultures and Systemic Risk, co-led by Dr Richa Kumar, Assistant Professor, Department of Humanities and Social Sciences, IIT Delhi.

Kadambari Deshpande Received the Inlaks Ravi Sankaran Fellowship – small grant, for the period 2017–18, to conduct PhD work.

Vikram Aditya received Wildlife Conservation Trust (WCT) Small Grant for Conservation of Endangered Species and their Habitats in June 2017.

Annesha Chowdhury received a scholarship for young scholars from the Human Development and Capability Association, to attend the Human Development & Capability Association (HDCA) Conference in Cape Town, South Africa in September, 2017.

Kadambari Deshpande received a fellowship from the Sense Organs, Nerve systems, Behaviour, and Communication (SNAK), Ph.D. School at the University of Southern Denmark towards the summer course fees.

Vidyadhar Atkore was awarded a travel grant from ATREE to visit Centre for Ecological and Evolutionary Synthesis, University of Oslo, Norway in December 2017.

Roshni Kutty received Edda G Sehgal Travel Grant to attend a workshop at the King Mongkut's University of Technology Thonburi, Bangkhuntien, Bangkok Thailand.

The following students received their PhD degrees this year:

Shivani Agarwal (batch 2011)
Thesis: Impact of institutions on land cover change and landscape fragmentation in an Indian dry tropical forest landscapes.

Vidyadhar Atkore (batch 2009)
Thesis: Drivers of fish diversity and turnover across multiple spatial scales: Implications for conservation in the Western Ghats, India.

Top: Students explore and make natural history observations across the gradient of eco system in KMTR. *© S. Thalavaipandi*

Above Left: Students from 2017batch learn the basics of vegetation sampling from Dr. R Ganesan. *© S. Thalavaipandi*

Above Right: ATREE hosted the 2016-2018 batch of probationers from the Indira Gandhi National Forest Academy *© Aditya Harikrishnan*

Talks@ATREE

The Academy brings together bright minds to deliver weekly talks on a wide range of subjects that trigger both insights and empathy and provoke conversations that matter. Over 35 public/internal talks were organised by the Academy in addition to film screenings and a theatre session.

ATREE WORK SEMINAR 2017

WHEN
2nd-4th August 2017

WHERE
ATREE, Bengaluru

Royal Enclave, Sriramapura, Jakkur Post
Bangalore 64

At the AWS, ATREE faculty, students, research associates and representatives of our community conservation centres (CCCs) discuss research, policy and outreach activities, results, and proposals. Dissemination to, and feedback from, the entire ATREE community are the major objectives of the AWS.

To know more, visit
aws.atree.org

Celebrating 20 years of ATREE

HIGHLIGHTS

PLENARY LECTURES (open to all!)
Aparna Sundar
Rohit Naniwadekar

TALKS AND POSTERS
By ATREE fellows, students, CCC representatives, and RAs

PRE-SEMINAR WORKSHOPS
Exciting choice of full-day and half-day workshops on 31st July - 1st Aug

FOCAL THEME
Long-Term Monitoring Research (LTMR) at ATREE, its vision, milestones, achievements, and future

Dr. Amita Baviskar, Dr. Kartik Shanker and Dr. Siddhartha Krishnan release the AWS 2017 conference proceedings.

Garima Parasher talks about the long-term rainfall trends in the mid-elevation wet evergreen forests of KMTR at AWS 2017.

Daniel and Kim from Common Studio talk about their collaborative work with ATREE on approaching the urban wastewater problem through design thinking at AWS 2017.

ATREE WORK SEMINAR (AWS)

The Academy organised the ATREE Work Seminar (AWS) from August 02nd – 04th, 2017. Held every alternate year, AWS offers a platform for faculty, students, research associates (RAs), and representatives from Community Conservation Centres (CCC) to disseminate and discuss their achievements, work findings, and potential work proposals with the entire ATREE community.

AWS 2017 featured three broad themes: Eastern and Western Ghats, Social Environment and Development and Himalayas and Grasslands & Semi-Arid Landscapes. As many as 56 abstracts were submitted across different formats (poster, short talks and long talks). AWS 2017, for the first time also featured talks delivered by the faculty.

A Panel Discussion at the AWS workshop

Certificate Courses and Training Programmes

- Open Data Kit (ODK) Training Programme: The Academy organized a course on the use of Open Data Kit (ODK) – a free and open source tool that is designed to create, collect and manage field data by creating spatial and non-spatial forms. The course was conducted to introduce users to the principles, structure of the ODK platform, form design, customisation and server configuration. A total of 36 participants attended the course which was co-organised with Google Earth Outreach

Systems Thinking & Modelling for Sustainability Research:

- The Academy offered a certificate course in Systems Thinking & Modelling for Sustainability Research which was attended by 17 participants from across the country. The course provided a hands-on experience of systems thinking and system dynamics modelling for sustainability research, using STELLA software. A report on this course can be found on the International System Dynamics Society website.

- As part of the Indian Forest Service's NGO attachment programme, ten probationers from the 2016-18 batch of Indian Forest Service visited ATREE. The probationers were given an overview of ATREE's work across the country during their visit to the ATREE office in Bangalore. This was followed by a 3-day field visit to Agasthyamalai Community Conservation Centre at the Kalakkad Mundanthurai Tiger Reserve (KMTR). The forest officers were informed about ATREE's interdisciplinary research and outreach work in KMTR, the surrounding grassland and wetlands.

- A workshop on Plant Ecophysiology - "Plastic Plants" was organised at ATREE. The workshop included a series of lectures and demonstrations on the methods employed in studying plant ecophysiology by Dr Sonali Saha (Miami-Dade College, Florida) and Ankila Hiremath (ATREE) with assistance from senior PhD students at the Academy.

GEO FOR GOOD USER SUMMIT

Geo for Good Summit is a training workshop conducted by Google Outreach team at Google Inc. Mount. View, CA. Google trains users on their geospatial and data tools like Google maps, Google Earth/Engine, Open Data Kit suite of software and other data tools like Fusion Tables etc. These sessions are divided into 4 different groups (GIS/ RS engineers, Geospatial Data Managers, Information Technology professionals and other end users from Non-profits/research institutions).

Shiva Subramanya.S, Web/Database coordinator, ATREE, made a partner panel presentation of a use case of Open Data Kit data collection suite of tools. The use case was about the application of ODK Suite of tools for the project "The Participatory Assessment of the Regional Distribution of Exotic Species in India". The spread/occurrence of invasive species across 60 plus, 10x10 km grids, spread across the Nilgiri landscape in Southern Indian states of Karnataka, Tamil Nadu and Kerala were documented using the ODK Collect application. The data was centrally managed on an ODK Aggregate server hosted at ATREE. The use case also highlighted the data collection techniques, survey methods and the data visualization patterns using the ODK suite of tools. Muneeswaran Mariappan, Coordinator, Ecoinformatics Lab, ATREE, also presented a partner talk on application of Google Earth Engine API for mapping forest cover in the Western Ghats region of southern India.

Shiva Subramanya S. and Muneeswaran Mariappan have been designated as trainers for various Google Geo tools like ODK, Google Earth Engine, Google Maps etc. ATREE is a partner institution with Google Outreach Programme with access to Google Voyager platform.

Shiva Subramanya S giving partner talk at Google Geo4Good Summit 2017 at Google Inc. Mt. View, CA

PUBLICATIONS

1. Home C, Pal R, Sharma RK, Suryawanshi KS, Bhatnagar YB, Vanak AT. 2017. Commensal in Conflict: Livestock depredation patterns by free-ranging domestic dogs in the Upper Spiti Landscape, Himachal Pradesh, India. Ambio. doi:10.1007/s13280-016-0858-6

2. Ramesh, M. and Rai, N. 2017. Trading on conservation: A marine protected area as an ecological fix. Marine Policy 82: 25–31.

3. Ramanujam, R Venkat 2017. Forest rights in Baiga Chak, Madhya Pradesh, Economic and Political Weekly, Vol. No. 52, Issues 25 & 26.

4. Atkore, V, Kelkar, N, Krishnaswamy, J 2017. Assessing the recovery of fish assemblages downstream of hydrological barriers in India's Western Ghats. River Research and Applications. https://doi.org/10.1002/rra.3163

5. Krishnaswamy, J, Kumar, M, Kelkar, N, Nair, T, Atkore, V. 2017. Moving from requiem to revival: India's rivers and riverine ecosystems. Pp. 94-103. In: Hiremath, A, Rai, N, Siddhartha, A (eds.) Transcending boundaries: reflecting on twenty years of action and research at ATREE. ATREE, Bangalore.

6. Marathe, A. and P. Dharma Rajan, 2017. "Quantitative Inventories of Ants from India: Gaps, Prospects, and Recommendations." Current Science (accepted)

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8. Home, C., Y.B. Bhatnagar, A.T. Vanak. Canine Conundrum: domestic dogs as an invasive species and their impacts on wildlife in India. Animal Conservation. doi.org/10.1111/acv.12389.

9. Aditya, V. & T. Ganesh (2017). Mammals of Papikonda Hills, northern Eastern Ghats, India. Journal of Threatened Taxa 9(10): 10823–10830; http://doi.org/10.11609/jott.3021.9.10.10823-10830.

10. Ramesh M. and Shanker K. 2018. From fishe? to flagship. Seminar 702: 37-41 (https://goo.gl/e76kmQ).

11. Muralidharan, R. (2018). Entangled lives of dolphins and fishers. Seminar 702: 62-65 (https://goo.gl/xJ3hdd)

12. Marathe, A., and D. R. Priyadarsanan. 2018. Quantitative inventories of ants from India: gaps, prospects and recommendations. Current Science 114:861-867.

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POPULAR ARTICLES

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- Kelkar, N. 2017. Save the Ganga, Sully the Ganga. The Indian Express Eye Sunday Magazine, April 23 2017.

- Ganesh, T., Prashanth, M.B., & Aditya, V. (2017). Exodus at Rollapadu. Down to Earth 31 May 2017. http://www.downtoearth.org.in/news/exodus-at-rollapadu-58001.

- Chintan Sheth, &Anirban Datta-Roy. (2017, December 21). Earthquakes in Tibet have triggered massive landslides darkening the Siang River. The Arunachal Times. Retrieved from https://arunachaltimes.in/index.php/2017/12/21/earthquakes-in-tibet-have-triggered-massive-landslides-darkening-the-siang-river/

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- Chintan Sheth, & Anirban Datta-Roy. (2017, December 22). Earthquakes in Tibet are Behind the Mysterious Darkening of Arunachal's Siang River. Retrieved 11 January 2018, from https://thewire.in/207431/arunachal-pradesh-siang-river/

WORKSHOPS ORGANISED OR ATTENDED BY PHD SCHOLARS

1. Chandrima Home attended a workshop on: Pedagogy and Science communication held at Centre for Ecological Sciences, Indian Institute of Science.

2. Madhuri Ramesh presented sections of her Ph.D. work at two conferences in the Netherlands;

   • The Value of Life: Measurement, stakes, implications organised by the Wageningen University (28-30th June)
   • People and the Sea: Dealing with maritime mobilities, organised by the University of Amsterdam (5-7th July).

3. Jyoti Nair attended the Oslo Summer School in Comparative Social Science Studies 2017 at the University of Oslo, Norway.

4. Ovee Thorat organised a workshop at SCCS (Student Conference on Conservation Science), Bengaluru with Dr. Rajkamal Goswami. The topic of the workshop was 'Social Science Methods in Conservation Science.'

5. Kadambari Deshpande participated in a Ph.D. summer course in Acoustic Communication, organised by the University of Southern Denmark.

6. Nachiket Kelkar chaired a session on 'Biogeography of Rivers' at the International Biogeography Society conference, Bangalore.

7. Aniruddha Marathe conducted a workshop at SCCS 2017 on `Exploratory Data Analysis'.

8. Annesha Chowdhury attended the HDCA 2017 conference on `Challenging Inequalities: Human Development and Social Change" held at Cape Town, South Africa.

9. Vikram Aditya, an alumnus of the Conservation Leadership Programme (CLP), organized the `CLP quantitative data analysis and statistics workshop', at ATREE. The workshop was conducted by Dr. Suhel Quader, NCF and attended by CLP alumni and ATREE researchers; with funding obtained through a CLP networking grant.

10. Anjan Katna attended the following summer schools:

    a. IRSAE - Summer School in Applied Ecology, Inland Norway University, Campus Evenstad, Norway, August 07 -11, 2017 (funded through the RNE grant)
    b. AniMove 2017 Summer school in Movement Ecology, Max Planck Institute of Ornithology, Radolfzell, Germany, August 27 - 09 September, 2017 (self-funded).

11. Roshni Kutty attended a workshop organized by Dr. Meredith Gore (from Michigan University) at King Mongkut's University of Technology Thonburi, Bangkhuntien, Bangkok Thailand. The five-day workshop focused on social science research design and methodology for conservation biologists.

12. Soumyajit Bhar attended a workshop on "The Interdisciplinary Workshop on Energy and Development" at IIT Bombay, organized by the University of Queensland, Australia.

13. Annesha Chowdhury attended a two-day Certificate Course in "Systems Thinking & Modeling for Sustainability Research", organized by ATREE, Bangalore.

Publications

JOURNAL ARTICLES

1. Aditya, V. & T. Ganesh (2017). Mammals of Papikonda Hills, northern Eastern Ghats, India. Journal of Threatened Taxa 9(10): 10823–10830; http://doi.org/10.11609/jott.3021.9.10.10823-10830.

2. Agarwal, S., Marathe, A., Ghate, R., Krishnaswamy, J., and Nagendra, H. 2017. Forest protection in Central India: Do differences in monitoring by state and local institutions result in diverse social and ecological impacts? Biological Conservation 26(9): 2047-2066.

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4. Atkore, V., Kelkar, N. and Krishnaswamy, J., 2017. Assessing the recovery of fish assemblages downstream of hydrological barriers in India's Western Ghats. River Research and Applications 33(7): 1026-1035.

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6. Broome, N.P., Rai, N.D. and Tatpati, M. 2017. Biodiversity Conservation and Forest Rights Act. Economic & Political Weekly 50 (25&26):51-54.

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10. Eswar, M. & B.K. Thomas, 2017, 'Data Discrepancies: Interpreting Rural Water Data in the Decadal Census', Economic and Political Weekly, 52(28): 29-32

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12. Hamel, P., Riveros, Iregui, D., Ballari, D., Browning, T., CÃ Ileri, R., Chandler, D., Chun, K.P., Destouni, G., Jacobs, S., Jasechko, S., Johnson, M., Krishnaswamy, J., Poca, M., Vieira Pompeu, P. and Rocha, H. 2018. Watershed services in the humid tropics: Opportunities from recent advances in ecohydrology. Ecohydrology, 11(3): 1921

13. Hill, M.J., Hassall, C., Oertli, B., Fahrig, L., Robson, B.J., Biggs, J., Samways, M.J., Usio, N., Takamura, N., Krishnaswamy, J. and Wood, P.J. 2018. New policy directions for global pond conservation. Conservation Letters, 12447.

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17. Jamwal, P. 2017. Fate of nutrients in the human dominated ecosystems - A case study of Jakkur Lake in Bengaluru, Resonance, (22) 3, 79-290.

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development pathways in South Asia: Evidence from six research projects. International Journal of Disaster Risk Reduction, 31, 92–101

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BOOK CHAPTERS

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2. Badiger, S. and Lele, S. 2017. Contested waterscapes: Land use change, decentralised interventions and complex impacts. Pages 148-155, In: Hiremath, A. J., Rai, N. and Siddhartha, A. (Eds), Celebrating 20 years of ATREE. Bangalore: Ashoka Trust for Research in Ecology and the Environment, Bengaluru.

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5. Ganesan R., N.A. Aravind, D.R. Priyadarsanan and G. Ravikanth. 2017. The nitty gritty of a name: Systematic Biology and Conservation. Pages 162-171. In: Hiremath, A.J., N.D. Rai and A. Siddartha (Eds). Transcending boundaries: Reflecting on twenty years of action and research at ATREE. Ashoka Trust for Research in Ecology and the Environment, Bengaluru.

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TN Khoshoo Memorial Award and Lecture 2017

Instituted by ATREE, the TN Khoshoo Memorial Award and Lecture, recognises the distinguished contribution of a mid-career academician or a practitioner with respect to environment and conservation. The award is also designed to inspire and encourage other emerging scientists.

The 14th edition of TN Khoshoo Memorial Award and Lecture was held on December 01, 2017. The award was conferred on Sonam Wangchuk, a leading sustainability advocate, education reformer and Founder, Students' Educational and Cultural Movement of Ladakh (SECMOL). The event also featured a guest lecture by Anshu Gupta, Founder, Goonj and the Ramon Magsaysay Awardee 2015. Another key highlight of the event was the release of `Champions of Change' – a book celebrating the lives and work of some of the inspiring individuals whose contributions to protecting the environment have been extraordinarily rich and diverse.

The event convened nearly 200 guests comprising of academics, head of institutions, influencers, media, government agencies, representatives from the non-governmental sector and students from various Bangalore based colleges and institutions. Representatives from James Hutton Institute, IISc, NCBS, IIHS, NCF and CSTEP, Arghyam, SPI Incubator, ISRO, CITRIX, TIDE, e-KISAAN, Pro-waste, Jal-MITRA and Christ University among others attended the award ceremony and the guest lecture. It garnered coverage in mainstream, vernacular, electronic and online media including including The Times Of India, The Deccan Herald, News 9, Education World, The Hindu and Prajavani and The Logical Indian and The Good City.

Rajiv Khoshoo and Dr. Kamaljit Bawa presenting the 14th TN Khoshoo Memorial Award to Sonam Wangchuk. *© Nishant Ratnakar*

Guests at TN Khoshoo Awards 2017. *© Nishant Ratnakar*

Anshu Gupta of Goonj, the keynote speaker at the TN Khoshoo Memorial Award and Lecture, 2017. *© Nishant Ratnakar*

Media and Outreach

ATREE's voice in the media has grown consistently. Contributions by ATREE researchers to both digital and print media in the form of opinion pieces, commentaries and policy papers are regularly featured. Additionally, media is hugely interested in ATREE's work which is very frequently reported.

2017–2018

NUMBER OF OP-EDS AND FEATURE ARTICLES PUBLISHED **37**

THE MEDIA COVERAGE **150**

FOLLOWERS **5609**

FOLLOWERS **1473**

FOLLOWERS **840**

Sights and sounds of SCCS, 2017.
© Vibhav Joshi and Prasenjeet Yadav

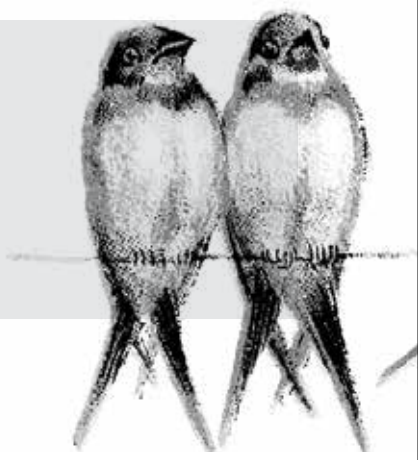
ATREE's social media reach has continued to grow and enhance our exposure to our key audiences. Our social media accounts attract high-quality followers including climate, sustainability and development experts, journalists, activists, government agencies and officials.

ATREE was an integral part of the 8th Student Conference on Conservation Sciences (SCCS) held at the JN Tata Auditorium, Bengaluru, between the 21st and the 24th of September, 2017. SCCS is the largest student conference in the country and ATREE has been a part of it since its inception. Along with providing funding support, ATREE faculty, students, and staff were actively involved in the conference. In 2017, nine students volunteered to help run the conference. Workshops were also organized by ATREE students. An ATREE booth at the conference was instrumental in reaching out to the conservation community in Bengaluru and providing information to students and the general public about its PhD program and interdisciplinary research initiatives.

ATREE also helped co-organize SPEEC-UP 2017 along with a host of other organizations. SPEEC-UP is a one day event created to encourage and promote interactions among students of ecology, evolution, conservation and environmental science working in Bangalore. The event featured a competition in the speed talk format (3 minute talks) and saw the participation of ATREE students and faculty. ATREE's social media reach continues to grow and enhance our exposure to key audiences.

Our Team

Our passionate and committed team strives to make a difference.



Faculty Affiliations

BIODIVERSITY MONITORING AND CONSERVATION PLANNING

- Dr. R. Ganesan (Programme Leader)
- Dr. Priyadarsanan Dharma Rajan
- Dr. N. A. Aravind
- Dr. G. Ravikanth

LANDSCAPES, LIVELIHOODS AND CONSERVATION

- Dr. T. Ganesh (Programme Leader)
- Dr. Ankila Hiremath
- Dr. Nitin Rai
- Dr. Abi Tamim Vanak

ECOSYSTEM SERVICES AND HUMAN WELLBEING

- Dr. Jagdish Krishnaswamy (Programme Leader)
- Dr. Soubadra Devy
- Dr. Siddhartha Krishnan
- Dr Nirmalya Chatterjee

WATER, LAND, AND SOCIETY

- Dr. Veena Srinivasan (Programme Leader)
- Dr. Shrinivas Badiger
- Dr. Bejoy Thomas
- Dr. Priyanka Jamwal
- Dr. Durba Biswas

FORESTS AND GOVERNANCE

- Dr. Siddappa Setty (Programme Leader)
- Dr. Sharachchandra Lele

CLIMATE CHANGE MITIGATION AND DEVELOPMENT

- Dr. Sharachchandra Lele (Programme Leader)
- Dr. Shikha Lakhanpal

HONORARY FACULTY

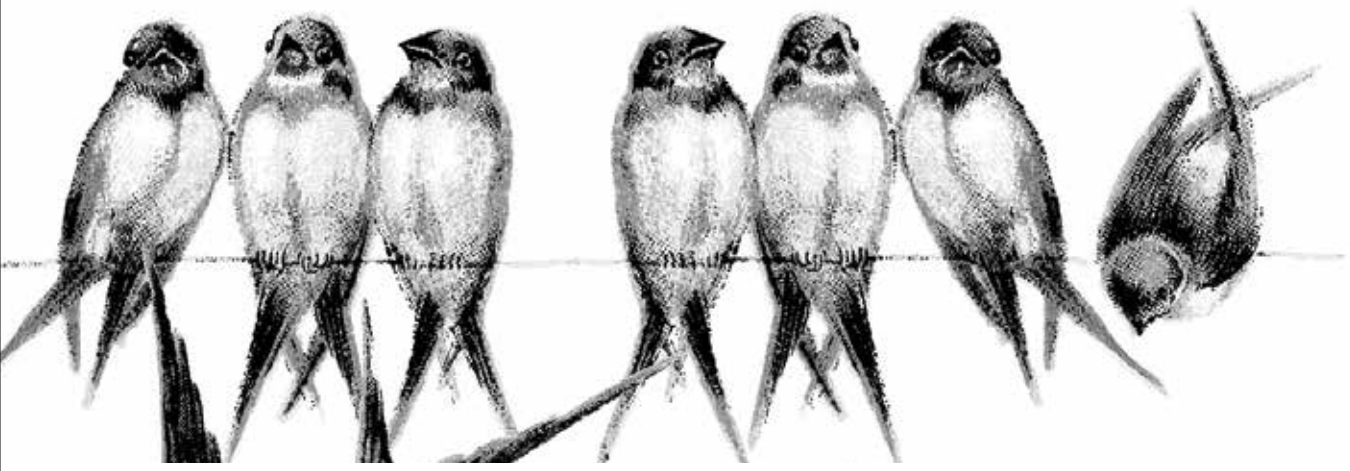
- Amrik S. Gill
- Dr. Shivanna K R
- Dr. Romulus Whitaker
- Dr. K. D. Singh
- Dr. Mahesh Rangarajan

SENIOR ADJUNCT FELLOWS

- Dr. Gladwin Joseph
- Dr. R. Prabhakar

ADJUNCT FACULTY

- Dr. Robert John Chandran
- Dr. T. O. Sasidharan
- Dr. Deepak Malghan
- Dr. Megha Shenoy
- Dr. Narasimha Rao (from February 2016)
- Dr. Asavari Devadiga (from August 2017)
- Dr. Shomen Mukherjee (from September 2017)
- Dr. Asmita Sengupta (from October 2017)
- Dr. Bharath Sundaram (from December 2017)



MANAGEMENT

- Dr. Kartik Shanker, Director
- Shrihari Udupa, Deputy Director – HR & Administration
- Sridhar Ramaswamy Iyengar, Deputy Director, Finance
- Dr. Sarala Khaling, Regional Director, Northeast India Initiatives

ACADEMY

- Dr. Siddhartha Krishnan
- Dr. Milind Bunyan
- Madhavi Latha

ECO-INFORMATICS

- Dr. Muneeswaran M.
- Tania Bhowmick
- Abhishek Samrat
- Gouri U

COMMUNICATION

- Aditya Harikrishnan
- Payal Pruthi
- Smrity Ramavarapu

ACCOUNTS

- Ashoka B.
- Bhogaiah N.
- Kariappa P. C.
- Rohini Y. M.
- Smita Mulgund
- Sunil Dahal
- Vartika Saxena

ADMINISTRATION

- Gangarathna
- Hemalatha G.
- Indrani
- Jayamala
- Lakshmi
- Lalitha N
- Lakshmikanthaiah N.
- Meena Rajaram
- Narayanamma
- Raghu R.
- Rajinder Singh
- Ramesh N.
- Sumithra
- Umesh M. C.
- Usha H.
- Venkataraju

HUMAN RESOURCES

- Rashmi R. Shet

LIBRARY

- Obaiah B.

INFORMATION TECHNOLOGY

- Shiva Subramanya

DEVELOPMENT

- Dr. Indira Singh

JOURNAL: CONSERVATION AND SOCIETY

- Ananda

ADMIN – FIELD SUPPORT

- Ajay Singh
- Brin Kr. Kharka
- Jadeswamy
- Karma Dorjee
- Kumbha
- Madesha
- Madha
- Nanje Gowda S.
- Narayanan
- Rajanna D.
- Renukha
- S. Thamizhazhagan
- Shivaram

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- Jojo T. D.
- Madegowda C.
- Mathivanan
- Saravanan A .
- Seena Narayanan

Khasi woman at Bara Bazaar *© Kiran Thomas*

Funding Partners

We thank our donors and partners for their unwavering support.

Endowments

- Rohini Nilekani
- The Ford Foundation
- ATREE Belmont and Sehgal Family Foundation
- Sarojini Damodaran Foundation
- Bawa Family, USA
- SDTT-ATREE CF
- Oak Foundation
- S.D. Shibulal and Kumari Shibulal
- BARR Foundation
- Centre for Interdisciplinary Studies in Environment & Development
- Vasudeva Rao
- Arghyam Foundation
- Kasturi Trust
- Raj Khoshoo and Mohini Khoshoo
- Jayshree and Ganesan Balachander
- Rani Dalbir Chaudhary
- TVS Motor Company
- Government of Karnataka (Abdul Kalam Award

Research Grants

- Alliance of Religions and Conservation
- Antrix
- Arghyam
- Azim Premji Philanthropic Initiatives Private Limited
- Azim Premji University
- Bangalore Water Supply and Sewerage Board
- Barr Foundation
- Centre for Ecology & Hydrology
- Conservation, Food and Health Foundation
- Department of Biotechnology
- Department of International Environment and Development Studies
- Department of Science and Technology-Science & Engineering Research Board
- Dr. Jörg Müller
- French Institute of Pondicherry
- Government of Kerala
- Indian Institute of Science
- Institute of Bioresources and Sustainable Development
- International Foundation for Science
- International Development Research Centre
- Karl Kübel Stiftung für Kind und Familie
- Ministry of Earth Sciences
- Ministry of Environment, Forest and Climate change
- Monash University
- Namsaling Community Development Center
- National Academy of Sciences
- National Geographic Society
- National Medicinal Plants Board
- National Mission on Himalayan Studies
- Norwegian University of Life Sciences
- Oracle
- Ocean Park Conservation Foundation, Hong Kong Research Grant Execution
- Rainforest Alliance Inc.
- Rights and Resources Group
- Royal Norwegian Embassy
- Rufford Small Grants Foundation
- Tata Education Trust
- The Harnisch Foundation
- The James Hutton Institute
- The Madras Crocodile Bank Trust
- U.S. Agency for International Development
- University of Cambridge
- University of Kassel
- Wellcome Trust DBT India Alliance
- Wipro Limited
- Xu Lianggen

FINANCIAL STATEMENT

Place : Bangalore

Date : 11.07.2018

INDEPENDENT AUDITOR'S REPORT

To the Trustees of Ashoka Trust for Research in Ecology and the Environment (ATREE)

REPORT ON THE FINANCIAL STATEMENTS

We have audited the accompanying financial statements of Ashoka Trust for Research in Ecology and the Environment (ATREE), which comprise the Balance Sheet as at March 31, 2018, and the Income and Expenditure account, Receipts and payments account for the year then ended and a summary of significant accounting policies.

MANAGEMENT'S RESPONSIBILITY FOR THE FINANCIAL STATEMENTS

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position, financial performance and cash flows of the Entity in accordance with the accounting principles generally accepted in India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

AUDITOR'S RESPONSIBILITY

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

OPINION

In our opinion and to the best of our information and according to the explanations given to us, the financial statements of Ashoka Trust for Research in Ecology and the Environment (ATREE) for the year ended 31st March, 2018 are prepared, in all material respects in conformity with the accounting principles generally accepted (GAAP)in India, and proper books of account have been maintained by the Trust, so far as appears from our examination of those books; and that the Balance Sheet, Income and Expenditure Account and Receipts and Payments account dealt with by this report are in agreement with the books of accounts to give a true and fair view of the state of affairs of the Trust as at 31st March, 2018 and its deficit, receipts and payments for the year ended on that date.

For G. Anantha & Co., Chartered Accountants

FRN: 005160S

Rani N.R, Partner, M. No.: 214318

BALANCE SHEET AS AT 31st MARCH 2018		(INR IN LACS)
SOURCE OF FUNDS		**31st March 2018**
Corpus Fund		4,566.66
General Fund		87.54
UTILISED RESERVES		
Project Assets		1,158.14
Other Assets		18.92
Land & Building		705.13
Project Fund		1,334.98
TOTAL		**7,871.38**
APPLICATION OF FUNDS		
FIXED ASSETS		
Project Assets		1,158.14
Other Assets		18.92
Land & Buildings		705.13
INVESTMENTS		
Corpus Investments		4,565.42
Other Investments		941.97
CURRENT ASSETS AND LIABILITIES		
Advances	41.29	
Other Current Assets	46.42	
Cash & Bank	399.41	
GROSS CURRENT ASSETS	**487.12**	
Less: Current Liabilites	5.32	
NET CURRENT ASSETS		481.80
TOTAL		**7,871.38**

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st MARCH 2018	(INR IN LACS)
PARTICULARS	31st March 2018
INCOME	
Grants	1,253.50
Interest	483.49
Donation & Other Income	2.90
TOTAL	1,739.88
EXPENDITURE	
Forests & Governance	354.78
Water, Land & Society	145.70
Climate Change Mitigation & Development	54.13
Ecosystem Services and Human Wellbeing	213.61
Biodiversity Monitoring & Conservation Planning	216.86
Landscapes, Livelihoods & Conservation	240.41
Academy for Conservation Science and Sustainability Studies	106.49
Salaries-Programme Support	89.58
Salaries/Consultancy-Institutional Support	209.08
Staff Welfare	6.24
Administrative Expenses	140.97
Depreciation	17.98
TOTAL	1,795.82
SURPLUS	55.94

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31st MARCH 2016	(INR IN LACS)
PARTICULARS	**31st March 2018**
RECEIPTS	
OPENING BALANCES (Cash and Cash equivalents)	6,012.12
RECEIPTS DURING THE YEAR	
Grants	1,312.63
Corpus/Endowments	100.00
Interest	417.98
Donation and Other Income	11.12
TOTAL	**7,853.84**
PAYMENTS	
Fixed Assets	111.92
Forests & Governance	305.16
Water, Land & Society	168.42
Climate Change Mitigation & Development	54.13
Ecosystem Services and Human Wellbeing	212.24
Biodiversity Monitoring & Conservation Planning	209.28
Landscapes, Livelihoods & Conservation	254.94
Academy for Conservation Science and Sustainability Studies	106.49
Salaries-Programme Support	89.45
Salaries/Consultancy-Institutional Support	211.64
Staff Welfare	6.24
Administrative Expenses	147.35
CLOSING BALANCES (Cash and Cash equivalents)	5,976.39
TOTAL	**7,853.84**

Ashoka Trust for Research in Ecology and the Environment (ATREE) is a research institution in the areas of biodiversity conservation and sustainable development. We focus on applied science through research, education and action that influence policy and practice on conservation of nature, management of natural resources, and sustainable development. ATREE is recognised as a Scientific and Industrial Research Organisation by the Ministry of Science and Technology, Government of India.

ATREE is registered with the sub registrar, Bengaluru North Taluk as a Public Charitable Trust and with the ministry of home affairs, Government of India under section 6(1) of the Foreign Contribution (Regulation) Act 1976. ATREE is registered as a wholly Charitable Trust under Section 12(A)(a) of the Indian Income Tax Act 1961 and donations to it are eligible for 175% / 100% tax exemption under Section 35(1)(ii) / Section80GGA(2)(a) of the Indian Income Tax Act 1961.

ATREE OFFICES

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ATREE COMMUNITY CONSERVATION CENTRES

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Malai Mahadeshwara Hills Community Conservation Centre

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Vembanad Community Environmental Resource Centre

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PROJECT OFFICE

Darjeeling Project Office

Ashoka Trust for Research in Ecology and the Environment (ATREE)
17/B Cooch Behar Road,
Near Himalayan nursery school,
Darjeeling - 734101
Tel - 0354 2252177

To know more about us, visit **www.atree.org**

Design: Kena Design. www.kenadesign.com

Mission Statement

To generate rigorous interdisciplinary knowledge for achieving environmental conservation and sustainable development in a socially just manner, to enable the use of this knowledge by policy makers and society, and to train the next generation of scholars and leaders.

ASHOKA TRUST FOR RESEARCH IN ECOLOGY AND THE ENVIRONMENT

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