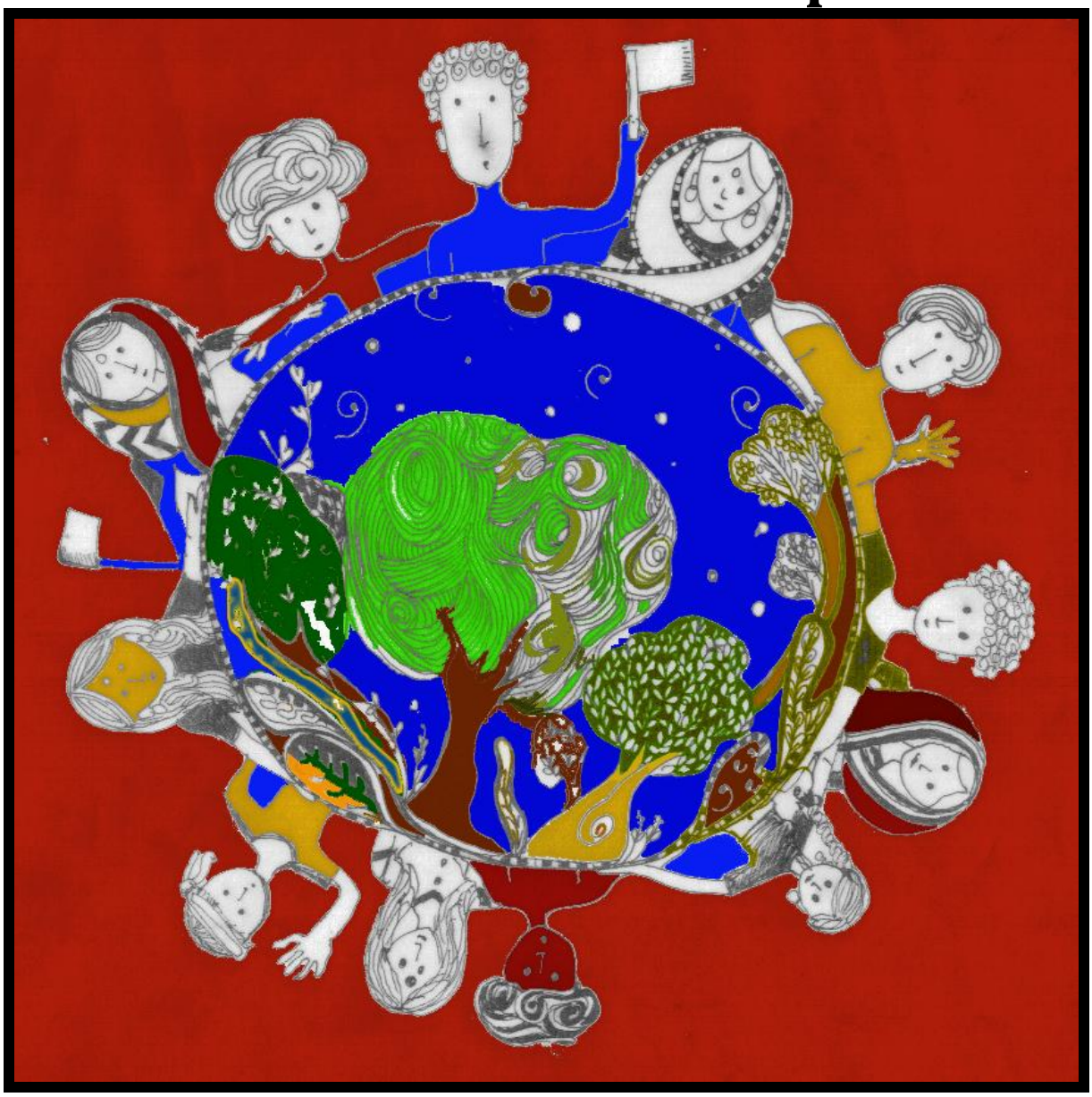
# Bringing Interdisciplinarity to Conservation and Development



## 2008-11 Final Report to JAMSETJI TATA TRUST

ATREE

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# Report to Jamsetji Tata Trust
*1 April 2008 to 30 October 2011*

*Submitted by*
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# EXECUTIVE SUMMARY

The Jamsetji Tata Trust (JTT) funded three components of ATREE's work for a three-year period from April 2008 to October 2011: interdisciplinary research, Academy for Conservation Science and Sustainability Studies, and infrastructure costs.

ATREE's capacity for interdisciplinary research and teaching has been strengthened by the merger of the Centre for Interdisciplinary Studies in Environment and Development (CISED) with ATREE. As part of our new strategy plan for 2010–2015, we have new programmatic structures (see figure on page 7) that facilitate better integration of research with outreach towards meaningful impact. ATREE has been able to raise an additional institutional corpus of Rs. 9 crores with funds earmarked for partially implementing its outreach and engagement strategy. Through the small grants programme, ATREE has been able to impact a network of like-minded institutions and expand the reach of our efforts. We continue to actively pursue donors for faculty chairs and student fellowships.

ATREE launched the Academy for Conservation Science and Sustainability Studies with core project funds from the Tata Trust in 2008. It currently has 39 PhD students, of which 16 joined in 2011. Four of our senior students are getting ready to defend their PhD thesis and graduate in 2012. Our first student, Bharath Sundaram, has submitted his thesis and has joined the prestigious National Centre for Biological Sciences as a post-doctoral fellow. The PhD programme is strengthened by academic partnerships with the University of Massachusetts, Boston and University of Life Sciences in Norway. We have a faculty and student exchange programme with the latter. We also have recently entered into an MOU with the College of Forestry at the Oregon State University.

The Academy now regularly conducts certificate courses in geographic information systems (GIS) and remote sensing, a course to introduce social perspectives to natural science students, conservation science courses and vacation training programmes for high school students. Conservation education is a large part of our outreach, through the Department of Biotechnology's Nature Awareness Clubs and teachers training, ATREE seminars and workshops. There have been a growing number of public talks over the years: from 4 between 2006 and 2009, to 23 in 2010, and 39 public talks in 2011. Thirteen interns in 2010 and 28 in 2011 worked with different departments. The JTT small grants have supported 19 grants in biodiversity conservation/natural sciences and 11 in policy, governance, and natural resource management. Besides, the Academy has seven field academies in strategic locations in the Western Ghats and the Eastern Himalayas, with extensive partnerships that provide rich learning and research facilities for students.

ATREE as an institution has been significantly strengthened and transformed by funds from the Tata Trusts in the last 3 years. We have written six books, published more than 120 articles in international and national peer-reviewed scientific journals; and 35 popular press articles in the period between 2008 and August 2011, with the number of citations doubling within the same period. ATREE has conducted over 45 workshops, conferences and seminars with a range of audiences – from Gram Panchayats to government officials and policy makers, to international and national scientific communities, students from schools to doctoral scholars to practitioners on the field. Going beyond numbers, there has been a

concerted effort to bring science closer to the layman, and improve awareness about development and conservation issues through citizen science initiatives such as the India Biodiversity Portal; through interactions with media on issues, and partnerships such as the media awards in regional language environmental journalism with the Centre for Development Learning. International conferences such as the 5th International Canopy Conference organized by ATREE, not only hosted prominent scientists from across the world, but also created special modules to make their learning and understanding accessible to lay audiences. We have institutionalized regular courses on geographic information systems, conservation science, interdisciplinary social science for ecologists' course, and an annual vacation training programme for school students who are on the threshold of pursuing higher studies.

Outreach has become a necessary feature of all field sites through a desire to apply science and understanding to local conservation and development issues. This also reflects, ultimately in the character of ATREE's interactions – with local governing bodies, and with policy makers, and also reflects in ATREE's growing credibility in national and international policy circles through its inclusion in important academic as well as policy-influencing committees. ATREE actively supports faculty to further ATREE's policy discussions at the national level, while working with communities on the ground.

Trust funds were used to complete our environment-friendly main office building at Bengaluru. The staff moved into the new premises in March 2009. The first phase of the construction of the Community-based Conservation Centres (CCCs) will be completed in 2011.

# STRENGTHENING THE ORGANIZATIONAL STRUCTURE

We organized ourselves so that the faculty could focus on larger relevant thematic areas and work across disciplines towards impact. We wanted to avoid growing into a conventional research and education institution that only emphasized individual research that was disciplinary. We expect that our structures will help catalyse creative, innovative research and also provide a space to work together more effectively. This process was a year-long excercise which resulted in a strategy plan for 2010–2015.

Three major changes that have helped unify procedures and aims across the organization are the reworked organization strategy and mission statement, organization restructuring and CISED's merger with ATREE.

## STRATEGY FOR 2009—2014

The revised mission statement, which now includes the element of 'socially just' provides the orientation for selecting issues, building capacities and forming meaningful collaborations: **ATREE's mission** is to promote socially just environmental conservation and sustainable development by generating rigorous interdisciplinary knowledge that engages actively with the academia, policy makers, practitioners, activists, students, and wider public audiences.

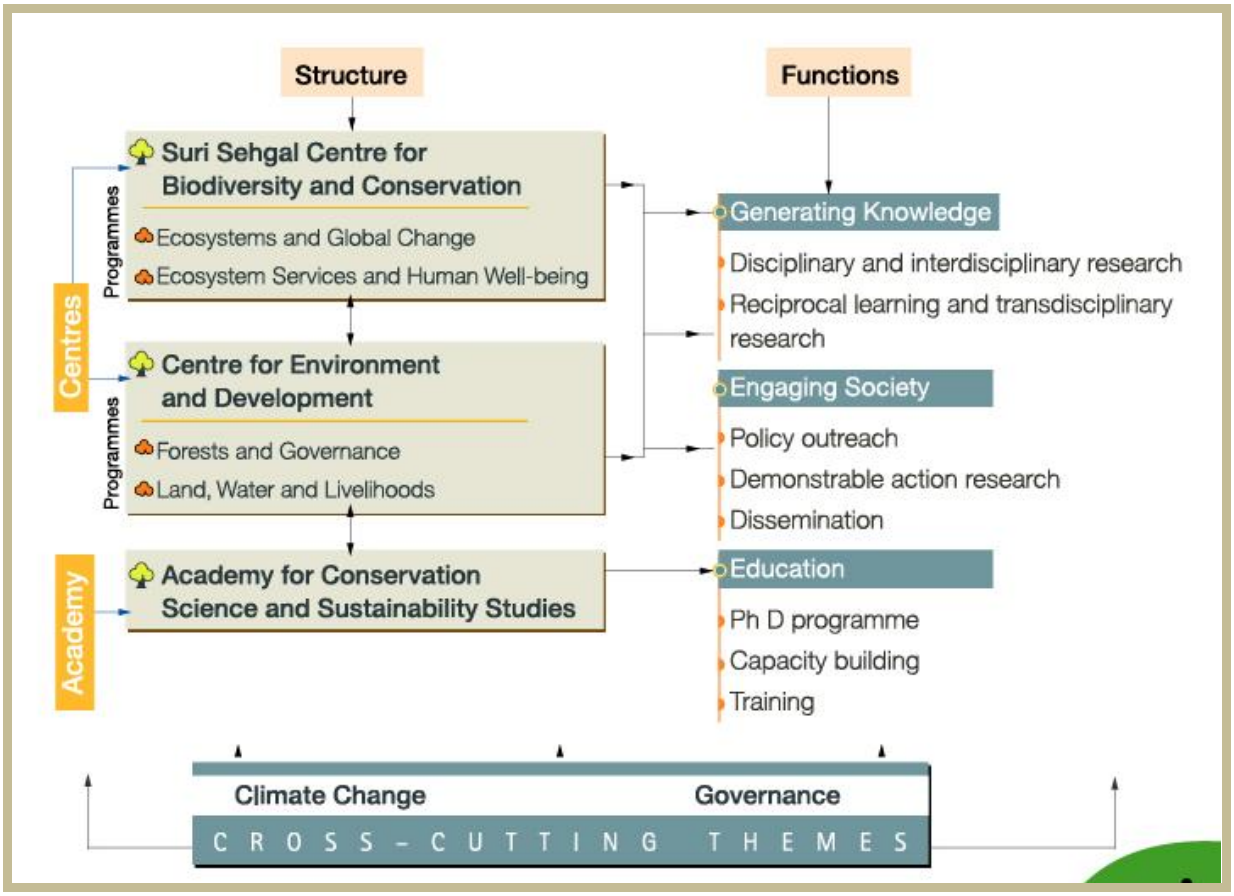
ATREE objectives for 2010–2015 are as follows.

- Generate knowledge that will change policies and governance related to the conservation and use of natural resources.
- Increase investments in building human capital so as to address contemporary environmental challenges.
- Focus outreach programmes to engage policy makers, civil society, and practitioners for fostering conservation and environmentally sound and socially just development.

## ORGANIZATION RESTRUCTURING

ATREE has reorganized its research programmes under two centres, with its capacity-building and pedagogic activities under the Academy for Conservation Science and Sustainability Studies. Each centre houses two interdisciplinary programmes. (See figure below.)

The themes of climate change and governance will cut across all programmes since they have the potential to exponentially impact conservation, sustainability and developmental objectives.




**CISED MERGER WITH ATREE**

The Centre for Interdisciplinary Studies in Environment and Development (CISED) merged with ATREE in June 2009. The merger has strengthened ATREE's competence in interdisciplinary research and brings in key faculty in water resources, forest governance, and environment-development studies, besides strengthening the ATREE executive board with members from the CISED board. Before this merger, CISED functioned as an autonomous centre hosted by the Institute for Social and Economic Change (ISEC), Bengaluru.

**NEW FACULTY AND OTHER KEY INFRASTRUCTURAL STAFF**

Apart from the CISED team joining ATREE, five new Fellows, and one Academy Coordinator have been recruited since 2008.

**2008:** Siddhartha Krishnan and Bejoy Thomas strengthened the social sciences arm. Siddhartha Krishnan was enrolled as a Fellow after completing a 3-year post-doctoral fellowship at ATREE, working in the Conservation and Livelihoods programme. He served as Programme Leader of the Land Water Livelihoods programme (LWLP) for a year (2010).

Bejoy Thomas has a PhD in Development Studies from the Development Research Institute, Tilburg University, Netherlands. He has a Master's degree in Business Economics from Cochin University. He is part of the LWLP.

**2009:** CISED team of S Lele, S Badiger and S Das joined ATREE's Centre for Environment and Development.

Aravind N A was appointed Coordinator, Academy for Conservation Science and Sustainability Studies.

Kiran M C was appointed coordinator of the Ecoinformatics Lab after the team's successful launch of the India Biodiversity Portal in December 2008.

Obaiah B joined as ATREE's librarian. He has systemized processes and added online access to journals from across the world.

**2010:** Subhrajit Saha, Swati Sreshth, and Ashokankur Datta joined ATREE's Forests and Governance programme. Subsequently, Swati Shresth took up the position of Policy Fellow in Delhi, dedicating half of her time to policy outreach and engagement. (Subhrajit Saha resigned from ATREE in December 2010 to take up a faculty position in the USA. His position has been re-advertised and will be filled up soon.) Ashokankur Datta is also a secondary affiliate of the Ecosystem Services and Human Well-being Programme.

Sridhar Iyengar joined as Assistant Director, Finance; Satyadeep Rajan joined as Director, Development. Rajan remained with ATREE until March 2011.

**2011**: Dr. Sarala Khaling joined as Regional Director, Eastern Himalayas Office, Gangtok. Dr.Sarala Khaling has held various research, coordination and management positions. In her most recent stint at WWF, she was the regional coordinator for the Eastern Himalayas (Bhutan, India, and Nepal) for the Critical Ecosystem Partnership Fund. Formerly, she was the director for programme development, research and monitoring for the WWF Nepal Programme. Induction of faculty in the NE, with Dr. Pashupati Chaudhary and Dr. Sunita Pradhan joining as Visiting Fellows in Gangtok. Dr. Sumit Sen has joined as Fellow, Gangtok. His primary research affiliations are with the Land, Water and Livelihoods programme.

# INTERDISCIPLINARY RESEARCH

**SURI SEHGAL CENTRE FOR BIODIVERSITY AND CONSERVATION**

In South Asia, most ecosystems are modified by historic human-use, human presence, and appropriation of ecosystem services. Maintenance of biodiversity, ecosystem functions and associated ecosystem services in a changing environment is a challenging issue, as is identifying the scale and intensity of human-use compatible with conservation of biodiversity and ecosystem services. The goal of the Suri Sehgal Centre for Biodiversity and Conservation is to build a critical body of knowledge about India's biodiversity, ecosystem functions and ecosystem services of natural and managed ecosystems in the context of global, regional and local change and challenges.

The programmes under the Suri Sehgal Centre for Biodiversity and Conservation are Ecosystems and Global Change, and Ecosystem Services and Human Well-being.

## Ecosystems and Global Change

***Primary faculty:*** *Ravikanth G, Priyadarsanan D R (co-programme convenor), Robert Chandran, Aravind N A, T Ganesh, R Ganesan, Ankila Hiremath (co-programme convenor), Harini Nagendra,*

***Secondary affiliations:*** *Nitin Rai, Jagdish Krishnaswamy, Shrinivas Badiger, Soubadra Devy, Siddharth Krishnan, Swaiti Shresth*

**Scope for Interdisciplinary Studies:** The Ecosystems and Global Change programme not only addresses the gaps in the knowledge in understanding patterns of occurrence of biodiversity, its role and functions, but also consequences of biodiversity loss. It integrates human-use and interventions as part of ecological dynamics over time and space. It also includes the study of bio-physical processes such as climate variability and human activities that can alter the dynamics and response of ecosystems and biodiversity over time and space. The programmes factor-in emerging threats from climate change, invasive species and disease in understanding biodiversity and the processes that govern its functioning.

The Ecosystem and Global Change programme has several working groups that focus on smaller, cohesive areas such as Biosystematics and Conservation Genetics, Monitoring and Managing Ecosystem Change, and Urban Ecology.

**Main research themes:** Structure and function of ecosystems; impact of invasive species and other anthropogenic factors including climate change on ecosystems and human well-being; management responses to changes in ecosystems.

- **Alien invasive species *Lantana camara* in the Western Ghats: Spread, socio-economic causes and consequences of invasion and management options**

***Team:*** *Ramesh Kannan, R Uma Shaanker (UAS and ATREE), Charlie Shakleton (Rhodes University, South Africa)*

Invasive alien plants (IAP) are one of the biggest threats to ecosystems and biodiversity worldwide affecting the delivery of ecosystem goods and services, and consequently human well-being (Shackleton, 2006). Against the overarching negative effects of the invasive species on biodiversity and ecosystem services, the global agenda has been to prevent and contain the invasive species and thereby to mitigate their impacts on local biodiversity, ecosystem services and human health (www.gisp.org).

While the negative impacts of IAP on ecosystem structure and function are undisputed, understanding their potential impacts on rural livelihoods and well-being is less developed, especially, since it is their land and waters that are most affected by IAP (from Shackleton, 2006). Under these circumstances, one of the strategies could be to study the possible utilization of the invasive and explore whether this can lead to an adaptive management of the invasive. Also, whether this could be achieved in a manner that would not only enhance ecosystem integrity/services, but also alleviate poverty of the rural communities in low-GDP countries such as India where control or management of IAP is not economically feasible.

Against this backdrop, we proposed that as a specific case of control of *Lantana camara,* an alien plant invasive, community-based management strategies that promote the use of lantana could be encouraged in Malai Mahadeshwara (MM) Hills, so long as these lead to minimizing the net costs of the lantana. We have successfully demonstrated the use of lantana by local communities at MM hills. It has increased income and can be viewed as one among the spectrum of management options that help limit damage as well as management costs of lantana.

ATREE has initiated research to study the impact of use of lantana on ecosystem and local livelihoods. The objectives of this study being, to reconstruct the history of lantana invasion in the Western Ghats; to study socio-economic causes and consequences of the use of lantana as an alternative source of livelihood for forest-dependent communities in the Western Ghats, and to critically review existing local management practices and forest working plans in short- and long-term management of lantana in the Western Ghats.

**Key questions**

When and where was lantana introduced in the country, and in the Western Ghats, in particular? When and where did the Forest Department (FD) realize the spread of lantana in the Western Ghats? When and where did the local communities 'perceive' the spread of lantana? What are the socioeconomic drivers, such as distance to native resource bamboo and rattan, agriculture productivity, soil health, and lack of local employment that predispose communities to adopt or use lantana as an alternative resource for livelihoods? What are the socioeconomic impacts of the use of lantana by forest-dependent communities? How does the use of lantana by forest-dependent communities affect the distribution and density of lantana? What has been the role of forest-dwelling communities in managing lantana? What has been the role of the FD's working plan in managing lantana both before and after the use of lantana as an alternative resource? ATREE has set up experimental plots in MM hills to study the effect of lantana collections at MM hills over the last 5 years. We would like to know what harvesting does to the availability of lantana in a given area. Does

lantana harvesting reduce lantana population? And to determine what other forest species, if any, are being recruited to the sites where lantana is being removed.

**Other support**
The research is supported in part by the Rainforest Concern.

**Outputs/outcomes**
The finding of this study will highlight the importance of this technology and the possibility of invasives' management through creating a market for its products, especially among forest/wildlife managers in wildlife-protected areas in India.

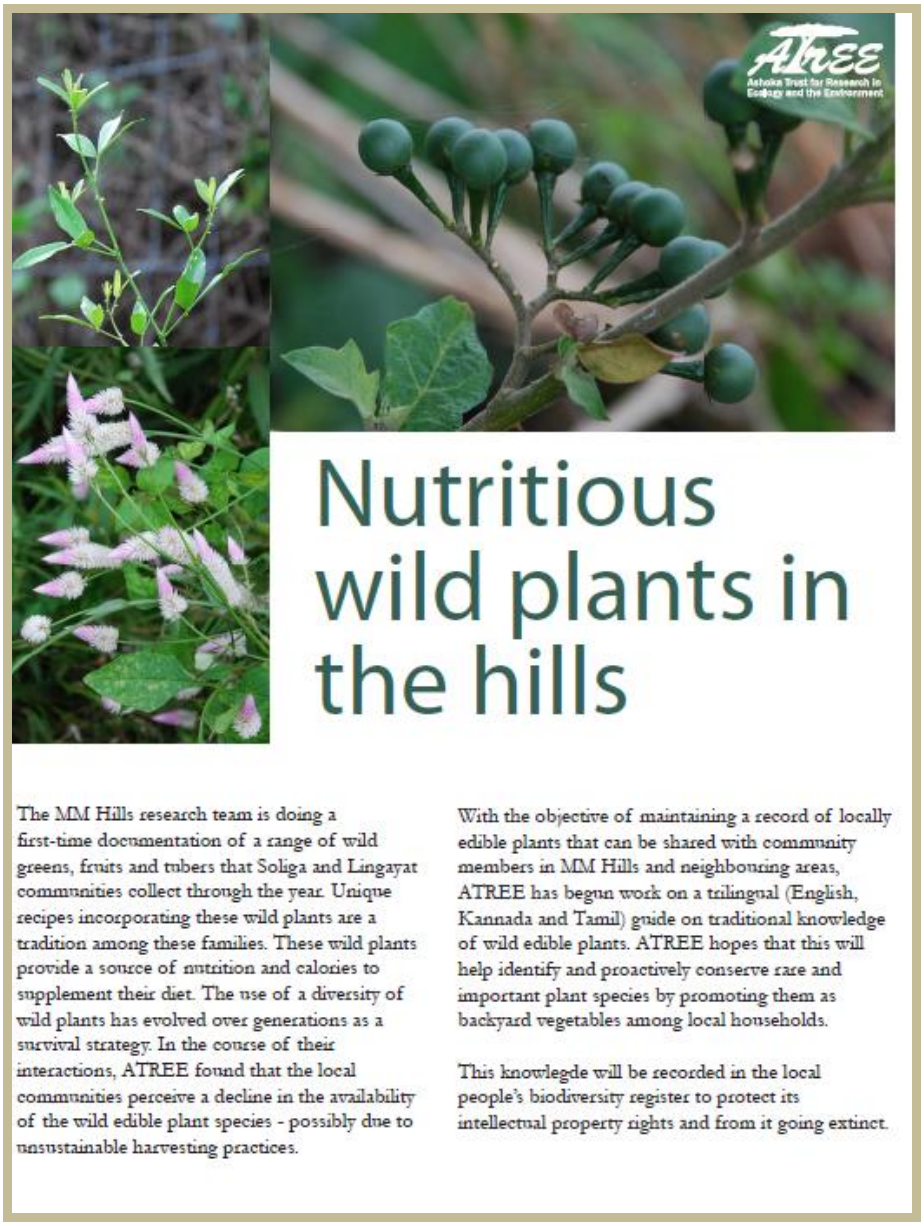
**Interdisciplinary linkages**
This project studies the ecological, social, cultural and economic aspect of lantana invasion as well as impacts of removing lantana by local communities.

- **Documentation of wild food plants used by forest-dependent communities in MM Hills, Karnataka**

***Team:*** *Ramesh Kannan, Harisha R P, Aravind N A, Ravikant G and R Uma Shaanker*

Soligas and Lingayats are the major forest-dependent communities at MM Hills. They use a variety of wild plants species in their diet in different seasons. Our aim has been to document a comprehensive inventory of ethno-botanical knowledge of these communities. The forest-dependent community uses ninety-two plant species as wild vegetables, of which 58 (62%) species are collected from the forest; the remaining is found in agricultural lands. Four wild plants are popular and found to be used in all houses as food. ATREE is investigating the nutritional profiles, processing methods, cultivation techniques, and conservational studies of the reported edible plant species.

This study contributes to the database of traditional indigenous knowledge of plants of the country.




**Other support:** This research is entirely supported by the JTT grant.

**Outputs/outcomes:** Manuscript published: Harisha R P 2011. Livelihood and potential conservation roles of wild edible herbs. *International Society of Ethnobiology Newsletter*.3(2):1–2. Future plans include publication of a bilingual booklet on plant usage at MM hills, in Kannada and English.

**Interdisciplinary linkages:** The project has ecological significance as it studies the ecological knowledge of forest-dwelling communities such as seasonal availability, plant growth, habit, and animal/birds usage of plants. The contribution of plant resources to the livelihood of the forest-dependent communities interests the social scientist to study the socio-economic aspect of plant usage by local communities.

## Ecosystem Services and Human Well-being

***Primary faculty:*** *Soubadra Devy, Jagdish Krishnaswamy (Programme Leader)*

***Secondary affiliations:*** *T Ganesh, Priyadarsanan D R, Seema Purushothaman*

**Scope for Interdisciplinary Studies:** If the case for 'development' is its economic worth to local, regional and global populations, then the case for conservation of biodiversity and environment might also be asserted on the terms of economic valuation. This programme aims to evaluate a range of services that sustain human welfare: *provisioning* services such as food, water, timber, fibre, and genetic resources; *regulating* services such as regulation of climate, floods, drought, land degradation, water quality, and disease prevention; *supporting* services such as soil formation, pollination, and nutrient cycling; and *cultural* services such as recreational, spiritual, religious, and other non-material benefits.

**Major research areas**: Role of ecosystem services in local land-use planning and decision making; socio-ecological and economic importance of ecosystem services, and their role in promoting equity and environmental justice; political and societal support for enhancing ecosystem services.

### Valuation of biodiversity-related ecosystem services

Biodiversity plays a fundamental role in sustaining ecosystem services. Changes in land-cover and loss of biodiversity can be associated with changes in ecosystem functions and related carbon, and hydrological services (Krishnaswamy et al 2009; Bonell et al 2010; Elmqvist et al 2010). Other ecosystem services (described below) can also make major contributions to livelihoods and human well-being.

- **Management of pollinator service for sustainable agriculture: Learnings from Kodagu coffee plantations**

*Team: M Soubadra Devy and Seema Purushothaman*

Kodagu coffee benefits from good pollination service provided by rock bees, *Apis dorsata* and the Indian bee, *A. cerana.* These pollinators straddle the forest landscape as well as coffee plantations. In recent times, there has been large-scale replacement of *Coffea arabica* with *C. robusta,* which is a sun loving coffee and this has had a cascading effect on shade management. Native shade trees are now being replaced by silver oaks. Our study has indicated that pollinator visits were lower in plantations dominated by silver oak trees, though these visits were still sufficient for a good fruitset of coffee. It must be noted the silver oak trees are still within a mosaic of native shade trees and therefore still meet the requirements of the pollinators. However, if 'silveroakification' of the landscape continues, it can result in large areas of silver oak-dominated shade, which might deter pollinator visits and result in poor fruitset and productivity. The other motivator for silver oak is that the existing land tenurial policy, exclusive to Kodagu landscape, does not facilitate planting more native trees. The rights of trees in plantations are with the government for most species, although the tenurial rights of land are with planters. Native tree saplings are not readily available even for interested planters, and fast-growing natives species have not

been identified. Besides, silver oak also has helped tide over times of plummeting coffee prices. Lack of incentive for maintenance of native trees has led to the shift to fast-growing silver oaks, on which farmers have rights.

Our socio-economic survey has demonstrated that planters, both large and small, do not relate fruitset to pollinators. However, they do associate native shade trees to good mulch, farmyard manure and healthy coffee plants. Strategies such as maintenance of native trees through innovative approaches of carbon credits or through payment of ecosystem services by downstream people should be adopted. However, it is a challenge to involve the small farmers in all these approaches. One positive direction is to find an institutional mechanism, which will integrate the farmers into one group to draw benefit from such possibilities.

**Other Support**
This study was initiated with FAO support and enhanced by JTT funding.

**Interdisciplinary linkages**
It evaluates the role of forests surrounding coffee plantations in provisioning pollination services, and the impact of changing shade management regimes from natural to silver oak trees. Information from these ecological aspects would be applied for valuation of management regimes. The perception of farmers and their ability to connect pollinators, the process of pollination and coffee productions is also being examined, while also drawing upon native farmer knowledge. We are looking at the current policy (Kodagu Tree Act), which is eroding the traditional practice of natural shade management. Organic certification now largely remains a domain of large farmers or corporate houses , we are looking at a framework which will be inclusive of small holders, particularly PES mechanisms (payment for ecosystem services) through REDD + and other ecological certifications.

### ➢ Pest control service of owls in the forest fringe agriculture landscape

*Team: T Ganesh and M B Prashanth*

Biodiversity in forests can help sustain biodiversity in adjacent agricultural ecosystems (Ranganathan et al 2010). The importance of forests to agriculture is often not very explicit. Mostly disservices such as crop raiding or cattle lifting by animals are highlighted, or ecosystem services such as water, fuel, and timber are mentioned. However, forests also provide services that are not very obvious. One such is the control of agricultural pests by owls. In dominant rice cultivated areas in Asia, rodents consume about 30 million tonnes of grain per year (Singleton 2003). Owls, snakes, and rat trappers (an indigenous local community) are the major regulators of rat populations and thereby provide critical ecosystem services. Of late, the value of these services is not appreciated because of easy alternatives such as rodenticides to control rat populations. Very few studies have looked at these interactions and none have quantified the benefits that arise from the services of owls and other pest population regulators that come from forests or some wild areas around agriculture fields. Such knowledge can have wide ranging application across tropical regions to highlight the value of owls, snakes and other creatures, and also appreciate the importance of forests in the neighbourhood.

We examined this agriculture- forest landscape next to the Kalakad Mundanthurai Tiger Reserve (KMTR) in south India where intensive rice cultivation is carried out. Large owl species move between forests and fields to feed on rats. Some of these owls are obligate rodent feeders, and are estimated to consume 577 rats in a year (Neelanarayanan and Kanakasabai, 2003). Of these, eagle owls require large rocks, ravines or large trees with crevices for roosting and nesting. Destruction of their habitats outside the reserve has confined them to the forests. Traditionally, the farming community in this region provided perches in their fields for owls to hunt, but this practice is disappearing due to various reasons. People now believe that owl populations have fallen and hence may not provide adequate service to control the rodent populations. People also hire rat trappers to control rats, but that comes at a higher cost, while applying rodenticide is the cheapest option. Indiscriminate use of pesticides has its negative aspects – soils, crops and water are poisoned. Rats poisoned by anticoagulant pesticides die slowly and make easy prey for large owls. Consumption of poisoned rats could adversely affect the population growth of owls, leading to their decline (Raid and Martin 2004). So, are the owls, rats, and humans caught in a vicious cycle of pesticide poisoning or are there any other reasons that have led to the erosion of traditional options? Is it possible to revive the traditional perching system with current owl populations?

Initial results have revealed the presence of eagle-owls all along the eastern edge of KMTR and interviews with farmers have confirmed the existence of perch-usage to invite owls over the last few generations. Collection of owl pellets and observations in paddy fields have revealed the predation of rats by owls during the harvest and post-harvest seasons. While the farmers still acknowledge the perch as an indirect method of rodent control, with the use of rodenticides being vastly common, the inability of the farmers to confirm the nocturnal predation of rats by the owls may have led to the decline of perch usage in the recent past. Field research to confirm the predation of rats by owls and spreading awareness through popular media to the farmers is being pursued as a viable option to educate the farmers about this practice.

**Other Support**

The project has core support from National Geographic Society, with additional funds from JTT for field staff salaries, travel, and CCC facilities.

**Interdisciplinary Linkages**

This study requires the employment of behavioural ecology, spatial ecology, along with economics and agriculture.

### ➢ Ecosystem services of river-fed wetlands in South Tamil Nadu

*Team: T Ganesh, R Ganesan and M Soubadra Devy*

Southern districts of Tirunelveli, Tuticorin, and Kanyakumari in Tamil Nadu are a water-deficient area, with 945-mm mean annual rainfall, ranking next to Rajasthan in water scarcity. However, through numerous small wetlands fed by the perennial rivers flowing from the Western Ghats, these districts have managed their water requirements and also

enjoyed flourishing agriculture. The wetlands support a healthy population of several threatened wetland bird species, including the largest concentration of the spot billed pelican in south India (Kannan and Manakandan 2005). Besides these biodiversity support services, the wetlands also offer scores of other services. Traditional mat weavers use reeds growing on the lakeside to weave mats and other products, which are used extensively in India and exported. Fishes and crabs are harvested and sold during the summer when water levels fall. One particular community also rear ducks (duck farmers) that forage on harvested paddy fields and small wetlands and move their flock depending on the availability of such sites. The wetlands are intricately linked and inseparable from the culture and tradition of the people in the region, and often temples are located on their banks. Besides, the wetlands are an integral part of their daily activities such as bathing and washing and for seasonal pilgrimages to several temples located along rivers and other water bodies.

Kundakulam bird reserve, which is now under the State Forest Department, is an ancient heronry protected by local communities. Migratory birds are viewed as harbingers of rains and prosperity. It holds the largest concentration of breeding populations of spot billed pelicans and storks in south India (Kannan and Manakandan 2005). The community protects the nesting trees and prevents poaching of birds. At the end of the nesting season, the community collects the guano and uses it as fertilizer (Subramanya 2005).

What are the institutions that may be required to inculcate these values and adopt principles of co-management? To address this, we identified several wetlands that support good bird diversity after a multi-season survey. These wetlands also capture the diversity of institutions under which they are managed. One of them, Vagaikulam, discovered by ATREE, is the next biggest heronry after Kundakulam in the region. We have quantified services provisioned by this wetland in terms of the nutrient enrichment of water and the yield of fish from the tank due to the nesting and roosting birds. Through multi stakeholder consultation, the feasibility of establishing a community reserve was examined, where protection and management was vested with the community, with other stakeholders in advisory role. However, as the wetland is state-owned, there was only scope of establishing a conservation reserve where the community is one among many stakeholders. Consultation with the community revealed that the community preferred PWD control so as to avoid potential conflict in the three villages.

At stakeholders meetings, ATREE demonstrated the importance of these small wetlands and the complexities involved in their management for biodiversity and ecosystem services. The findings of this study will contribute to a policy brief which will help govern small inland wetlands for both human and biodiversity needs.

As part of the wetland programme, we conducted a comprehensive survey of wetlands for birds in the Tuticorin and Tirunelveli districts involving groups of committed people from the landscape. This revealed significant threats both to the wetlands and the birds along the Tamarabarni basin. A few groups have been formed which would monitor changes in the landscape and inform the concerned departments and village panchayats to take remedial measures.

**Other support**

The Ecosystem Grant Programme (EGP) was initiated with core funding from theInternational Union for Conservation of Nature (IUCN) to understand the river-fed-wetlands biodiversity and related services. JTT supported the Agasthyamalai CCC staff, articulate in the local language, to organize a series of stakeholder consultations, critical for this work. Also outreach material such as bird brochure, wetland bird guide in regional language and wetland bird census that is planned with community support, will be supported by JTT funds.

**Interdisciplinary linkages**

This work cuts across disciplines such as ornithology, ecosystem ecology, and application of principles of sustainability science. As this project involves implementation of Tamil Nadu's second conservation reserve, it requires further understanding of socio-economic and socio-ecological aspects.

**Outputs/outcomes**

ATREE will set up a 'Conservation Reserve' involving multi-stakeholders and institutions such as FD and civil society organizations, panchayat and the community to manage the wetland. The vision is of biodiversity conservation, apart from drawing benefits such as the hydrological-related service, food through fish culture, reed collection etc.

The outcomes of this study will contribute to a policy brief which will help govern small wetlands for both human and biodiversity needs. Individual wetland-based management strategy document that has been developed for six different types of ponds in the region will be representative of different groups of wetlands in the larger landscape of Tamil Nadu, hence have wider application.

## ➢ Neighbourhood parks and ecosystem services in an urban setting

*Team: Savitha Swamy and M Soubadra Devy*

*See papers*

Devy, M. S., S. Swamy and N. A. Aravind. 2009. Reshaping urban green spaces. *EPW* 44(46).
Swamy, S., and S. Devy. 2010. Forests, heritage green spaces and neighbourhood parks: Citizens attitude and perception towards ecosystem services in Bangalore. *Journal of Resources, Energy and Development* 7(1).

In India, most conservation efforts are towards forested landscape and there is lack of emphasis on urban green space and its biodiversity-related service. While large green spaces within cities seem to get protection and support of both ecologists and citizenry, small neighbourhood parks are often ignored. It is increasingly being realized that to develop new parks and build stewardship towards green spaces and urban biodiversity, understanding people's attitude and perception towards them are essential. We evaluated small green spaces within the city for the biodiversity and recreational services they provide to the citizenry groups and also assessed the attitudes and perceptions of the communities towards these parks.

All neighbourhood parks in Bengaluru are identified and mapped using GIS and remote-sensing techniques. These parks are further categorized into three size classes to estimate if there is a critical park size that would support biodiversity and provide recreational services. Biodiversity was assessed using key taxa such as birds and butterflies. A biodiversity fondness survey; attitude and perception survey were conducted among park users and beneficiaries, and those who seek alternate options such as gyms and do not use parks. Preliminary results show that people are fond of birds and butterflies, mainly because of their charismatic appearance. Small parks seem to support unique migrant bird species and a mix of wooded and open area butterfly species. Attitude survey revealed that people perceive only large parks to provide ecosystem services, than small and medium size parks. In general, there was a lack of stewardship even among users towards these parks although they harbour biodiversity. Also, there is scope for these neighbourhood parks to be managed to support more biodiversity.

Survey on identifying the various stakeholders of neighbourhood parks revealed that lesser privileged people benefit more from the livelihood services the park provides them. While carrying these social surveys, information on the existence of various types of management around neighbourhood parks was gathered. Of the existing managements, the two most dominant types of managements were chosen for identifying which management has been more successful in addressing both the social as well as the ecological aspects of the neighbourhood park. Social network analysis (SNA) was used to analyse the strength and weaknesses of the two management types, the ecological knowledge that exists within the network, the communication and relationship network between the individuals who form the network and the success in management of the park. Thus SNA, which is in progress, will help identify ways in which these managements can be strengthened to uplift the state of the existing parks to a higher state in order to deliver enhanced ecosystem services to the society.

**Other support**

This project is partially supported by funds from the Stockholm Resilience Centre and core funds are from JTT.

**Interdisciplinary linkages**

This problem is addressed under the co-management framework to examine how multiple players could act to make these parks deliver improved services. Apart from the basic ecological work which involves assessment of these parks for biodiversity, application of social networking tools will help identify missing linkages, which will enable the system to function, will be identified. Environmental psychology methods are used to understand the perception of biodiversity, ecosystem services and understand what components of biodiversity will be acceptable, if we were to build and spruce up these neighbourhood parks to support biodiversity. Current legal framework governing the state urban parks will be analysed to identify gaps for neighbourhood parks and outcomes of this study will help develop a policy, which will be inclusive of neighbourhood parks. Essentially, this problem will apply principles of basic ecology and sociology to address the conservation of neighbourhood parks.

**Outputs/outcomes**
A paper on conservation of neighbourhood parks has already been published in an international journal. At least 2 more papers will be published and information will be shared with the city corporation and other decision-makers in various city agencies associated with neighbourhood parks management.

## ➢ Pollinator-inclusive agriculture policy for food security and nutrition

*Team: M Soubadra Devy and Jahnavi Pai*

The success of many crops, especially horticultural crops depend heavily on pollinators, the loss of which can affect not only the country's economy (to which agriculture contributes 17.8% of the GDP and 58.2% of employment of the workforce (FAO Annual Report, 2009)), but also threatens to impede on eradication of poverty. In a bid to boost agricultural production to meet the growing demands of the population, intensification of agriculture is being carried out since the 'Green Revolution'. As a result, resources such as water and soil are being stressed and arable land is reducing. Forests are being cleared to create new agricultural and pasturelands (Sachs, 2010). This kind of agricultural intensification by increased use of pesticides and fertilizers along with clearing of natural vegetation can play havoc on one of the most important but often unacknowledged resource – the pollinators.

We are reviewing the threats that pollinators are facing in India, learnings from other countries and measures that need to be taken up at the policy level to mitigate an impending pollinator-decline. We are collating secondary data on pollinator-dependent crops and its expansion and performance in the last few decades in India. Our preliminary analysis has revealed that there has been a general decline in pollinator-dependent crops. We are also looking at the trends across various geographical regions and political boundaries.

**Additional support**
Initial funds were from FAO; core funds are from JTT.

**Interdisciplinary linkages**
More rigorous trend analysis will be carried out in the coming phase. A gamut of policies are connected with agriculture and pollinators such as Agriculture Policy, Forest Conservation Act, Indian Biodiversity, and the Quarantine Policy will be reviewed to see if the conservation of pollinators can be factored into these existing policies. The option of exclusive policies is also not ruled out as in many other countries. Essentially, this work will straddle across ecology, conservation, and policy analysis.

**Outputs/outcomes**
The policy brief or report, which will be the major outcome of this work, will be based on empirical data on pollinator-dependent crops.

Devy, M. S., and Jahnavi G. Pai. Invited talk. Securing pollination systems of India: Can we stop with biology? At national seminar on Forest resources pollen diversity utilization and conservation, 9–11 March 2011, GKVK, Bengaluru.

Devy, M.S., and Jahnavi G. Pai Forgotten pollinators, forsaken food security: Need for integrated pollinator-friendly policy. Paper submitted to *Economic and Political Weekly*.

## Hydrological services

- **Perceived value of hydrological services and economic benefits of the** Biligiri Rangaswamy Temple **Wild Life Sanctuary by farmers in the Gundal command**

*Team: Seema Purushothaman, Jagdish Krishnswamy, and K N Rakesh*

*See paper*

Purushothaman, Seema, Seema S. Hegde, Sheetal Patil, and Sham Kashyap. 2009. People's perception on benefits from a protected catchment: A case study of Gundal command in Karnataka. *Indian Journal of Agricultural Economics* 64(4): 573-584.

Irrigation reservoirs are fed by streams from protected catchments and heavy disturbance in the catchments release sediments that accelerate siltation and reduce the capacity of these reservoirs. Protected habitats help maintain reservoir water levels by regulating sediment inflow with their dense vegetation cover. This role has neither been quantified nor economically valued.

We carried out a study on hydrological services of a protected area in a 90 $km^2$ catchment in the Biligiri Rangaswamy Temple Wildlife Sanctuary (BRT WLS), an important tiger habitat, upstream of the Gundal reservoir. We instrumented a 90 $km^2$ catchment in the BRT WLS, and measured sediment discharge in the Gundal stream. ATREE estimated the direct benefits accruing to downstream farming communities in the form of drinking water, crop production, changes in cropping patterns and intensity, fish catch, drinking water and fodder for livestock, Apart from this, farmers' perceptions on indirect benefits such as increase in groundwater table, recharging of water in open wells, improvement in biomass, increased soil moisture, and potential for multi cropping were also assessed (Purushothaman et al 2009). ATREE will follow this up with a study of the reduction in benefits if the protected catchment were degraded, and the policy implications of resource use and perceived benefits.

This project is the first of its kind to attempt to enhance civil society support for tiger habitat conservation through multi-disciplinary assessment of ecosystem services of well-protected tiger habitat and modelling of such services for other tiger habitat in the Western Ghats. In particular, the combination of primary hydrologic measurements and socio-economic data for a catchment in combination with use of remotely sensed surrogates for quantifying and mapping ecosystem services several tiger reserves is a unique feature of this project. This pilot project has in particular made a good start in linking the economic and livelihood welfare of downstream beneficiaries of irrigation services to upstream tiger conservation.

**Future research**

Apart from the existing gauging of rainfall, stream flow and sediment, we plan to initiate measurements on soil moisture at various depths. We will use the time-series of data on

streamflow, soil moisture, Normalized Difference Vegetation Index (NDVI), sediment and climate to estimate sediment, hydrologic and carbon dynamics of Gundal forests and its contribution to local and global ecosystem services.

**Other support**
This project is also supported by a grant from the National Fish and Wildlife Foundation under the Save the Tiger Fund.

**Outputs/Outcomes**
We expect at least one peer-reviewed journal article on hydrologic and sediment control services of the Gundal forests and another on carbon sequestration dynamics of Gundal forests. A poster that summarizes the benefits of upstream conservation for farmers downstream will be designed and published, and a meeting with the water-users group will be organized.

**Interdisciplinary linkages**
The perception of farmers of benefits from Gundal reservoir has already been documented. Once we estimate the actual sediment control services performed by the forests upstream of the catchment, we will compare it with farmers' perception of these services and share our findings with the water-users groups through discussions and posters. We will also share our findings with the Soliga communities who live upstream of the reservoir, through the Soliga Abhivruddhi Sangha (SAS) and Vivekanand Girijan Kalyan Kendra (VGKK).

- **Hydrologic services in the Western Ghats**

*Team: Jagdish Krishnaswamy, M C Kiran, and Rakesh K N*

*See paper*
Bonell, M., B.K. Purandara, B. Venkatesh, J. Krishnaswamy, H.A.K. Acharya, U.V. Singh, R. Jayakumar, and N. Chappell. 2010. The impact of forest use and reforestation on soil hydraulic conductivity in the Western Ghats of India: Implications for surface and sub-surface hydrology. *Journal of Hydrology* 391: 47–62.

The role of well-protected tiger habitats in the Western Ghats as an umbrella for biodiversity has been demonstrated (Das et al, 2006). Western Ghats is typical of an intensively used natural resource-rich montane area, which sustains the livelihoods of many. Approximately 245 million people living in the peninsular Indian states receive most of their water supply from rivers originating in the Western Ghats. The state of Karnataka and Kerala derive a major proportion of their electricity generation from hydropower projects (about 59% of Karnataka's and up to 70% of Kerala's power needs are met by hydel projects) that are mostly located in the Western Ghats region and the associated Mysore plateau.

Almost every Protected Area, including all the major Tiger Reserves and important tiger habitats ranging from the Kalakad–Mundanthurai and Anamalai in Tamil Nadu, Periyar and Parambikulam in Kerala, Nagarahole, Bandipur, BRT, Kudremukh Bhadra, Anshi–

Dandeli in Karnataka to Koyna/Chandoli and Radhanagari in Maharashtra in the Western Ghats are also in the upstream/upper catchment of major irrigation and hydel projects. ATREE examined whether this is significant in the role that a protected area might play in providing hydrological services.

We found that well-protected tiger-habitats maintain the quality of surface and ground-water, reduce sedimentation and regulate flows into hydel and irrigation projects. These services have not been quantified, economically valued and disseminated amongst key political players and civil society, and so have not resulted in adequate political and civil society support for tiger conservation.

Only tangible forest products with a realised economic value and the costs of conservation are recognized and understood. Establishing the economic value of these services to end-users could generate broader awareness and support for tropical forest and biodiversity conservation and their sustainable management. This project will help develop landscape-level conservation vision for the Western Ghats tiger landscape that has buy-in from governments, local communities, non-government organizations (NGOs), and put mainstream tiger conservation into the national and regional development agenda.

**Other support**

This work is additionally supported by support from the Suri Sehgal Foundation and the National Fish and Wildlife Foundation under the Save the Tiger Fund.

**Outputs/outcomes**

A map showing the distribution of hydrologic services throughout the Western Ghats will be prepared. A report to the National Tiger Conservation Authority, Government of India and the Expert Panel on Western Ghats, Government of India will be submitted.

A peer-reviewed manuscript on hydrologic services of protected tiger habitat will be prepared.

**Interdisciplinary linkages**

We will synthesize spatial knowledge and map hydrologic services with irrigation and water requirements of different land-use and communities and towns that are located downstream of adjoining tiger reserves.

### ➢ Carbon ecosystem services

*Team: Jagdish Krishnaswamy and Robert John Chandran*

Carbon stored in soils and vegetation is a major global reservoir for terrestrial carbon. Carbon emission from destruction and degradation of tropical forest ecosystems is among the largest sources of carbon dioxide emissions to the Earth's atmosphere. Thus, avoiding deforestation and degradation is an important way to decrease carbon dioxide emissions to the atmosphere. Carbon held in forest vegetation and soils constitutes an important service provided by forest ecosystems.

While reduced carbon emissions is widely recognized as a compelling reason to prevent deforestation and forest degradation, the implementation of this approach is hampered by the lack of quality data on carbon stored in terrestrial vegetation and soils for many important regions of the Earth. The ATREE project assembles large datasets built from available secondary data from published sources, institutions, and individual researchers, using which we aim to quantify above- and below-ground carbon in the Western Ghats. The results will be used to explore the relationship between the level of ecosystem services and factors such as forest type, climate, soil properties, management and human-use, and disturbance.

**Outputs/outcomes**

Peer-reviewed paper on 'Soil carbon under different land-cover in the Western Ghats' is being prepared. Map of soil carbon showing hotspots of carbon storage in the Western Ghats will be prepared. Forest-dwelling communities can perhaps benefit from knowledge of the carbon value of the forests and soils that they depend on and use that for negotiations.

**Interdisciplinary linkages**

We have presented the ideas and data coming out of the project to a range of stakeholders, including the Karnataka Forest Department and other conservation agencies. We presented our work to the Western Ghats Ecology Panel of the Government of India and for the first time, ecosystem services, especially hydrologic services of well-protected tiger habitat will be considered in identifying ecologically and environmentally sensitive sites in the Western Ghats.

Many ecosystem services have synergies and trade-offs with each other (Elmqvist et al 2010). The choices we make about how to manage landscapes is ultimately a political and economic decision. As an example, carbon services and hydrologic services have certain synergies and trade-offs. Furthermore, one has global stakeholders and the other has local stakeholders. We will gain experience in communicating these trade-offs to these different stake-holders and on how these trade-offs can be managed within a single framework that links livelihoods, local and global ecosystem services and market-based mechanisms and demand for carbon services. Initiatives such as the Green India Mission, which are largely carbon-centric, will benefit from the knowledge generated by these issues.

**CENTRE FOR ENVIRONMENT AND DEVELOPMENT**

## Land, Water and Livelihoods

***Primary faculty:*** *Shrinivas Badiger (Programme Leader), Bejoy K Thomas, Seema Purushothaman, Siddhartha Krishnan (until May 2011), Mohan Seetharam (until December 2010)*

***Secondary affiliates:*** *Veena Srinivasan (adjunct), Sharachchandra Lele*

Rapid increases in irrigated agriculture and industrial production have subjected south Asia's land and water resources to immense stress and conflicts between agricultural, domestic, and industrial stakeholders. Reducing such stress and resolving conflicts require an understanding of the linkages between the state of land and water resources, use and demand by different sectors, and social cultural, economic and political processes affecting policies and decision-making.

**Research themes:** Interactions between agricultural, domestic and industrial land-use and water-use practices, related policies, and livelihood systems in resource-stressed agricultural regions; direction and drivers of change in water availability, water quality, land degradation and food security; appropriate institutions and policies to achieve environmental sustainable land and water use; impact of climate change on interactions among land, water, and livelihoods.

The interdisciplinary character of the LWLP emerges from both the team profile and the research agenda that has been corollary to such a profile. The disciplinary diversity of LWLP faculty members includes hydrology, development studies, ecological economics, and sociology.

- **Negotiating tradeoffs: Making informed choices about ecosystem services for poverty alleviation (initiated in December 2010)**

*Team: Shrinivas Badiger, Jagdish Krishnaswamy*

*See papers*

Badiger, S., and T.V. Reshmidevi. 2010. Ecosystems and livelihoods at crossroads: Modelling land-use change impacts on water regimes and downstream users. In: *ASCE–EWRI's 3rd Developing Nations Conference: India 2010. An international perspective on current and future state of water resources and the environment*. Chennai. 5–7 January 2010.

The study uses the ecosystem services framework for developing approaches that simultaneously provide ecological stability and livelihood security, especially in the most vulnerable regions such as those in Malaprabha sub-basin, to integrate concerns about the resilience of ecosystems with their broader developmental implications. Most trade-off analyses neglect the reality of actual decision-making in the context of ecosystem management strategies. At the field level, decisions typically involve repeated processes of consultation, negotiation and compromise. How do conflicting stakeholders make choices in specific empirical situations? What are the relative roles of different actors, and how do they exercise power in this process? Whose values and interests are reflected in final outcomes,

and to what extent can outcomes be seen to enhance social well-being? What are the institutions and structures of governance that enhance effective decision-making? These are difficult questions, but are critically important if improved ecosystem management is to be used as a tool for sustainable poverty reduction. Only by empirically documenting the decision process itself, in all its messy political reality, will we be able to generate a genuine understanding of the feasible ways in which ecosystem services can be protected or enhanced, while simultaneously benefiting the most marginalized and vulnerable groups in society. This project will develop a framework to understand how actors actually negotiate over tradeoffs in the context of ecosystem management. It will use a process of expert-led modelling of ecological and socio-economic dynamics alongside an engagement with more 'lay' or everyday perspectives from local stakeholders. It will use structured software for systems dynamic modelling to develop expert and participatory models of the local socio-ecological system, and will use these to engage local stakeholders in a structured dialogue about tradeoffs and choices, through a series of site-based workshops. The findings from these modelling exercises, and from the stakeholder workshops, will be used to analyse the ways in which decisions are actually made in these local contexts, with a specific focus on how political constraints influence the nature of the process. These observations will be used to construct a grounded framework that documents the political economy of negotiations over resource use, which will ultimately help policy makers develop better strategies for pro-poor ecosystem management.

Funding Support: ESPA Programme, UK
Collaborators: University of Cambridge, University of Oxford, Winrock India International.

Additional Support: Ford Foundation
Outputs: Journal articles, policy briefs, ES toolkit, stakeholder workshops

**Interdisciplinarity**
The project incorporates biophysical (hydrologic, biodiversity), sociological, and political economy in its methodological framework.

### ➢ Land, water, and sustainable livelihoods in Malaprabha sub-basin

*Team: Shrinivas Badiger, Bejoy K Thomas, Iswaragouda Patil, Siddhartha Krishnan (until June 2011), Mohan Seetharam (until December 2010)**

*See paper*
Reshmidevi, T., and S. Badiger. 2009. Impact of irrigation intensification on inter-sectoral water allocation in a deficit catchment in India. In: *Proceedings, Symposium JS.3 at the Joint IAHS & IAH Convention*. Hyderabad, India. 6–12 September 2009.

Patterns of land and water resources use in the Malaprabha sub-basin have drastically changed in the last two decades, leading to changes in the vulnerability profile of communities and households. This study focuses on the livelihoods of farming communities presently cultivating sugarcane in Malaprabha mid-catchment. We attempted to address the following research questions: (1) What are the geographical determinants of differential

access to water? (2) To what extent do social characteristics explain differential access to water? (3) What is the nature of conflicts over water access and control? and (4) What are the well-being effects of differential access to water on different livelihood and social groups?

The framework used in this case study draws from political economy (food policies and community level impact), geography (land-use change) and sustainable livelihoods (relative importance of economic, social and institutional resources at the household level). We acknowledge the direct and indirect impact that different actors/institutions (state, non-state) and processes (policies) at the macro- and meso-levels have on the sustainability of livelihoods at the household level (as represented by their endowments of human, social and economic capitals), resulting in diverse well-being outcomes. These linkages are being examined in the context of changing agricultural practices in the study area.

**Additional support**
Core funds are from the Ford Foundation, but two Fellows are supported by JTT funds. Partial support towards travel is also from JTT.

**Outputs/outcomes**
This study will also lead to research papers and popular articles.

**Interdisciplinary linkages**
The study is based on a previous project carried out at ATREE, which included detailed forest and agricultural land-use analysis using remote-sensing, and scenario building of land-uses in a comprehensive hydrologic modelling framework, along with an understanding of conflicts between various communities in accessing water within the sub-basin for irrigation water uses and drinking water requirements. This component uses a vulnerability and sustainable livelihoods framework given the understanding of the biophysical resource base.

## ➢ Towards an integrated perspective on vulnerabilities in Vembanad region

*Team: Bejoy K Thomas, Shrinivas Badiger, Biju Abraham, Siddhartha Krishnan (until June 2011), Mohan Seetharam (until December 2010)**

*See paper*
Thomas, B. K., R. Muradian, G. de Groot, and A. de Ruijter. 2010. Resilient and resourceful? A case study on how the poor cope in Kerala, India. *Journal of Asian and African Studies* 45(1): 29–45.

The Vembanad estuarine system, a Ramsar site, and its surrounding paddy belt of Kuttanad represent a complex socio-ecological system comprising the backwaters, natural and man-made canals, lagoons and reclaimed land on which approximately 1.6 million people in 40 village panchayats depend for their livelihoods. This peculiar context requires a comprehensive understanding of the hydrology, water quality issues and socio-economic dynamics in the region. The point of departure for the pilot phase of research (July 2010–July 2011) has been that extant literature on Kuttanad/Vembanad lacks an integrated and

multidisciplinary approach to the region's issues with the socio-economic studies focusing largely on the agrarian issues in the Kuttanad region (emphasizing social vulnerability of paddy farmers and agricultural labourers); ecological degradation of Vembanad lake and its surrounding riverine ecosystems.

The longer-term objective of the team's work is to bring the socio economic and bio physical/ecological streams together using empirical and grounded research with conceptual and methodological inputs from social and natural sciences. The ongoing research, which is the first step towards this, focuses on the linkages between water access (especially clean drinking water, given that water quality is getting degraded by contaminants discharged from agriculture, industries, tourist boats, urban sewage), human well-being and associated vulnerabilities. In its framework and execution, the study brings together spatially explicit information on the dynamically inter-related biophysical and socio-economic factors in this complex socio-ecological system.

**Other Support**
Core funds are from the Ford Foundation, with additional support for faculty salaries from JTT.

**Outputs/outcomes**
Research and popular articles will ensue once the data is consolidated and analysed by August/September 2011.

**Interdisciplinary linkages**
The context of Vembanad–Kuttanad region requires a comprehensive understanding of the hydrology, water quality issues and socio-economic dynamics in the region. Research includes the linkages between water quality and quantity, human well-being, vulnerability, risks, epidemiology, climate change and poverty. Research initiatives engage with ATREE's cross-cutting thematic areas of policy and climate change. Climate change is being factored into both natural and socio-economic aspects of the research.

## ➢ LUPIS project Interdisciplinary methods to assess the impact of policy on sustainable agriculture in Karnataka

*Team: Seema P, Seema Hegde, Sheetal*

*See papers*
Reidsma, P., H. König, S. Feng, I. Bezlepkina, I. Nesheim, M. Bonin, M. Sghaier, S. Purushothaman, S. Sieber, M. K. van Ittersum, and F. Brouwer. 2011. Methods and tools for integrated assessment of land use policies on sustainable development in developing countries. *Land Use Policy* 28(3): 604–617.

Purushothaman, S., and S. Kashyap. 2010. Trends in land use and crop acreages in Karnataka and their repercussions. *Karnataka Journal Agricultural Science* 23(2): 330–333.
This study started with a district-wise analysis of change in land-use pattern, cropping pattern and farmer suicides (published). The analysis helped us obtain support from

European Commission in 2007 to study selected districts to test the hypothesis that polices have an important role in determining sustainability of small farms in Karnataka and that we can use interdisciplinary methods to assess these impacts.

JTT supported the part of our study that required qualitative and quantitative methods for the analysis of the data collected through a workshop on integrated models and building capacity of our research staff to prepare such models.

**Other support**
Core funds are from European Commission. Additional funds from JTT will support the completion of this project and look at the politico-economic aspects of small farm sustainability and ecosystem services from production landscapes.

**Outputs/outcomes**
Papers, articles, policy briefs, policy fora, participatory assessments

**Interdiscplinarity**
The study examines agrarian distress from a politico-ecological-economic angle. The natural science contribution is in identifying, measuring and interpreting ecological sustainbility indicators in small farms of Karnataka. Quantitative techniques are used in answering efficiency questions and *ex-ante* assessments. Participatory assessments and institutional analysis are used in assessing social sustainability.

### ➢ Emergence of Independent Regulatory Agencies in the water sector

*Team: Shrinivas Badiger, Divya Badami Rao*

India's experiments with alternating policies emphasizing greater role for the state, collective action and markets as essential components for resolving water problems have worked in some places, but have failed in most other diverse contexts. During this study, comprehensive review of new directions and policies in the water sector in India, and its specific relevance to new regulatory institutions and pricing mechanisms debated in Karnataka and other states were studied.

**Other support**
Core funds were provided by Ford Foundation via the project holder PRAYAS, Pune. Partial support from JTT will be used to publish and disseminate the research finding through a citizen's reader/booklet.

**Outputs/outcomes**
Water governance in Karnataka: 20 questions civil society should ask. Bilingual citizen's reader on rights, participation and sustainability in water governance (a bilingual booklet).

This booklet is based on a comprehensive review of policies in the water sector in India and its specific relevance to new regulatory institutions and mechanisms debated in Karnataka and other states. It provides the readers essential elements of water governance constituting

rights, participation and sustainability of water resources. It is presented in a Q&A format to trigger critical thinking among civil society members including academicians, practitioners and policy makers to help them make informed choices in their contexts. The booklets will be printed both in English and Kannada to reach a wide spectrum of audience, including community level institutions such as village panchayats and water user associations.

The initial set of booklets (about 500) will reach ATREE's contacts, NGOs in Karnataka and other organizations working broadly in the natural resources sector, including the water sector by the end of 2011. Remaining copies will be sent to interested individuals and institutions upon request.

**Interdisciplinary nature**
The study looks at challenges in water governance that include issues of sustainability of water resources, rights and participation of communities that require comprehensive understanding of both the hydrologic cycle and socio-economic issues.

## Forests and Governance

***Primary faculty:*** *Nitin Rai, Siddappa Setty, Swati Shresth, Subhrajit Saha (until December 2010), Ashokankuar Datta, Sharachchandra Lele (Programme leader)*

Forests and common lands generate products and services that benefit stakeholders at local, regional, and global scales. The Forests and Governance Programme examines the form and nature of these stakes and how these stakes might be compared and prioritized; how current attempts to define stakes and decentralize institutional arrangements and regulate forest loss are actually playing out; and how forest governance could better reconcile competing claims and multiple stakes. The Forests and Governance programme at ATREE focuses on these questions in the context of the forests of south Asia.

The research themes are: the ecology of sustainable forest use and extraction by local communities, the ethnography of traditional ecological knowledge, the economics of forest dependence and its variation under different forest governance regimes and socio-political contexts, and the institutional and legal analysis of existing and proposed changes in forest governance.

### ➢ Collaborative conservation, rights, culture and history in Biligiri Rangaswamy Temple Wildlife Sanctuary

*Team: Nitin Rai, Made Gowda, Suchismita Das, and Sushmita Mandal*

*See papers*
Lele, S., M. Pattanaik, and N. Rai. 2010. NTFPs in India: Rhetoric and reality. In: *Wild product governance: Finding policies that work for non-timber forest products* (eds. Laird, S.A., R. McLain, and R.P. Wynberg). Pp. 85–112. London, UK: Earthscan.

Menon, A., C. Hinnewinkel, C. Garcia, S. Guillerme, N. Rai, and S. Krishnan. 2009. Competing visions: Domestic forests, politics and forest policy in the Central Western Ghats of South India. *Small-scale Forestry* 8: 515–527.

Krishnan, S. (ed.). 2009. Perspectives on the Forest Rights Act. *Current Conservation* 2(4).

Krishnan, S. 2009. What can the Forests Rights Act decentralise: Protection or conservation? In: *Perspectives on the Forest Rights Act* (ed. Krishnan S.). *Current Conservation* 2(4).

ATREE's work in forest and governance aims to combine ideas from different disciplines to arrive at a nuanced understanding of ecological and cultural landscapes and also bring about local empowerment and management. The Recognition of Forests Rights Act of 2006 (RFRA) has resulted in previously marginalized scheduled tribes claiming rights to agricultural land, forest produce and forest management. The RFRA provides an opportunity for local communities to exercise their rights and to jointly manage ecosystem resources with state agencies. ATREE recognizes that the first step in conserving biodiversity is the restitution of rights as well as the inclusion of local communities in conservation efforts. The work on the dissemination of information on the RFRA, studying the process on the ground and at the regional level, as well as engaging with national level efforts on policy reform is progressing. This long-term work has included the holding of workshops; the production of maps that represent cultural information and is now being used by tribal groups to claim collective rights; and networking with national groups to ensure constant information exchange between local and national entities for better implementation of the Act. ATREE has held two regional workshops on the RFRA in Mysore. The first was held in 2009 and the second in 2010. Tribal groups, FD officials and civil society members attended these meetings. These meetings have provided an unprecedented opportunity for tribal activists and state officials to openly discuss contentious issues as well as explore the possibility of collaborative management of biodiversity and forest resources.

ATREE has been working closely with the SAS, a welfare organization of Soligas, to both implement the Act and disseminate information on the Act in the district of Chamrajanagara. The close cooperation has resulted in the district administration being the leader in the state for the implementation of the act and especially the implementation of the provisions relating to the community forest rights. State agencies have invited ATREE, SAS, and the VGKK to assist them with the training and capacity building of local groups and forest officials.

We will continue to track the implementation of the Forest Rights Act in the Sanctuary and study the impacts of the implementation of the Act on the lives and livelihoods of the community and also on the forest resources once the community forest rights are granted. In particular, we will study the impacts on women as a result of secure tenure: the changing relations with the land and its impacts on the household livelihoods and food security in particular.

**Recent policy change and future work**

A recent surprise move by the Ministry of Environment and Forests to declare BRT WS a tiger reserve has caused concern amongst the Soligas. The fear of eventual relocation and curtailment of access is currently running high. These fears are based on actual reports of such relocations from tiger reserves across the country. The long history of residence, cultural attachment to the forest, customary practices that have resulted in the current high levels of biodiversity and the continuing dependence of a large number of Soligas suggests that a different model of tiger reserve governance, that includes local communities, might be viable at BRT.

The Forest and Governance programme will as a first step put together a cogent argument based on ATREE's long-term ecological work, recent cultural and historical information and work on institutions of forest management to present a case for BRT as a collaborative experiment that could be a model for a people's protected area.


**Other support**

This work is entirely supported by the JTT grant.

**Outputs/outcomes**

The collaborative management effort in BRT WS has resulted in the production of a detailed map that represents Soliga sacred sites and cultural landscapes.

This effort in counter-mapping is the first such effort in India and has already been widely appreciated as being exceptionally important for the Soligas to claim participation in the conservation decision-making process in the wildlife sanctuary. The process while documenting and archiving a vast resource of places and stories also provided a critical understanding of the ways in which Soligas interact with the landscape. We used formal cartographic instruments such as the use of GIS-enabled devices to locate places and names that Soligas identified with in mainstream maps. We have developed maps produced in consultation with Soligas that have been converted to posters presenting the Soliga narrative. These posters have been

used for wider dissemination. This is the first effort by Soligas to re-engage with the landscape after their displacement and curtailment of rights since the establishment of the protected area. They perceive the map as a political tool in the reassertion of their rights within the landscape. The RFRA recognizes such evidences and also provides space for asserting such rights.

**Interdisciplinary linkages**

The study combines the results of a decade's ecological research with the cultural and historical aspects of Soliga life. Our work involved ecologists, social scientists, and policy analysts for a nuanced understanding of conservation and livelihoods in forest-fringe areas. The cultural mapping, understanding of forest dynamics, and work with communities on claiming rights under the Forest Rights Act is a demonstration of the interdisciplinary nature of the work.

- **An analysis of ecotourism in protected areas**

Ecotourism is being encouraged by the state as well as industry as the magic solution for conservation and development. However, the experience on the ground has been very different. While landscapes will continue to be visited by tourists, we are interested in how local communities can play a more significant role in translating their landscape and their culture in ways that are empowering and that ensure the long-term respect of their place in the landscape as equal partners in its conservation and commodification.

Over the last year, the project has been used to study the utilization and implementation of ecotourism, in the BRT WS in India. Ecotourism is a market-based development tool that puts a monetary incentive on conservation and while guaranteeing profitability for entrepreneurs and visitor satisfaction, also brings benefits to the community, leading to their empowerment. We looked at how the idea is being implemented in the BRT WS and steps required to optimize its potential as a development and conservation tool.

Along with conservation education, tourists also need to be sensitized to issues of indigenous people, and the need to safeguard their rights and respect their in-depth and intimate knowledge of nature. The cultural map, depicting how Soligas conceptualize their landscape, outside of the scientific, geographic mapping of the experts, which ATREE has helped Soligas consolidate, is a document whose dissemination can serve this purpose. Other methods and materials need to be created or procured to this effect; and ways of displaying these should be sought. Since the naturalists and guides are locals, while providing the scientific knowledge, which they have acquired though recent training, to the tourists, they should also be allowed to discuss indigenous beliefs, practices and perceptions regarding the flora and fauna of the forest.

**Other Support**

Core funds were from the Blue Moon Fund, with partial support from JTT for travel and field support.

**Interdisciplinary nature**
This timely study brings together disciplines such as sociology, anthropology, and ecology together in addressing often ignored questions and concerns in tourism initiatives.

**Outputs/ outcomes**
A report, a paper and a short article for Down to Earth will, in general, advance a deeper understanding of how ecotourism projects can be empowering and respectful of local communities and their home.

**Note:** JTT funds have also provided marginal support for research in the LWLP in Vembanad and the study of minor forest produce in Madhya Pradesh, both of which were primarily supported by the Ford Foundation institutional development grant.

# ACADEMY FOR CONSERVATION SCIENCE AND SUSTAINABILITY STUDIES

The Academy uses the advantage of having experienced and specialized faculty to widen the reach of education to a wide berth of beneficiaries. This is made possible through:

- PhD Programme
- Certificate Courses in Conservation Science, Conservation Genetics, and in Social Sciences
- Conservation education programmes with schools
- Conservation Education
- Capacity-building initiatives with community bodies, NGOs, FD personnel, journalists, etc.
- Public Talks/Lectures
- Small Grants Programmes
- Internship Programmes

The Academy implements conservation education in schools through vacation training programmes, environmental education programmes for school teachers and students, through DNA Clubs, Eco Clubs, greening the schools, mini research, the World Environment Day celebrations, World Wetland Day celebrations, etc.

CCCs are the sites where students and researchers can closely observe the community resource interface and where fledgling participatory practices, incorporating the demands of local participants, have grown to assume dimensions that have resulted in action from stakeholders and change at ground level. The CCCs have helped students and researchers create a first-hand account of a participative, inclusive, and multi-disciplinary approach with conservation solutions.

**ATREE SEMINAR 2009**

The ATREE Seminar is held to give researchers and students an opportunity to present ongoing work and initiate discussions with colleagues. It is seen as a great opportunity to know about the diverse range of issues/subjects that people in ATREE are working on in different parts of the country -- Eastern Himalayas, North-east region, and from ATREE's CCCs.

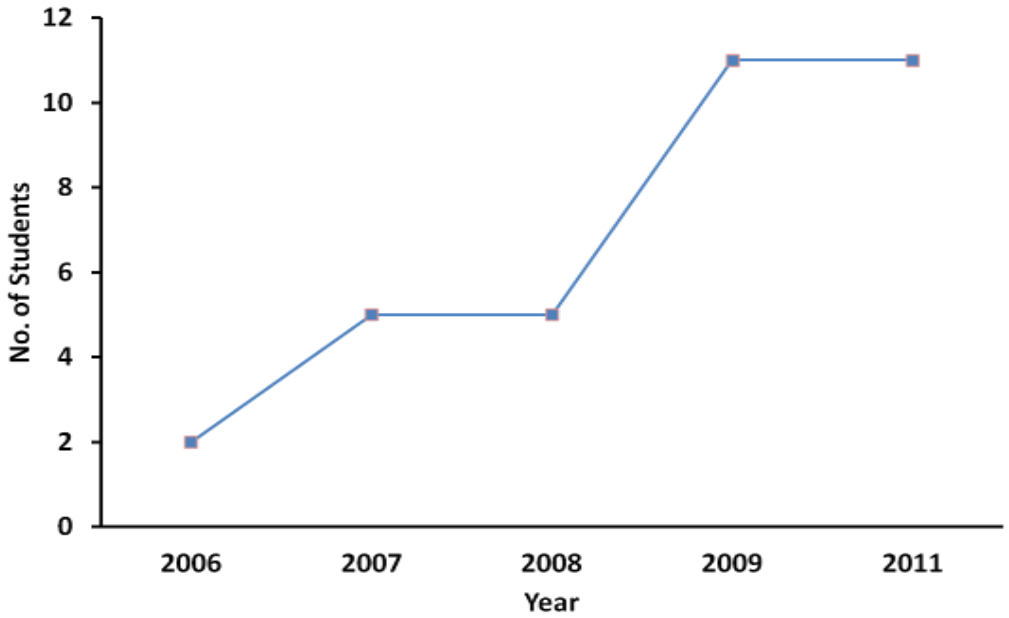
The last ATREE Seminar was held in June 2009. There were 38 talks and 8 poster presentations over two days by about 70 participants. The seminar was grouped into five thematic sessions: ecological monitoring; livelihoods and environmental governance; policy and environment; ecological processes and patterns; and conservation outreach.

## PH D COURSEWORK: INTERDISCIPLINARY LINKAGES AND INTEGRATION

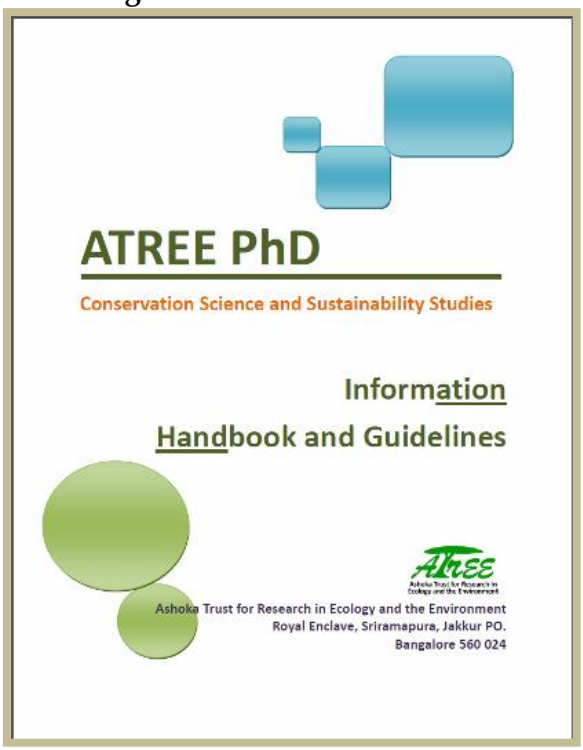
As of 2011, ATREE has 39 PhD students, of which 16 joined in 2011.

Bharath Sundaram became the first ATREE Ph D to get a doctorate this year, with the successful defence of his thesis 'Patterns and processes of *Lantana camara* persistence in South Indian tropical dry forests', in June 2011.

Four students will defend their theses in 2012.




### PhD Programme




The ATREE doctoral programme in Conservation Science and Sustainability Studies integrates tools and approaches from ecology, economics, sociology, and climate science. A doctoral committee of 3–5 members with expertise in different disciplines provides student guidance.

The course work has been framed so as to provide comprehensive overviews into natural and social sciences for students with backgrounds lacking in either. The foundation course in natural science covers principles in basic ecology and evolution, behavioural ecology, population biology, community ecology, ecosystem ecology, landscape ecology, and soils and hydrology. The foundation course in social science introduces natural science students to the basic principles

of economics and sociology, focusing on classical and contemporary economic and sociological theory and expanding into ecological economics and environmental sociology.

Advanced core courses in conservation science and in research design and methods (for both natural and social sciences) follow from the foundation courses. The core course in conservation science is built on three thematic issues that are central to the current debate on conservation of biodiversity and sustainable economic development viz., the decline of biodiversity, land degradation, and climate change. Each thematic issue is studied from multidisciplinary perspectives, which are then brought together for an integrated approach.

The core course in research design and methods trains students in advanced statistical, computational, and analytical methods to equip them with the necessary tools to design and implement research, and analyse data.

Elective courses give students exposure to advanced discussions on current research and understanding on ecology, conservation science, and environmental and forest policy, and governance.

Collaborations with organizations in related fields ensure the best knowledge inputs in environment conservation and sustainable development studies. Some of the collaborations are:

- Centre for Ecological Sciences, Indian Institute of Science, Bengaluru, Karnataka, India
- Centre for Wildlife Studies, Bengaluru, Karnataka, India
- Department of International Environment and Development Studies (NORAGRIC), Norwegian University of Life Sciences
- Foundation for Ecological Security, Anand, Gujarat, India
- Foundation for Revitalisation of Local Health and Traditions, Bengaluru, Karnataka, India
- Green Foundation, Thalli and Bengaluru, Karnataka, India
- Institute for Social and Economic Change, Bengaluru, Karnataka, India
- Institute for Wood Science and Technology, Bengaluru, Karnataka, India
- Kalpavriksh, Pune, Maharashtra, India
- National Centre for Biological Sciences, Bengaluru, Karnataka, India
- National Institute of Advanced Studies, Bengaluru, Karnataka, India
- Nature Conservation Foundation, Mysore, Karnataka, India
- Stockholm Resilience Centre, Stockholm, Sweden
- University of Agricultural Sciences, Bengaluru, Karnataka, India

**See Annexure 2 for interdisciplinary linkages and integration in the theses of Ph D students at ATREE**

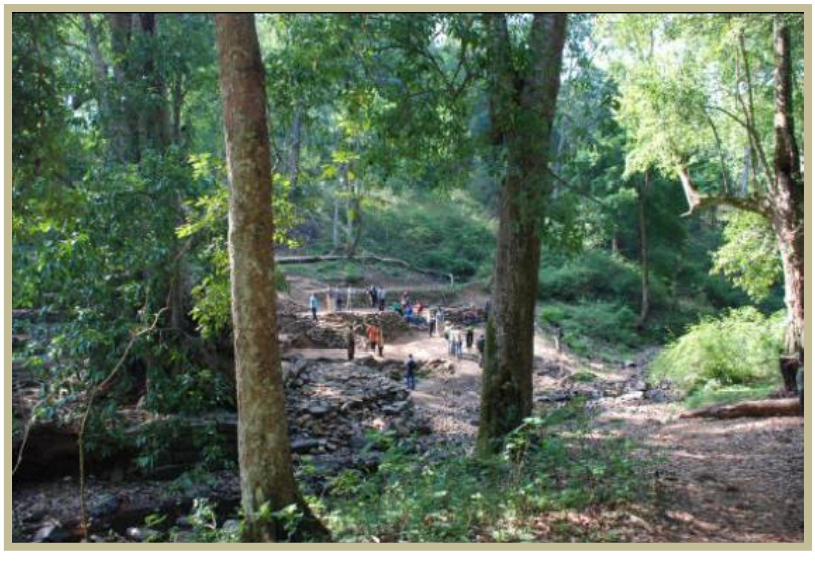
## CERTIFICATE COURSES

### Certificate Course in Conservation Science

This course was held from the 10 to 23 August 2010. The course began in Bengaluru with a series of lectures by faculty, staff and external resource personnel introducing students to the 'science' of conservation. The lectures focused on conservation issues at the regional level, but with a global perspective. This was interspersed with interactive discussions in the first four days.

Following this, the students were taken to ATREE's Agasthyamalai CCC. Here, they were given a brief on ATREE' s work in the landscape and an introduction to KMTR with a field trip to Kakachi and Kodayar in the wet evergreen forests, as well as to Mundanthuria's dry evergreen and deciduous forests. As part of the course work, students came up with some interesting studies, covered in more detail in the *Agasthya* newsletter.

### Vacation training programme 2010 and 2011



Twenty-one secondary school students attended the Bio-resource course held from 26 April to 15 May 2010; and 26 April to 14 May 2011 at ATREE, Bengaluru. The objective of the course was to introduce young minds to research areas and issues pertaining to the use and conservation of natural bio-resources.

Classroom sessions consisted of lectures by eminent scientists and experts from various fields on biodiversity, urban wildlife, wildlife rehabilitation, waste management, sustainable agriculture, conservation issues, water quality monitoring, sustainable living and forest products that contribute to the livelihood of tribal folk. Lectures were followed by assignments and group projects.

Field trips exposed students to the applications of concepts and served as a platform for introducing them to the skills required for doing field work on bio-resources. This included

visits to the Biligiri Rangaswamy Wildlife Sanctuary, Ramanagara Vulture Nesting Area, Ranganthittu Bird Sanctuary, Butterfly Park in Bannerghatta National Park, and Navadarshanam – an eco-ashram.

### Certificate course introducing geospatial tools for conservation

This 12-day course, from 14 February to 26 February, 2011, provided participants with an opportunity to learn the basic principles of remote sensing, GIS and GPS. The course also provided rigorous, individualized hands-on training in GIS/RS techniques using state-of-the-art software.

### Certificate Course on Perspectives on Environment and Development: Concepts and Debates

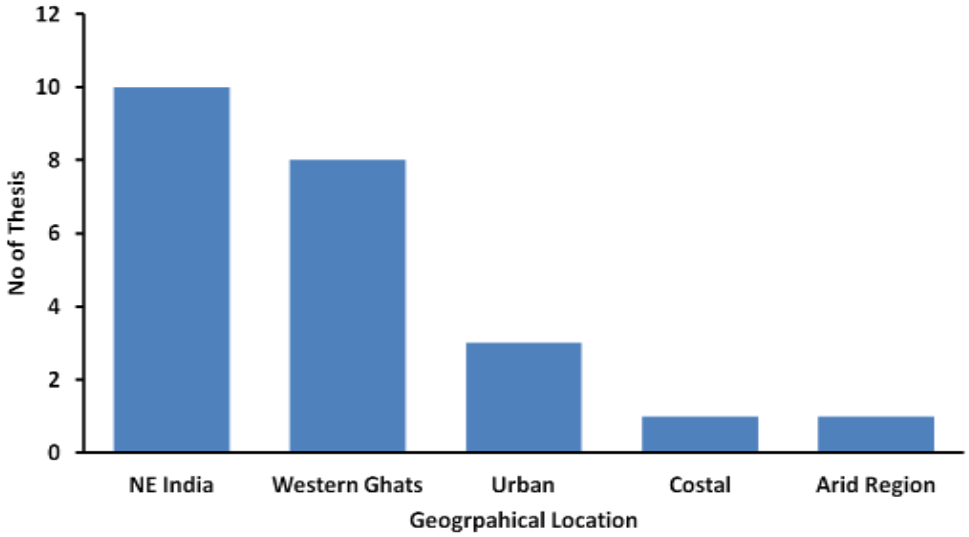
The course was targeted at mid-career professionals and researchers and included modules on socio-economic and bio-physical concepts and applications. Dr. Anshu Bharadwaj, executive director of Centre for Study of Science, Technology and Policy (CSTEP), Bengaluru delivered the keynote address. Speakers and discussants included Dr. Priya Sangameswaran (CSSS Kolkata), K J Joy (SOPPECOM, Pune) and Dr. Sambit Mallick (IIT Guwahati), in addition to ATREE faculty. Shrinivas Badiger and Bejoy K Thomas were joint co-ordinators of the course. This course was conducted from 9 to 16 March 2011.

### Public talks/ lectures

| Year | No. of public talks | Other events* |
|---|---|---|
| Oct 2006 – Dec 2009 | 4 | 6 |
| Jan 2010 – Dec 2010 | 23 | 5 |
| Jan 2011 – Dec 2011 | 39 | 18 |

*Other events include visits

**GEOGRAPHIC REACH OF THE ACADEMY: CCCs**

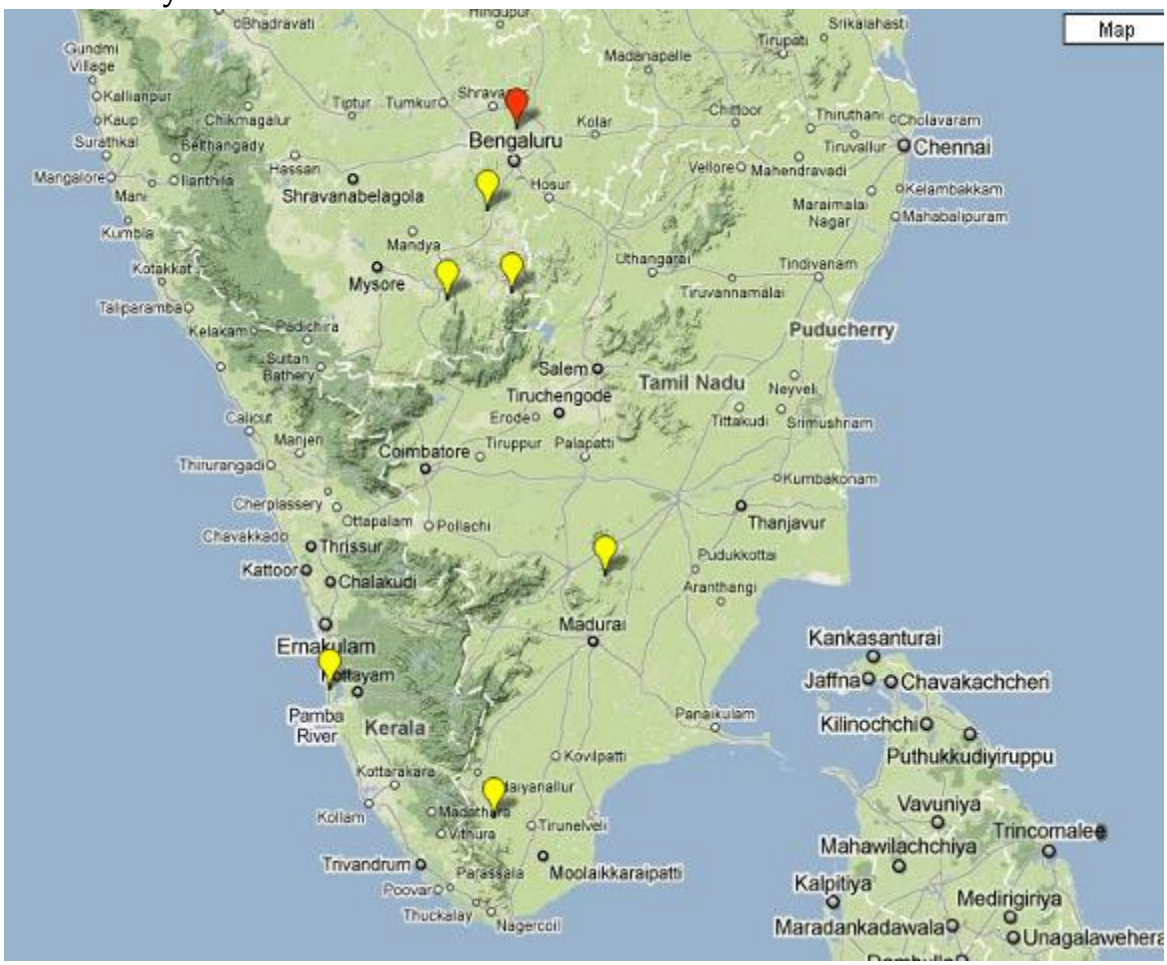



Apart from the study sites of Ph D students, ATREE has seven CCCs (Vembanad is a CERC—Community Environmental Resource Centre), including the new CCC, Darjeeling. These serve as field academies for researchers and students and provide a base for partnerships with local communities and NGO and government bodies, for carrying out research, capacity-building and work in environmental governance.

A host of ATREE research projects has emerged out of CCCs where ecological research has been conducted with awareness of the sociological and economic features of communities, and the anthropogenic effects of communities in forest-fringe spaces on conservation and degradation of the environment.

Reaching lay public over the Worl Wide Web are interactive citizen science initiatives of the India Biodiversity Portal and Vembanad Information Systems. These will be further covered under the section on Resources that Advance Cross-disciplinary Learning.

## Community Conservation Centres/ Field Academies




### Vembanad Community Environmental Resource Centre

**Stakeholders**

Inland fishermen, farmers, tourism stakeholders, Panchayat Raj institutions

**Objectives**

The Vembanad project, initiated in 2006, completed its first phase in June 2010. On the basis of the experiences and learning from the first phase of the Vembanad project, it was concluded that the conservation issues can be addressed best, if livelihood problems are addressed. So, the second phase of the Vembanad project will focus on developing approaches, methods, and tools that will attempt to restore and strengthen the ecosystem elements, which could directly benefit stakeholders as well as derive public support to sustain these efforts. The modules to be implemented to achieve these objectives are: Restoring ecosystem fidelity for poverty reduction, conservation education (Jalapadom), awareness and action campaigns and climate change adaptation. Specifically, CERC will:

- Assess the institutional, policy and information gaps which adversely affect the conservation and sustainable use of the Vembanad wetlands
- Facilitate discussions on long-term, effective and inclusive institutional mechanisms involving government agencies, academia, NGOs, and local community groups with clear-cut roles and responsibilities

- Increase environmental awareness among various stakeholders and enhance their capacity to address conservation issues pertaining to wetlands.
- Enable local communities to participate in the design and implementation of the management plan

**CCC building status**

- Accommodated in a $1000^2$ ft house at Mullakkal, Alappuzha, Kerala which has been provided by S. D. Shibulal, Chief Operating Officer, Infosys
- Facilities: Rooftop class room facility for 50 persons

**Research, policy, outreach and capacity building**

Work on policy, outreach and capacity-building continue under the following heads:

- Wetland Policy Analysis (governance and capacity-building components)
- Awareness and Capacity-building Initiatives for Stakeholder Groups
- Jalapaadom – Environmental Education Programme (self governance, outreach and capacity-building)
- Jaladarpanam – Vembanad Water Watch Partnership Programme (self-governance, outreach and capacity-building)
- Vembanad Wetland Conservation Information System (capacity-building)

**Research**

- CERC carried out a participatory fishery resource assessment of River Manimala.
- Is developing methodology for 'Counter-mapping of the resources of the lake' (background works such as collection for details from mining and geology department, fisheries department, collecting grid maps, developing semi-structured questionnaires for participatory mapping exercises, etc.). Counter-mapping of clam resources – pilot study is scheduled in the third week of December. Baseline information about the license and catch quota will be obtained from the Mining and Geology Department, Kerala
- Tricho card-making unit at Aymanam: A feasibility survey was conducted. Background work has been completed.
- CERC staff and volunteers attended a Participatory Rural Appraisal Training at SIRD Kottarakkara.
- Participatory socio-economic survey to identify below poverty line (BPL) families (field work, data validation and report preparation) was done in two villages – Velyanad at Alappuzha district and Amboori at Trivandrum district for the state Local Self Government Department.
- ATREE Vembanad team set up stalls and participated in the India Biodiversity Congress, 27 December 2010.

**Climate change adaptation**

This component aims to understand climatic vulnerabilities that stakeholders in Vembanad are exposed to. Farmers are monsoon-dependent and weak or erratic monsoons upset crop calendars and cycles. The frequent onset of depressions on the western coast has intensified the vulnerability. Over the last two monsoons, there have been instances of loss of standing crops. Vembanad is a complex ecosystem whose hydrology was subject to artificial manipulation after the Thaneermukum bund was installed. So, there is the need to

understand how floods or dry spells can affect water quality and livelihood stakes of farmers and fishermen. There is also infrastructural vulnerability due to flooding as people in Vembanad reside in a low-lying area.
The geographical characteristics of Vembanad and associated agricultural landscapes make it extremely vulnerable to impacts of climate change. Special efforts will be made to sensitize local communities to climate vulnerability. Adaptation strategies will be discussed with stakeholder groups and scientists, with focus on different livelihood sectors. A mapping of climate vulnerabilities (ecological, livelihood, health, infrastructural) will be conducted to help communities and authorities to strategize possible interventions. The information system will be populated with the latest and relevant information regarding this.

**Wetland policy analysis and environmental governance**
With the objective of making wetland governance inclusive, and bottom-up instead of top-down, ATREE has analysed land and forest laws and rules, and pertinent constitutional provisions of the Kerala Panchayati Raj Act, 1994. ATREE drafted a working paper to highlight policy gaps in terms of insufficient regulatory provisions in prevailing laws and legislations and a lack of understanding of the provisions themselves, and organized workshops and discussions with key actors and stakeholders to discuss institutional and regulatory potential.

Comments on the draft regulatory framework on wetlands have been sent to the MoEF, GoI, after analysis of rules and regulations. There has been active participation in state level discussions and on how the role of Panchayati Raj Institutions might be strengthened for environmental conservation vide the provisions of the 73–74 amendment.

The draft on Kerala State Inland Fishery bills was analysed in workshops involving subject experts and other stakeholders, recommendations drafted and submitted to the fisheries minister, wider coverage, and publicity given through media. Discussions were arranged at the grassroots level too.

**Stakeholder consultation and capacity development**
Vembanad CERC seeks to facilitate the participation of stakeholders in efficient and sustainable management of the Vembanad socio-ecological system by creating a system of information exchange that will lead to an enhanced understanding of the wetland ecosystem and its services, to provide updated information on environmental quality and build monitoring capacities, to enhance the collective understanding of constitutional provisions, laws, legislations and feasible management options, and to network with government and non-government institutions to facilitate common platforms for wetland conservation and livelihood supports.

Activities
- Primary and secondary data collection among the stakeholders – farmers, fishermen, and tourism sector
- Data analysis and preparation of stakeholder status reports on agriculture, fisheries, and tourism sector
- Stakeholder consultations – organized several focus group discussions

- Networked with grassroots level institutions
- Information dissemination for conservation of the wetlands – organized several participatory action programmes. E.g. fish counts, fish sanctuary, anti plastic campaigns, water quality monitoring
- Twelve lake protection forums (LPF) involving fishermen had been organized and federated (extending the coverage to Thannermukkom and Kumarakom panchayats), with plans for organizing 10 more. LPFs spread awareness on ethical fishing practices, check destructive fishing practices, unauthorized sand mining, clam dredging, and issues of lake pollution. All these LPFs were registered and federated to form the federation of LPFs with representation of all forums. As independent units, they can take up local development plans under fisheries sector, in the PRI institutions. CERC will provide backend support for this.
- Evaluation of the 'impact of fish and clam sanctuaries' will be done scientifically with the support of the fisheries department of St. Albert's College, under the leadership of Dr. Benno Pereira. Seasonal evaluations are scheduled and two such evaluations carried out so far pointed to a positive impact. Local fishermen report the same positive impact.
- Federation of the LPFs formally registered and organized a meeting to discuss the roles and responsibilities. An LPF Federation meeting in Muhamma was organized to schedule action plans.
- Observation of 'Aaylyam – Makom'thozal a traditional ritual worshipping the lake for better fertility for the coming year, by the LPFs. Discussions on the need and significance of ethical fishing practices in the lake were held.
- Five fish sanctuaries were set up and managed by the LPFs, with two new fish sanctuaries at Aryakkara and Ambalakkadavu in the last six months. Indigenous methods adopted technical feasibility verified with many experts from CUSAT and retired fisheries department officers. Clam deposits were made in the outer layer of sanctuaries to promote clam multiplication. These community structures viz 'matsyathavalams' were formally dedicated to the lake on 25 July 2010.
- Plastic-free Vembanad Campaign with the support of NSS Volunteers of Alappuzha Colleges and LPFs was organized.
- Working funds distributed to more wetland clubs and discussions on the presentations on student's congress, scheduled for February 2011 initiated.
- Photo competition on 'Athijeevanam' announced, in collaboration with the Press Club, Alappuzha.

Partnerships have been forged with several institutions: KSCSTE, Wetland Cell; Kerala State Biodiversity Board; Environmental Management Agency of Gok; Land Use Board; Fisheries Department, Fisheries College, MG University, CUSAT, Matsyafed; Agricultural Research Station, RARS; Pollution Control Board; Tourism Department; State Planning Board; All India Radio, PRIs, district collectorates, Medical College, Alappuzha; Forest Department; KILA, Education department; Kudumbasree; Total sanitation mission; Kuttanad development package; LPFs and their federation; cooperative societies of farmers, fishermen, clam collectors; Vembanad Nature Club; Chamber of Vembanad Hotels and Resorts, Houseboat Owners Associations; Kottayam Nature Club, CED, KSSP, Vembanad Nature Club, KCYM, Rotary Club, JCC, Planet Kerala, Kuttanad Farmers Cooperative, self-help groups (SHGs); 51 schools/colleges/TTI around the lake; Water Partners Inc, Arghyam;

SEUF, Mar Athenacious College, St. Alberts College; youth clubs, Grandhasala sangams; UNDP solution exchange sites; the India Water Portal; the CRG group of hotels; All Kerala Boat owners' Association, Alappuzha; Kuttanad Development Society; CERG group.

**Annual Vembanad fish count in 2008, 2009, 2010 and 2011**

- Vembanad fish count was organized in 2008, 2009, and 2010 in collaboration with Regional Agri Research Station, Kumarakom, Kerala State Biodiversity Board (KSBB), Vembanad Nature Club, etc. to inventorize the fish biodiversity of the lake and its variations over a period of time. The exercise is also aimed at creating mass awareness on the need for conservation of the lake through sensible management.
- The fish census brings together scientists, naturalists, students (fisheries colleges), voluntary organizations; fishermen, cooperatives, and the general public. Reports are published. Based on this, KSBB decided to conduct fish counts in all 44 rivers of Kerala and CERC has been entrusted to conduct fish count in six rivers.
- The fourth edition of the annual Vembanad Fish Count was held on 26 May 2011. The survey revealed an alarming fall in aquatic life in the ecologically fragile lake and a steadily deteriorating biodiversity. The count organized this year recorded only 45 species of fin fish and nine species of crustaceans. The survey has also thrown light on the decline of larvivorous fishes affecting the ecosystem health of Vembanad, as these fishes along with the frogs of Vembanad played a significant role in controlling mosquitoes in the region. There were participants from Kerala State Biodiversity Board; Vembanad Nature Club; Regional Agricultural Research Station, Kumarakom; St. Albert's College, Ernakulam School of Environmental Studies, Mahatma Gandhi University; Conservation Research Group Kerala; Kerala University of Fisheries and Ocean Studies; and LPFs around the Vembanad region.

**Participatory mapping of natural resources in Vembanad Lake**

In order to record past and current trends of natural resource use of the Vembanad lake, the CERC has initiated resource mapping using participatory tools and techniques. The Department of Environment and Climate Change, Govt of Kerala has approved funding support of Rs. 7.029 lakhs for a period of 14 months for this exercise.

Participatory approaches will involve the primary stakeholders of the lake such as fishermen, clam collectors, farmers, tourism operators, Panchayat representatives, and local people who have direct stakes in the lake. The data will have three types of information: The salient features, natural and man-made, of the southern portion of the Vembanad lake being mapped (with landmarks identified); zones used for subsistence activities (fishing, sand mining, clam collection, gathering of fodder, house boats/resorts/tourism activities in the lake, weed covered areas and any other significant use of the lake); and areas of resource availability – past and present tracks and areas of special importance. The methods employed for participation will be through locality transect walks, focus group discussions, interviews with senior community members for older narratives, meetings with panchayat members etc.

**Interventions in the farming sector**

ATREE supports a switch to organic farming/integrated farming since pesticides from the farms pose a threat to water bodies and public health. Tricho cards were introduced to replace pesticide use in Aymanam Panchayat (55 acres) and Kainakary Panchayat (70 acres), on a trial basis and this proved to be a success. A television documentary of tricho cards was telecast on *Kairali* TV channel. Trials for organic farming and weed control using hyacinth as manure will be explored. Participatory weed management planned with the support of LPF in the lake spread and proposals for funding support has been submitted to the Kuttanad package project. To make available sufficient tricho cards to the farmers, setting up of tricho card units as a micro-enterprise involving farmers' co-op societies was planned at Aymanam. Interactions/facilitation with the farmers club in Aymanam Panchayat and NABARD were started, seeking possibilities for setting up a biopest control unit. Work to set up a 'pilot unit for a backyard hatchery'was initiated. Aquarium and hatchery tank were set up at the office. Backyard ponds were identified for piloting. ARTEE CERC has submitted four proposals (weed management, ecosan for Kuttanad, fish sanctuaries, and backyard hatchery) to the Kuttanad Package Cell (Govt. of Kerala) for funding support.

**Tourism sector interventions**

Tourism round table conference was organized involving the sector players. It chalked out a combined action plan to promote sustainable tourism. Our intervention will be plugging the loopholes in the responsible tourism strategy of government, focusing on environmental issues and covering the lake and wetland as a unit. A survey was conducted on the resorts, hotels, houseboats, and home stays operating in the area and the report is ready. There will be focus on promotion of best practices/certification processes. Awareness building programmes among operators, management, and tourists were discussed. Possibility of setting up training centres at CERC will be explored

Cleaning campaigns/plastic-free Vembanad – a campaign in association with the All Kerala Houseboat Owners Association, soon after the 2009 Nehru trophy boat race was carried out.

***Jalapaadam* – Environmental education programme for the conservation of Vembanad**

Objectives

Conservation education programmes have been set up for school–college students, to transfer scientific information and skills to create social capacity for participatory monitoring. Wetland study centres have been set up to organize programmes. Student interactions, film shows, field trips with scientists, training in water quality assessment and analysis, and documentation of various environmental and biodiversity, hypothesis testing of simple ideas by students are some of the activities.

Activities

Wetland study centres have been set up in 51 schools/colleges and 6000 students to be involved in the project, with 20 more school orientation visits in the period between July and December 2010. This year's *Jalapaadom* was initiated with a teacher's orientation workshop, held in July. A student's workshop on the use of schoolyard ponds for fish biodiversity improvement was organized. CERC arranged technical support and fish seeds from the state fisheries department.

*Jalapaadom* students' magazine 2010 edition is ready for final corrections and sent for DTP after final editing. ATREE also organized a student's workshop to develop skills on preparation of 'biodiversity registers' for local landscapes.

Other activities in the past two years have included:

- Wetland module, supporting brochures, posters, information boards, CDs, etc. circulated
- Wetland festival/students competitions, Annual Wetland Festivals – on World Wetland Day (2 February every year)
- Hypothesis testing methods catching up. Students presented 5 papers in a national seminar organized at St. Joseph's College.
- CERC orientations to students on selected topics – fishes, birds, butterflies and odonates of Vembanad, puppet making, water quality monitoring, street plays, etc. completed.
- Cleaning campaigns (after Nehru boat races in Punnamada lake)
- Documentary screening (*Jalapaadom* students developed two documentaries)
- Zonal seminar
- Annual World Water Day celebrations-
- Three workshops (theatre methods, water birds of Vembanad, water quality)
- Wetlands album competition
- Handwritten magazine competition
- *Jalapaadom* teachers magazine
- Cleaning campaigns at all schools
- Summer camp

In the last 6 months (January–June 2011), the *Jalapaadom* magazine was released and distributed, Students Wetland Congress as well as Wetlands Day celebrations were held. A detailed list of plants, birds, butterflies, and odonates was prepared for preparation of a biodiversity register.

A schoolyard fishpond was cleaned and seeded with about 15 indegenous fish species in LF HS Kavalam School. Other activities under *Jalapaadom* included summer camp, teachers' workshop, school orientation visits, and external training programmes.

***Jaladarpanam* – Participatory water quality monitoring**

*Jaladarpanam*, the participatory water quality monitoring programme has been revived, this time with the LPFs. Information boards and kits have been shifted to the LPFs, field-level orientations initiated. *Jaladarpanam* was started with local citizenry monitoring quality of water and relating this to understanding the condition of the lake and to provide a basis for effective policies that promote wise use and better management of the lake.

However, this did not catch on, in spite of continued follow-up for two years, possibly due to lack of positive action to provide clean drinking water to those who recognize that the water they drink is of poor quality. Now, we have shifted these sites to the vicinity of the lake and involved fishermen in the LPFs, who monitor the salinity, turbidity, pH, and temperature parameters of the lake water, which is more relevant to them from the impact on fishery point of view.

Fourteen basin stations have been set up around the lake, volunteers oriented on lake water quality monitoring, water quality testing kits supplied, and monthly monitoring results displayed on information boards.

The research programme team of 'Land water and livelihoods' has initiated a project on water quality issues related to health hazards in Vembanad area. Ph D student, Vaisakha is also focusing on water quality issues of the lake as part of her Ph D thesis. These results will be used for further interventions under this module.

**Vembanad Wetland Conservation Information System**: read more about this under Resources

## Other interventions

Under the Kuttanad Development Package vide the recommendations of the M S Swaminathan Commission Report, several interventions are coming up in Kuttanad and Vembanad. The CERC team had a detailed discussion with the Project Officer of Kuttanad Development Package, Justin Mohan IFS, and submitted proposals for funding a community-based water management project for Kuttanad (reverse osmosis (R/O) unit to address the drinking water crisis in Kuttanad) and setting up more fish and clam sanctuaries in the Vembanad lake. As CERC has already proved the success of fish/clam sanctuaries, the proposal for setting up 15 sanctuaries at the cost of Rs.11.38 lakhs has been accepted by the Kuttanad Development Package. This fund will be channelled through the Gram Panchayat, Muhamma, to implement the same during the current financial year.

## Capacity building

**Photo exhibition and competition on Life in wetlands – *Athijeevanam***

A photo exhibition cum competition was organized in association with the Press Club of Alappuzha. The theme for the photo exhibition was 'Life in Vembanad ' including the people and their day to day life, culture, biodiversity, agriculture, fishing, landscape, boat race, environmental degradation, reclamation, wetlands, mangroves, pollution, flood, etc.


**Campaign against pesticide use**

A campaign against the use of pesticides was organized in January 2011, in collaboration with the NGO Ecorun. NSS volunteers from SD College and those who registered for a marathon run participated in this event.

**Workshops and conferences**

- The significance of wetlands in integrated water resource management' – Annual Forum of the Water Community of UNDP Solution

exchange.

- Conservation interventions of ATREE on Vembanad wetlands, in the stakeholder conference for revival of Umiam Lake at Shillong organized by the People's Learning Centre, (PLC) Shillong and Arghyam, Bengaluru
- Presentation in the Southern Regional Forum of the Environmental and Water Community, UNDP Solution Exchange
- Two papers published in *Land Use Board Journal* and selected for IUAES

**Grants received**

- Funding support for the project from Sarojini Damodaran Foundation
- Received financial support from Kerala State Biodiversity Board (Rs. 20000/- each – twice for Vembanad Fish Count 2008–2009), from Kerala Land Use Board (to conduct wetland festival during 2008), $1000 donated by Sierra club members for setting up fish sanctuaries, etc.

**Publications**

- Krishnakumar, K., R. Raghavan, and B. Pereira. 2009. Protected on papers, hunted in wetlands: Exploitation and trade of freshwater turtles (*Melanochelys trijuga coronata* and *Lissemys punctata punctata*) in Punnamada, Kerala, India, *Tropical Conservation Science.* 2 (3):363–373.
- Krishnakumar, K., Rajeev Raghavan, G. Prasad, A. Bijukumar, Mini Sekharan, Benno Pereira, and Anvar Ali. 2009. When pets become pests – exotic aquarium fishes and biological invasions in Kerala, India *Current Science.* 97(4):474–476.
- Krishnakumar, K., Latha Bhaskar, R. Raghavan, and S. Joseph. 2010. Protect the golden goose or unleash the carbon bomb – the choice is ours: Significance of conservation and management of Vembanad lake in the context of climate change. In: *Impact of climate change on the environment* B. Indira (Ed.). Proceedings of the National Seminar on Impact of Climate Change on Environment, Sree Narayana College, Chertala, pp 65–69.
- Bijukumar, Krishnakumar, K., and Kurian Mathew Abraham 2010 River Fish Monitoring Programme: Manual of Methodology. Kerala State Biodiversity Board (KSBB), 32 pages.
- Latha Bhaskar and K. Krishnakumar. An attempt for the bio diversity conservation of the Vembanad lake through Lake Protection Forums – a case study, United States–India Educational Foundation, Fulbright Indo-American Environmental Leadership Program. Biodiversity Conservation with Stakeholder Participation, 6–9 October 2009, Kerala.
- Krishnakumar, K., Anvar Ali, Benno Pereira, and Rajeev Raghavan. 2011. Unregulated aquaculture and invasive alien species: a case study of the African Catfish *Clarias gariepinus* in Vembanad Lake (Ramsar Wetland), Kerala, India. *Journal of Threatened Taxa*. 3(5): 1737–1744.

**Presentations**

- K. Krishnakumar 2010.Aliens in wonderland: Exotic fish invasion in Western Ghats Biodiversity Hotspot, India. Student Congress in Conservation Science, Department of Zoology, Cambridge, United Kingdom 23 to 25 March 2010, Oral Presentation.

- Jojo T.D. 2010.Participatory approach in water resource management: Experience from Vembanad. Seminar on Water Resource Management, Department of Environmental Sciences University of Kerala and WWF, 19 February 2010, lead presentation.
- Jojo T.D. 2009.Water and wetland resources of Kerala. Seminar on Wetland Conservation, Department of Zoology, Nirmala College Muvattupazha, 13 November 2009, lead presentation.
- K. Krishnakumar. 2011. Talk on fishes of Western Ghats of Kerala at forest headquarters. Talk to new batch of forest guards on 1 April 2011 on fishes of Ghats, by Krishnakumar.
- Latha Bhaskar. 2011. Interviews on All India Radio on the event of the Vembanad Fish Count 2011 and significance of wetland conservation.
- Latha Bhaskar. 2011. Invited talk on 'Interventions by ATREE at Vembanad for wetland conservation', on World Wetland Day seminar organized by the Wetland Cell of Kerala State Council for Science Technology and the Environment on 2 February 2011.
- Three interns completed their one-month internship at CERC in the last 6 months (from January–June 2011)
    - Monisha, MSW student from Sree Sankara Sanskrit University
    - Dhanya K, MSW student from Sree Sankara Sanskrit University
    - Ashish Mathew George, MSW student from Rajagiri College of Social Sciences

Official invitations

- Latha Bhaskar, selected and included as a jury member of the Green Kerala Express, a social reality show for Panchayats in Doordarshan, in the first round of selection, included in 25 panchayats jury panel and in the second round of selection, included in the jury panel for three selected panchayats.
- Latha Bhaskar selected and included in the joint programmes advisory committee of All India Radio and Doordarshan Kendra, Trivandrum for two years, 2010–2012.

## MM Hills

**Main community:** Soligas (tribal, traditionally forest-dwelling), Lingayats

**Overall picture:** Decade-long ATREE association with Soliga community, which started as a microfinance and micro-enterprise engagement, conservation by substitution (of bamboo) experiment, and now, CCC for co-management of forest and resources.

**Objectives of the ATREE Field Academy, MM Hills:**

- To identify the stakeholders and issues related to forest resource management
- To document the indigenous knowledge on forest resource use
- To enhance the livelihood of the forest-dependent communities with green enterprise
- To train local communities and students in monitoring ecosystem services

**Stakeholders**

- Forest-dependent communities (Soligas and Lingayats: NTFP (non timber forest produce) harvesters, farmers, fuel wood
- Collectors, artisans, etc.)
- Business communities in and around MM hills temple (shop keepers, hotels, and lodges)
- Schools (teachers and students)
- Forest department (range forest officers, foresters, watchers, and guards)
- Temple (MM hills temple board, pilgrims, transport corporations, *Sallur matta)*
- Local institutions (*Gram sabha*, NGOs, *Panchayats*, community organizations,
- SHGs)
- Wildlife

**Issues**

- Agriculture (low productivity, poor crop diversity)
- NTFPs (low income, poor value for NTFPs, contractors' domination)
- Water (access to potable water, agriculture, pollution of streams, and rivers)
- Environment pollution (littering in forest and temple areas, plastic use)
- Fuel wood (increasing number of pilgrims, demand from the hotels)
- Lantana invasion (on agriculture as well as on forest land)

## Research

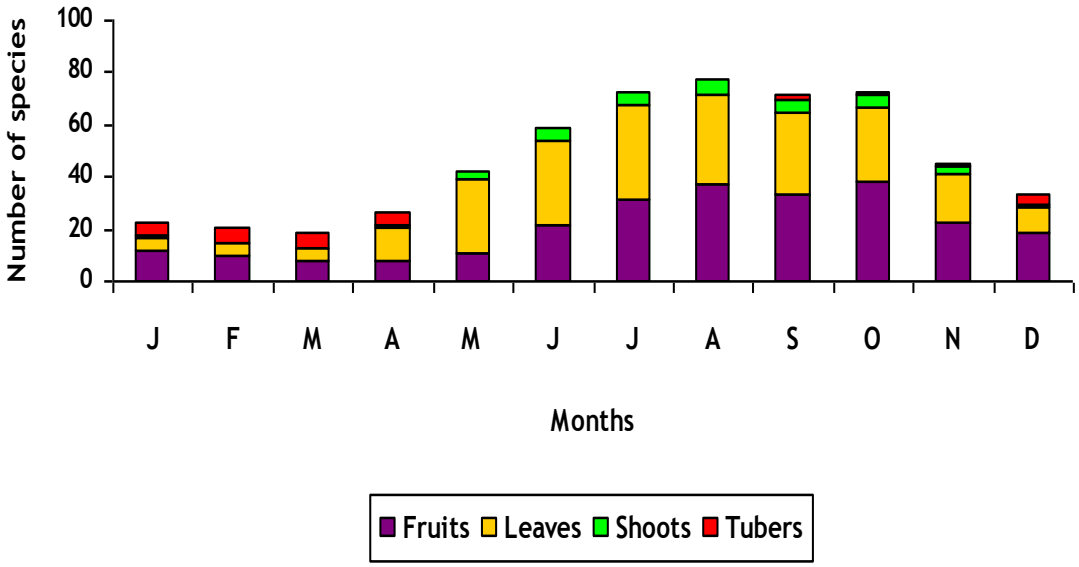
**A study of local communities' knowledge of forest floral resources**

CCC–MM hills is documenting communities' knowledge on use of forest resources, understanding the role of forest resources in the local communities' food system, and studying the supply and demand ratio of forest resources used by the local communities.

Key findings of the study:

Majority from the Soliga and Lingayat communities grow finger millet (*Eleusine coracana*) and hyacinth bean (*Dolichos lablab*), few grow maize (*Zea mays*) and jowar (*Sorghum bicolor*) as dry land farming; and it forms the major staple. The local communities depend on wild vegetables for their micronutrient requirements. Collecting wild vegetables seems easier than buying from the shops, in terms of time and money. Wild vegetables can be procured fresh every day from the forest or from cultivated land. Usually local communities gather leafy vegetables and fruits from agricultural land, and they collect wild vegetables from the forest while collecting fuel wood or grazing or when employed to create fire line, or work on plantation and regeneration activities by the FD.

Households that do not own agricultural land and seldom venture into the forests depend on grocery shops for vegetables. Communities are aware of seasonality as well as areas where certain species might be found. The following graph shows a collection of different produces during different seasons.




**Important wild vegetables and their use index (UI)**

| *Scientific name* | *Family* | *Use index* |
|---|---|---|
| *Celosia argentea L.* | Amaranthaceae | 1.00 |
| *Jasminum ritchiei Cl.* | Oleaceae | 1.00 |
| *Canthium parviflorum Lam.* | Rubiaceae | 1.00 |
| *Solanum nigrum L.* | Solanaceae | 1.00 |
| *Solanum indicum auct.* | Solanaceae | 0.98 |
| *Dendrocalamus strictus (Roxb) Nees* | Poaceae | 0.96 |
| *Amaranthus viridis L.* | Amaranthaceae | 0.93 |
| Mixed species | Mixed | 0.93 |
| *Dioscorea pentaphylla L.* | Dioscoreaceae | 0.82 |
| *Acacia farnesiana (L.) Willd.* | Mimosaceae | 0.74 |
| *Bambos arundinacea Retz.* | Poaceae | 0.74 |
| *Holostemma annulare (Roxb.) K.* | Asclepiadaceae | 0.73 |
| *Solanum xanthocarpum L.* | Solanaceae | 0.60 |
| *Cassia tora L.* | Caesalpinaceae | 0.56 |

Supply and demand of the plant resources

Based on the information of plant usage collected from the community, the MM hills team will study the supply and demand of the species in the forest. Key areas of collection will be identified and the availability of plant in that region will be studied by laying transacts and enumerating abundance of the important/rare plant species in that forest range. It will help us to prioritize the species based on abundance and develop plans for *ex situ* conservation practices by encouraging SHG members to cultivate those plants in backyard gardens.

## Capacity building

### Workshop on alien invasive plants at MM hills

A workshop on alien invasive plants was organized on 8 and9 December 2010 at MM hills. The objectives of this workshop were to identify major alien invasive plant species in MM hills and adjacent forest range, map their spread, and train foresters in monitoring the spread of the invasive.

Three foresters and 12 forest guards from three ranges participated in the workshop. The medium of instruction of the workshop was Kannada.

Dr. Siddappa, Fellow at ATREE emphasized the importance of biodiversity and impact of alien invasive plants on biodiversity and ecosystem services. He identified the major invasive plants in India -- *Lantana camara, Eupatorium*, and *Parthenium hystrophorous*. Dr. Siddappa, who studied the spread of lantana in BRT in 1997, was followed by Bharath Sundaram, a Ph D student at ATREE, who revisited these plots in 2007. Combined studies reveal that lantana has increased by 50% to 60% in the last decade in the BR Hills. Participants felt that this degree of lantana spread was observed in their forest areas too.

The foresters agreed on three major points, which need to be considered towards management of lantana

- The time of lantana removal should be before flowering
- Lantana removal from a place should continue for three consecutive years
- The same land should be used to plant fast-growing species such as bamboo

As part of the workshop, participants were requested to list and map the major invasive species found in three ranges namely MM Hills, Yediyarahalli, and Cowdalli. They were given topo sheets of all the three forest ranges and asked to map the spread of the four major alien invasive plants -- *Lantana camara, Eupatorium, Parthenium hysterophorous,* and *Prosopis juliflora* -- in their forest areas. Data from these marked topo sheets will be converted to shape files and superimposed on GIS map of these areas. The team is planning to repeat this exercise in other forest ranges in Kollegal.

The participants of the workshop visited the Lantana Craft Centres (LCC) at MM Hills.

*Foresters interact with master craftsman, Murugesh.*

**Local institutional linkages**

Further developments on the LCC front since July 2010: The MM hills team is helping create links between LCC and government departments such as Department of Handicraft and Marketing Extension (Dept. HME), Tribal Cooperative Marketing Development Federation of India Limited (TRFED), and NABARD. Dept. HME recently organized a meeting at Chamrajanagar and invited the LCC members from MM hills. The objective of this meeting was to inform artisans about easier access to low interest credit. The artisans were invited to submit a proposal for machinery to produce toys from lantana. The Department of Marketing Extension has also invited LCC members to attend exhibitions in Mysore and Chamrajanagar districts. They will provide transport, food, and accommodation to the artisans during the exhibition.

LCC members from Konnankera village recently attended an exhibition sponsored by Dept.HME from 12–14 September 2010 at Mysore during *Dasara*. Lantana artisans and Divyajyoti federation jointly set up a stall in Krishimela 2010 at GKVK campus, University of Agricultural Sciences, Bengaluru from 11–14 November 2010. This *mela* had a footfall of more than 500,000 people and the LCC stall bagged the best stall award in the SHGs category.

The LCC is registered under the Indian Societies Registration Act 1860 (Reg.No.119/2009-10).

**Expansion of lantana programme to Javadu Hills and Palani Hills, Tamil Nadu**

Following the successful lantana craft training for the Palliyars at Korankombu and Manathevu in Palani Hills, the master craftsman team from MM hills trained Palliyar trainees at Kadasikadu in Palani Hills and Malayali tribals in Javadu Hills, Tamil Nadu. Around 12 trainees attended the training programme and learned to produce more than 10 products.

A similar training programme was conducted in Dhasaripudur in Javadu Hills. Malayalis are tribal communities in Javadu hills practising dry land farming and dependent on forest resources for their livelihood. Javadu Hills is part of Eastern Ghats in Tamil Nadu. A large portion of Javadu hills is infested with *Lantana camara*. Srinivasan Service Trust, a CSR initiative of TVS groups, invited ATREE to train the Malayali tribes. Madeva, master craftsman from MM hills started the training on lantana craft on 12 November 2010 at Javadu Hills and it is still going on.

*Designer workshop at MM hills*

**Imparting designing skills from Uravu, Wayanad, Kerala**

The programme at MM Hills does not just impart training; it also borrows new designs and design ideas from new partner organizations. Uravu, an enterprise with 300 artisans working on bamboo craft in Wayanad, Kerala sent representatives to MM hills to experiment with new designs using lantana at MM hills. They started a designer workshop at MM hills with the LCC master craftsmen from 1 December

2010. The workshop will be conducted for 10 days in a month for six months and the team will design a minimum of five products per month.

**Lantana Crafts Mela 2011**

The 2011 Annual MM Hills Mela was kicked off on 30 April 2011. The aim of the mela was to link artisans with mainstream marketing and financial institutions and to popularize lantana products. The mela was inaugurated by Dr. Venkatesh Tagat, Chief General Manager of National Bank for Agriculture and Rural Development (NABARD). Harish Java, General Manager of NABARD and Nagendra Rao, Assistant Conservator of Forest, Chamrajanagara graced the occasion.

Dr. Tagat released the new utility-based lantana products developed through Rural Innovation Fund (RIF)–NABARD support programme and promised to support the lantana enterprise along with ATREE and Tribal Cooperative Marketing Development Federation of India Limited (TRIFED). The lantana utility products training manual and bilingual brochure were also released.

**Banning plastic at Malai Mahadeshwara Temple**

Following discussion between temple authorities, the FD, and local shop keepers since 2009; the Malai Mahadeshwara Temple authorities have finally banned plastic in and around MM hills. This marks a significant victory for the CCC negotiators who have been trying to create awareness on the harmful effects of plastic through meetings, rallies, and by roping in school kids. Plastic is currently being replaced with cloth and paper bags, and paper cups, supplied by SHG members, creating an enterprise opportunity for them too. ATREE also provided skills training in making cloth and paper bags.

**School outreach: Eco-clubs formed**

We have selected three schools for environment education activities, based on location of the schools. Shagya Government High School is located in the middle of agriculture land and distant from the forest. Eighth and ninth standard students (120 students) will document agriculture crop diversity, ethno-botanical knowledge in villages and identify the diversity of birds and butterfly in and around their school vicinity.

Ponnachi High School is located on a hill surrounded by a thick patch of forest rich in bamboo resources, NTFP, and wildlife. Elephant, wild boar, and sambar are frequent visitors to the

forest areas and sometimes on the agriculture lands. This place is very important in terms of wild life and floral resources. The main objective of forming an eco-club in this school was to engage the students in documenting and monitoring diversity of plants, butterfly, and birds in and around their school vicinity. The 32 students who have joined the club will also be trained to develop a biodiversity book for their village.

**DePaul University students' visit to CCC–MM hills**

The MM Hills team organized an exposure visit for environmental science undergraduate students from DePaul University, Chicago, USA. This was part of a study tour to India of 21 students and three faculty members. Their visit included a trek in the moist deciduous forest of Komudikki village, MM Hills, for bird watching where they spotted giant squirrel, white-bellied drongo, green bee eater, scarlet minivet, and barbet. The students also visited the Kommudikki village, interacted with farmers and visited their farms. On their way back, the students stopped at LCC, Hannehola, and interacted with lantana craftsmen.

*DePaul University students at Kommudikki village*

**Conference/seminars**

- Harisha R. P., N. Ramesh Kannan, Aravind A. and G Ravikanth. Uses of floral resources by forest dependent communities in southern India (2010) presented in the Young Ecologist Talk and Interact from 5–7 October 2010 at Indian Institute of Science, Bengaluru
- R. P. Harisha attended the International Seminar on Conservation, Cultivation Sustainable Collection Processing and Marketing of Medicinal Plants held on11 and 12December at Bengaluru and organized by National Medicinal Plant Board, Department of AYUSH, Ministry of Health and Family Welfare, Govt. of India.

**Relevant links**

- http://www.indiaeveryday.in/karnataka/fullnews-tribals-craft-furniture-from-weed-to-earn-a-livelihood-1159-2610924.htm
- http://www.atree.org/lantana_press_release
- http://www.atree.org/bmip2010
-

## Biligiri Rangaswamy Temple Wildlife Sanctuary

**Main community:** Soligas

**Background**: ATREE has been working in BRT since the last 15 years. Community-based organisation – SAS – in BRT is politically aware and conscious of utilizing opportunities such as mapping of sacred sites and RFRA to claim rights. Community has been roped in for long-term ecological monitoring of harvested species to ensure sustainable harvesting of NTFP.

There have been two very recent–end of 2010–changes in BRT that will leave a long-term impact. One, the Ministry of Environment and Forests has declared BRT WS a tiger reserve. Second, VGKK has set up an ambitious ecotourism unit. VGKK also has had long-term ties with Soligas, and this project might benefit both ecotourism as well as the Soligas.

Declaration of BRT as a tiger reserve has caused concern amongst the Soligas. The fear of eventual relocation and curtailment of access is running high.

### Research

#### Phenology studies

We have been documenting the periodic plant life cycle events and how these are influenced by seasonal and interannual variations in climate. This includes the date of emergence of leaves, flowers, and fruits. We have continued data collection from permanently tagged 200, 250, 162, and 100 tree species in scrub, dry deciduous, evergreen, and shola forests, respectively in the BRT. Intensity of these events is also being studied. These phenological records can be useful to study change in species population levels with climate change.

#### Monitoring bee colonies

ATREE has been monitoring rock bees for 15 years to understand annual and inter-annual variability in number of bee colonies before and after harvest by Soliga users. ATREE studies

variability of number of bee colonies with the flowering phenology and rainfall across the year and tries to relate the impact of harvest on number of bee colonies and explore scope for co-management.

Our studies indicate that population of the honey bee colonies are more or less the same from 1996 to 2005. After 2006, it was expected that the bee colony numbers would increase as there was a ban on harvest of bee colonies and also other NTFPs. However, it has shown a decreasing trend. This clearly shows that harvesting does not have any relationship with the change in the bee colonies' number. There may be other parameters playing a major role in shaping up colonies' number. It could be insecticide and pesticide usage by the farmers to their agricultural land, or due to increase in lantana density in the forest as it has insect repellent property and a negative impact on native plants and their intensity of flowering in the forest. Overall, there was a decrease in bee colony number across the year. There was a gradual decrease in bee colony number from 1995 to 2008. Larger number of bee colonies was recorded – 646 during 1997, and 477 and 483 during 2004 and 2000, respectively.

**Governance**

**Recognition of Forest Rights Act**

After the enactment of the RFRA in December 2006, several workshops and meetings were organized in BR Hills to disseminate information on the Act among community leaders and members. Significant initial workshops include a workshop organized in collaboration with SAS, VGKK, and Kalpavriksh towards disseminating the key features of the Act among members of the Soliga community. Subsequently, 20 SAS as well as ATREE in collaboration with SAS organized several workshops to develop the capacity of the Soligas to claim rights under the Act.

The progress in implementation was affected by confusion in the FD in this case on whether the Act is to be implemented in protected areas or not. Recently, the Chief Secretary has issued a clarification that the Act is to be implemented in wildlife sanctuaries and national parks. At the District Level Committee meeting, the decision to grant community rights to Soligas in BRT has been agreed upon in principle. Surveys for individual claims on land are in progress.

**Mapping sacred natural sites in BRT**

We mapped sacred natural sites in BRT wildlife sanctuary to understand the historical and cultural ecologies of the Soligas who have inhabited the landscape for centuries. The process, while documenting and archiving a vast resource of places and stories, also provided a critical understanding of the ways Soligas interacted with the landscape. Our effort included the use of formal cartographic instruments such as the use of GIS-enabled devices to locate places and names that Soligas identified with in mainstream maps. We have developed maps produced in consultation with Soligas into posters for wider dissemination presenting the Soliga narrative. This is the first effort by Soligas to re-engage with the landscape after their displacement and curtailment of rights since the establishment of the protected area. They perceive this as a reassertion of their rights within the landscape. The RFRA recognizes such evidences and also provides space for asserting such rights.

The collaborative management effort in BRT WS has resulted in the production of a detailed map that represents Soliga sacred sites and cultural landscapes. This effort in counter-mapping is the first such effort in India and has already been widely appreciated as being exceptionally important for the Soligas to claim participation in the conservation decision-making process in the wildlife sanctuary.

## Capacity building

**Brainstorming meeting with community and the forest department**

With the help of Prof. Uma Shaanker and Dr. Lucy Rist, discussions were held with communities and their traditional institutions and FD officials on current management challenges for BRT WS. The set of issues causing common concern were identified as NTFP harvesting, fire, invasives, hemiparasites, conservation of fauna, medicinal plants, NREGA implementation, and wildlife conflicts.

ATREE discussed with the FD what the major drivers behind these concerns could be. What does the FD think should be the way forward on each of the priority issues? What mechanisms does the FD ideally require to reach management decisions that are seen as sound and are fair to communities? The FD felt that there are often too many points of view that reflect specific interests, whereas management, that is FD, must take a single approach to tackling all of them. Under these circumstances, management decisions can be very demanding and if they are not based on the fullest set of information, they may not be optimal. We have tried to look at how solutions that are optimal can be reached.

Community representatives felt that FD's restriction on fire that was traditionally used by Soligas had led to a decline in the health of the forest, with weeds such as lantana and hemi-parasites on amla trees proliferating. The FD, on the other hand, was more concerned about human–animal conflicts in the fringe of the forest. Brainstorming discussion with community highlighted issues such as fire, invasive, hemiparasites, NTFP harvesting, etc.

Integrating resource users and local communities into management and conservation is desirable in striving for biologically and socially sustainable conservation; however, the practices implemented in many forest areas are often at odds with livelihood objectives. There is a dichotomy between the interests and perspectives as well as bodies of knowledge and cultural backgrounds of the different groups involved. The challenge is to overcome the obstacles that this dichotomy presents, moving towards a convergence of interests and goals rather than remaining within the current situation that is characterized by compromise.

**Workshop on hemiparasites with the FD**

The Karnataka Forest Department, with ATREE, organized a one-day workshop on removal of hemiparasites from amla trees in BRT WLS. Forty FD employees and 10 SAS leaders participated in the workshop. The training included information-sharing, demonstration of removal of hemiparasites in the field and monitoring amla trees after removal of hemiparasite (*uppilu*). After the meeting, the FD decided to get cleaned around 20,000 amla trees of *uppilu* with community help. ATREE will assist them in monitoring trees from which u*ppilu* have been removed to monitor efficacy of this practice.

**Workshops on RFRA**

ATREE held two regional workshops on the RFRA in Mysore. The first was held in 2009 and the second in 2010. Tribal groups, FD officials, and civil society members attended these meetings. These meetings have provided an unprecedented opportunity for tribal activists and state officials to openly discuss contentious issues as well as explore the possibility of collaborative management of biodiversity and forest resources.

ATREE has been working closely with the SASto both implement the Act and disseminate information on the Act in the district of Chamrajanagar. The close cooperation has resulted in the district administration being the leader in the state for the implementation of the act and especially the implementation of the provisions relating to the community forest rights. State agencies have invited ATREE, SAS, and the VGKK to assist them with the training and capacity building of local groups and forest officials.

**Conservation education**

ATREE organized a field trip for the students of Valley School in November 2010 to BRT. Eighty children and 8 teachers attended the programme. The three-day programme was designed to expose children to different perspectives of ecology and environment such as culture and ethics, wildlife, forest dependent livelihood, food security, and agricultural biodiversity.

The batches spent time enjoying the beautiful view of the mountain ranges and the plains. They visited and learnt about megalithic burials in the forest. The interactive session with the tribal children at VGKK was one of the highlights of the entire field trip. An evening was dedicated to a Soliga cultural programme. Lessons in ecology were explained through interesting activities such as ‘web of life’.

## Kanakapura CCC

**Main Community**

Vokkaligas and Lingayats form the main community composition. Adikarnataka, Lambani, Irula, and Soligas are the other backward communities in the area.

**Overall picture**

ATREE's work in the last 7 years has been on environmental education programmes for children, green enterprises through women SHGs, agroforestry initiatives and training on sustainable agricultural practices in forest-fringe villages. The physical CCC space has served as a stage for local actors to engage with researchers and prioritize action relevant to the sustainability of the socio-ecological landscapes.

**Governance**

- ATREE and the Bilikal Reserve Forest (BRF)-adjacent community are in the process of developing a management plan for BRF, which would help the community establish village forest boundaries for better co-management and lay a plan for the better conservation, protection, and collaborative management of community forest resources.
- Approaches to developing the co-management plan are Participatory Rural Appraisal (PRA), socio-economic surveys, ecological studies, policy and institutional analysis.
- ATREE has helped build awareness among four Panchayats and 40 villages adjoining BRF on the subject of tenural issues and the process of claiming legal rights through RFRA, by providing relevant evidence. Once community rights are accorded to people, the forest management committee (formed by the forest rights committee) at each Gram Sabha can implement the strategies in this management plan.
- The National Rural Employment Guarantee Scheme (NREGS) is envisaged to enhance the livelihood of the poor by guaranteeing at least 100 days of employment in a financial

year, to any rural household whose adult members are willing to do unskilled manual work. In Kanakapura, the NREGS employment involves three types of work: providing rural connectivity, water conservation and water harvesting, and renovation of traditional water bodies. Importance is being given to water conservation because there is no perennial water body nearby.

- In 98% of the Panchayats, jobs have been provided to people who have demanded it. About 50% of the Panchayats have issued job cards to registered households. Wages have been disbursed within 7 days. This timely payment of wages has had a positive impact on the income of the villagers.
- Problems such as low wages, lack of awareness, and heavy workload on Gram Panchayat staff have been observed.

## Capacity building

### Master's studies/Student internship

- Tina Ulvin, an intern from University of Life Sciences, Department of International Environment and Development Studies (NORAGRIC), Norway, is carrying out a one-month internship. She is working on a NREGS scheme of the Govt. of India. Based on this work, she will be producing a report titled 'Social Security for Poverty Reduction: A study of GNREGA in Doddamaralwadi Gram Panchayat in Kanakapura Taluk, Karnataka, India'.
- Kumar D S, an intern from CMR College, Bangalore University, did a four-month internship. He worked on the NREGS of the Government of India. Based on his work, he produced a report 'Implementation of NREGS: A case study of Kanakapura Taluk'.
- Alok Kumar Dash and Rohan Koshie, interns from Sri Dharmasthala Manjunatha Institute for Management Development, Mysore, did a 2-week internship. They also assisted Kumar D S, in data entry in his NREGS work.
- Skanda S, an intern from Bangalore University, Department of Environmental Science, did a five-month internship. He worked on a conservation education approach to assess bird diversity, through school children. Based on his work, he produced a report 'Assessment of the knowledge in school students, before and after their training on bird diversity'.

### Conferences and workshops organized

- The Earthwatch Institute continues collaboration with ATREE. We have been conducting the Local Volunteering Programme (LVP) of HSBC Climate Partnership Programme for HSBC employees, at Forest Trails in Bannerghatta every month. LVP focuses on creating awareness about biodiversity, the need to conserve native species of plants and animals in their natural environment, and the threats posed by climate change on biodiversity, and in turn on human well-being. This time, 19 HSBC employees volunteered for the programme.
- A one-day programme on awareness building for 21 students from DePaul University, USA, was organized as a part of their study-abroad course. The programme included a trek in the forest with emphasis on forest conservation and its problems. An introduction to the local culture and occupations was held in villages. They were exposed to environmental problems of the area such as water shortage, human–elephant conflict,

and habitat degradation. As part of the hands-on programme, they were involved in agricultural activities of harvesting a ragi crop. The programme was organized in CCC premises and other villages in Kanakapura.

A similar programme was also held for 12 University of Kansas (USA) students earlier this year.

- School children have been introduced to bird watching in a new programme that aims to initiate interest in nature and conservation. Birds provide an accurate and easy to read barometer, allowing us to see clearly the pressures our current way of life places on local biodiversity. Bird watching sensitizes children to avian life, along with its scientific and technical aspects. The project employs an informal and out of the classroom approach to educate children about the ecological importance of birds and the role they play as indicators of biodiversity.
- Growth rate of seedlings planted under the Nandanavana programme is being monitored by school children on an annual basis. Students take the height and girth measurements of the trees, with the help of field staff. Students and field staff document data. Through this, students gain an insight into the growth rate of different plant species.
- Seed collection activity of forestry species was given to school children of forest-fringe villages and planting programme was carried out in 10 schools with different native species. Around 45 seedlings were planted and fenced by the students.
- Work on a bilingual field guide on agroforestry tree species of semi arid regions is in progress.

**Papers presented**

- Kavitha A., Oral Presentation on 'Role of agro-forestry on community livelihood and climate mitigation in semi-arid region of South India' at the 2nd International Conference: Climate, Sustainability and Development in Semi-arid regions, 16 to 20 August 2010, Fortaleza, Brazil.
- Kavitha A., Oral Presentation on 'Distribution of trees and the socioeconomic status of farmers growing them in a rainfed agro-ecosystem of South India' at the 2nd World Congress of Agroforestry, 23 to 28 August 2009, Nairobi, Kenya.
- Kavitha A., Poster presentation on 'Distribution of trees and carbon sequestration in a rain-fed agro biodiversity. A case study from Karnataka, South India' at the Second DIVERSITAS Open Science Conference, 13–16 October 2009, Cape Town, South Africa.
- Kavitha A., Oral Presentation on 'Activities of ATREE Community Conservation Centre-Yalachavadi' as a part of 'Environmental awareness and conservation' programme for Oracle employees, on 26 April 2010, at ATREE's Community Conservation Centre, Kanakapura.
- Deepthi N., Oral Presentation on 'Trees with heritage and cultural value' as a part of "Environmental awareness and conservation" programme for Oracle employees, on 26 April 2010, at ATREE's Community Conservation Centre, Kanakapura.
- Skanda S., Oral Presentation on 'Birds as indicators of environmental quality' as a part of "Environmental awareness and conservation" programme for Oracle employees, on 26 April 2010, at ATREE's Community Conservation Centre, Kanakapura.

- Kavitha A., Oral Presentation on 'Introduction to Kanakapura and ATREE's activities' as a part of awareness building programme for Kansas University, on 27 Ma 2010, at ATREE's Community Conservation Centre, Kanakapura.

### Grants received

- Kavitha A received Rufford Small Grant for the project titled 'Biodiversity conservation through education programmes in the Kanakapura region of South India' for a period of 18 months, starting September 2010.
- Kavitha A received a scholarship from Government of the State of Ceara, Banco do Nordeste, Ministry of Environment and Ministry of Science and Technology, to attend the International Conference: Climate, Sustainability and Development in Semi-arid regions, 16 to 20 August 2010, Fortaleza, Brazil.
- Kavitha A received a scholarship from World Congress of Agroforestry and ATREE's Edda Sehgal Fund, to attend the 2nd World Congress of Agroforestry, 23 to 28 August 2009.
- Kavitha A received a scholarship from The Research Council of Norway (RCN), to attend the 2nd DIVERSITAS Open Science Conference, 13 to 16 October 2009.

## Agasthyamalai CCC

Ecological, social, and community-based conservation is going on in the Agasthyamalai Community-based Conservation Centre (ACCC), at Manimuthar near Kallidaikurichi, in Tirunelveli District. The new ACCC office built with eco-friendly materials started functioning from 14 July 2010.

**Issues**

Issues that the ACCC continues to address:

- Fuel wood collection inside the forest
- Grazing and fodder collection inside the forest
- Stone mining within 5-km radius from the reserve
- Mass usage of pesticides and chemical fertilizers
- Decreasing village green cover due to brickline industries
- Wetland encroachment and loss of wetland biodiversity
- Temples and scenic spots which are located inside the reserve
- Human wild animal conflict
- RFRA
- Special economic zone (SEZ)

**Stakeholders**

- Farmers
- Fuel wood collectors
- Landless labour
- Students
- Teachers
- Forest Department

- Education Department
- Public Works Department
- Temple authority
- Fishing contractors
- Panchayat leaders
- District Administration
- Local NGOs (Swasam, TREE Trust, Arumbugal Trust)

## Research

### Ecological biodiversity mapping

The present information on bioresources is mostly qualitative and not easily accessible for those who manage and use these resources. As a sub-set of a larger multi-institutional collaborative project to quantify and map plant bioresources in the Western Ghats, ATREE was involved in sampling along the eastern slopes of southern Western Ghats.

### Long term monitoring and global change

Understanding changes in natural systems is a long-term process that requires careful selection of the critical parameters that have to be monitored. In early 1990, following the global trend to understand community ecology – more so in the Asian tropics, a series of monitoring programmes evolved, building on initial studies at Kakachi in the wet forest of KMTR. As part of this, phenology of trees, vegetation dynamics, pollinator and frugivore abundances, and weather parameters have been monitored since then. These monitoring studies have shown that inter-year variations are strong and often unpredictable. Pollinator movements are predictable in terms of its occurrence, but not in terms of its variability.

The 4th census of permanent plots established 18 years ago in the wet evergreen forests was conducted in March 2011. The plots have shown how relatively undisturbed forests, very rare in the world today, respond to natural disturbance and climatic changes.

**Monitoring resource use by communities:** About 270 and more villages surrounding KMTR were dependent on the forests for fuelwood and grazing. We have a monthly monitoring programme on fuelwood use and grazing pressure on forests by Singampatti and surrounding villages using the footpath method. Fuelwood use from forests appears to have decreased in the last 7 years of monitoring. Grazing inside the forest does persist, but at a much lower level than before.

The dependency on the forests by communities living outside the tiger reserve continues to decrease. The profile of people venturing inside the forest trends more towards older people. Grazing however has remained the same over the last few years

**Forest canopy research:** Some of the pioneering studies on forest canopies in India have been done in Agasthyamalai. Most interaction studies in the wet forests have been achieved by accessing the canopy. Indigenous access techniques such as

ladders and ladder bridges have been locally designed to facilitate such research, from where it has advanced to single rope technique. We have also progressed in our research -- from processes-based study to applying assembly rules and niche theory to explain canopy communities. Canopy research and long-term monitoring has been, in some sense, a flagship programme of the KMTR research agenda. Canopy work in KMTR made it possible for ATREE to host the fifth International Canopy Conference in Bengaluru. We are hoping that this will lead to setting up of a National Canopy Programme.

**5th International Canopy Conference:** This conference came about mainly as a result of ATREE faculty's canopy work in Agasthyamalai. ATREE hosted some of the most eminent names in canopy science at the 5th International Canopy Conference, at Bengaluru, between 25 and 31 October 2009, where scientists discussed the relevance of canopies and canopy study to conservation, sustainable use and to the global challenge of climate change. About 250 scientists including more than 70 scientists representing Australia, Africa, Europe, Asia and the Americas attended the conference.

**Conservation restoration:** The forests of KMTR have been exploited for centuries by various stakeholders. The scars of these are still visible, even several decades after cessation of activities such as logging. Large areas now inside the reserve have been planted with eucalyptus, cardamom, teak, tea, and other commercial crops. These have either been abandoned or likely to be so in the future. How native species found in the forest colonize these abandoned areas and what management protocols need to be followed to facilitate native species colonization is one of the key areas of research pursued in the landscape.

## Emerging programmes

**Wetland conservation: T**he Agasthyamalai mountains are the source of many perennial rivers such as Tamarabarani. Through a network of reservoirs, canals, and tanks, the rivers are both a resource for livelihood for the farming community and an important area for local biodiversity. Wetlands around KMTR and in other places are under threat; they are encroached upon, polluted, silted, and overgrown. We are surveying wetlands within 5 km from the reserve boundary and recording the plant and bird species to identify key wetlands for long-term conservation. We are also exploring how these wetlands can be conserved using local communities and what policy amendments are needed for their conservation. The major heronry identified in 2008 at Vagaikulam continues to be under threat from contractors. Local people and press have together been able to keep off the powerful contractor lobby. And at ACCC, we continue to seek a long-lasting solution for making it a community reserve.

### Owls, rodents and people

The interaction between forest and agricultural area around it provides opportunities to explore the services of the forests to the agricultural landscape. The periphery of KMTR provides suitable habitats for rodent-eating owls that forage in the adjoining agricultural areas. What ecological services the owls provide to the farmers and what in turn can farmers do to sustain such services is the focus of the research on rodent-eating large owls. The findings will be shared with farmers through street plays, starting August 2011. The research team plans to extend this study to dry areas too.

## Capacity building

### Stakeholders meeting on conservation of wetlands

ATREE has identified areas that can have a community-based conservation initiative with the help of panchayat and other relevant individuals and organizations. ATREE will form a biodiversity conservation committee in which panchayat leaders, irrigation committee leader and important institution around these areas will be part of the committee. The members of the panchayat from the selected wetlands were taken to existing bird reserves to show the benefits of protecting the wetlands.

ACCC has conducted several consultation workshops on conservation of wetlands at Tirukurangudi, Vagaikulam, and Koonthkulam in 2010. Representatives from selected wetlands and voluntary organizations participated in these meetings.

### Tamil Nadu Agricultural University students: Agro-biodiversity, practices and pesticide use

Rat catcher explaining to students about the rattraps

In a tie-up with the Agricultural College & Research Institute, Killikulam, Tamil Nadu Agricultural University (TNAU), the ACCC facilitates exposure to local farming practices and knowledge. This is part of the institute's Rural Agricultural Works Experience (RAWE) programme. The tie-up with TNAU began in 2007, and this is the fourth batch coming to Agasthyamalai. In 2010, the focus was in letting students learn about the biodiversity in agricultural landscapes, other than crops.

The most recent visit template consisted of power-point-aided lectures and field visits covering ATREE's initiatives in the KMTR landscape, success stories of home gardening, constructing green buildings for better environment, natural farming, and need for biodiversity conservation in forest-fringe survey conducted among Zamin Singampatti and Pappankulam farmers. Students surveyed fertilizer and pesticide inputs in fields. They also shared their thoughts on biodiversity in agricultural fields, organic farming, and future plans. The survey objective was also to sensitize students to ground realities and to think beyond agricultural productivity.

The fifth group of students from TNAU, Killikulam came to ACCC for their programme from 15–29 July 2011. They tried to understand the socio-ecological issues of temple tourism of a farming community in a tiger reserve by taking part in monitoring exercises.

## Bird census


The first large-scale waterbird census was conducted at Tirunelveli and Tuticorin districts on 22 and 23 January 2011. ACCC organized the census, in which 43 volunteers surveyed 32 tanks in Tirunelveli district, and 10 tanks in Tuticorin district. Experts from Bengaluru, Kerala, and Tamil Nadu participated, and several volunteers from the southern districts of Tamil Nadu helped in this massive exercise. Prior to the survey, an orientation session was organized and a brochure of birds most likely to be encountered was distributed.

**Nature tracking – Biodiversity monitoring workshop for school teachers**

The intention of producing the nature guide 'Treasures on Tiger Tracks' (see 'Outreach' section below) was to create awareness of biodiversity among the local people, especially children living in the KMTR buffer area. In order to further this, we designed a monitoring programme involving school children, teachers and anyone who was interested in nature and natural history. The uniqueness of this monitoring programme is that the reports will be sent to a common database over SMS, which eliminates paper work and the need to access Internet. The idea evolved over discussions around removing barriers that are in the way of reporting observations. With mobile phones penetrating even the remotest village, the use of SMS seemed the most practical option.

On 11 and 12 June 2011, a reconnaissance workshop was conducted to train school teachers on making observations and reporting through SMS. The participants included nine teachers in charge of eco-clubs in their respective schools, the Chief Environment Officer who oversees the activities of environment education in schools and about five other naturalists from the landscape.

**Workshop to monitor the impacts of temple tourism on biodiversity**

Religious enclaves within forests in India have existed for centuries as pilgrimage destinations. Most of these are located either at the confluence of rivers or at the top of a hill. Today, many of these enclaves lie within the boundaries of wildlife sanctuaries and other protected areas which have come into existence recently. These temples can still be accessed during festivals. In recent times, the number of pilgrims to these enclaves has seen an unprecedented rise because of easy access by roads, and affordable and convenient transport. These numbers impact the environment and biodiversity of the area. There is an urgent need to conserve the unique and rich biodiversity areas around such religious enclaves with the involvement of its various stakeholders. ACCC had conducted a workshop on 23 July 2011 at Interpretation Centre, Papanasam – KMTR to train volunteers to assess the impacts using methods that have been tested and refined over five years. The modules comprise estimating large mammal abundance, assessing the impact of traffic on small fauna, impact of camping on regeneration of plants, uses of traffic survey, perception of forest inhabitants on the festival, and water quality analysis.

## Outreach

The ACCC outreach activities are diverse and all encompassing. They include providing multi-purpose plant species for meeting the needs of local communities, building awareness and capacities of NGOs, Panchayats, other institutions, individuals and stakeholders on environmental conservation, using art as a medium to take conservation to a larger audience. The environmental education programme, in its sixth year in 2010, has concentrated around Singampatti villages, but is expanding to areas further north near the proposed conservation reserve of Vagaikulum and south to Tirukunakudi.

### Treasures on Tiger Tracks – Nature guide release function

This is a bilingual nature guide of the KMTR region in particular, which could also be of use for the Western Ghats region in general. The guide, in English and Tamil, aims to be a more accessible vernacular guide for local tourists and communities.

### World Environmental Day celebration

One of the several ways to take the message of conservation to rural audiences is through skits and dramas weaved with local concepts. On 5 June 2010, World Environment Day, ATREE's ACCC at Singampatti launched a performance art group called *Nature Talkies* with 13 kids from ATREE's Green Brigade and six children from the nearby Mukkudal village. These kids were trained in Kalialattam, Kolattam, and street dramas by well-known folklore artists in the area, Elango, Kanagalingam and Merlin Gnana Jeeva during the summer holidays. The kids drove home the message of environment protection through drama, dance, and skits. The focus of the message was on protection of water resources and its biodiversity. Around 200 villagers witnessed these programmes.

### World Wetland Day

World Wetland Day marks the date of the adoption of the Convention on Wetlands on 2 February 1971, in the Iranian city of Ramsar on the shores of the Caspian Sea. Each year since 1997, government agencies, NGOs, and groups of citizens at all levels of the community have taken advantage of the opportunity to undertake actions aimed at raising public awareness of wetland values and benefits in general and the Ramsar Convention in particular. The year 2010 is the first time ever that the Wetland Day has been celebrated in the Vagaikulam tank.

Students from two elementary level schools participated in this event. The teachers from the schools and local people appreciated ATREE's efforts regarding Vagaikulam tank.

World Wetland Day was celebrated in Tirunelveli this year too, on 2 February 2011.

**'Be a better ancestor' campaign in KMTR – 2010 and 2011**


பக்தர்கள் தாமிரபரணியை
அசுத்தப்படுத்த வேண்டாம்


பிளாஸ்டிக் பொருட்களை பயன்படுத்த தடை


Prolonged stay in forest affects ecosystem: Scientist


"Minimise stay in forest to reduce pollution levels"

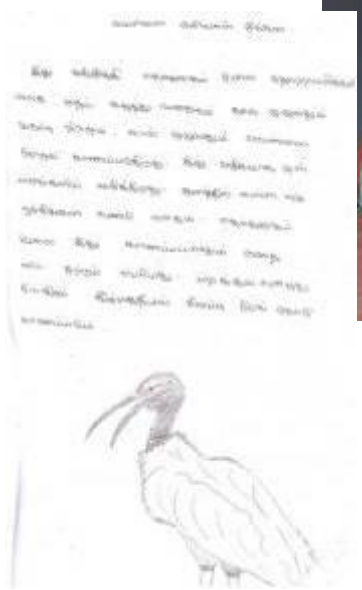
Sorimuthiyan Kovi is a religious enclave within Kalakad Mundanthurai Tiger Reserve, where 3–4 lakh devotees converge during *adi-amavasai*. In 2006, ATREE's Agasthyamalai CCC started an intense anti-plastic campaign during that culminated in the ement of the FD and ion of ban on plastics serve in 2008. This year, as come down visibly and hya team made its campaign objectives more ambitious by also addressing issues of collection of firewood and litter at pilgrims' camp sites. This expanded theme has been termed 'Be a better ancestor' campaign.

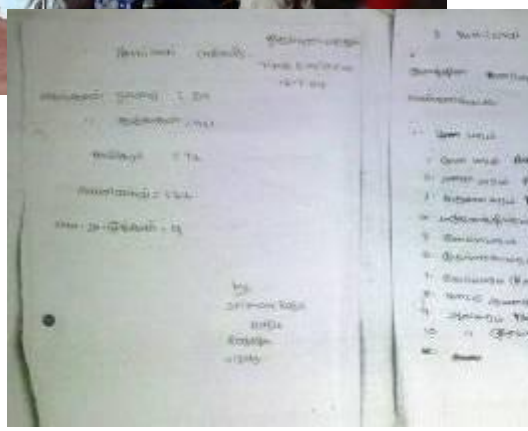
The direction has been guided by the team's assessment (starting 2008) of the impact of the festival on surroundings through scientific monitoring of physical and biological parameters such as monitoring animal trails to see how movement and habitat get affected by the presence of pilgrims; trends in road-kills caused by increased festival traffic; and water quality. The team also interacted with pilgrims to assess their perception of the festival and the effectiveness of the ATREE campaign.

The team campaigned for 'Be a better ancestor' this year too during the temple festival month of June.

## Capacity building and training workshops for children

Children from Nanalkulam and Vagaikulam, two villages near Vagaikulam tank were trained in identifying birds and counting populations of birds at the tank. Regular sessions on bird identification and counting were conducted in the months of December 2008 and January 2009 to get them conversant with different birds and their local names. Besides, weekend training sessions are being held which involve classroom as well as outdoor activities and learning.

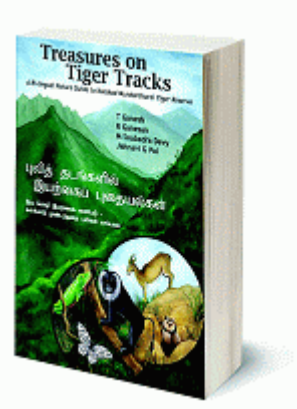




eThe bat monitoring programme has been scaled
P up and includes more sites like the one at
TThirupudai Maruthur. 16 students o the ACCC
egreen brigade programme will monitor bats once
month.

## Outreach material

### Nature guide




Building awareness about the richness of life around us in the local context requires material in local languages, conveying information about the local flora and fauna. The available field guides are mostly in English and filled with jargon that is often intimidating for a lay person. To address this issue, ATREE has come out with a first-of-its-kind bi-lingual; multi-taxa nature guide to KMTR. The guide, authored by T Ganesh, R Ganesan, Soubadra Devy, and Jahnavi Pai, aims at disseminating basic information about common and unique plants and animals of the region among school children and other individuals interested in knowing more about the reserve.

### *Agasthya*

The ACCC team brings out a newsletter -- *Agasthya* once in four months. This highlights the significant work in the Agasthyamalai region by ATREE staff in a reader-friendly language. We are also planning to bring out *Agasthya* in Tamil and encourage people from the landscape to contribute to it.

We are in the process of developing a comprehensive education manual for wetlands, which would encourage students to discover life in the wetlands around their villages and instruct them about the steps they can take to conserve it.

### *Kulam valam*

This newsletter is titled *Kulam Valam* which means 'wetlands are our resources'. The reason for bringing out this newsletter is to highlight the importance of wetlands in Tirunelveli and Tuticorin districts which are considered as 'the rice bowl' of southern Tamil Nadu to a wide range of audience. It covers news about the Tamarabarani river and dependant wetlands, their importance, conservation issues, livelihood issues, kids corner, and ATREE's efforts towards conservation of these wetlands.

*Kulam Valam* will be circulated among all local schools and colleges, District Collector, PWD Department, FD, local Panchayats, Revenue Department, press clubs, citizen groups, temple trustees, and all public libraries in the Tirunelveli District.

### Wetland Birds of Tamarabarani: Brochure:

The ACCC team has developed a two-page foldable brochure depicting commonly seen wetland bird species to popularize bird watching and build compassion among community to protect birds. This is particularly applicable for downstream wetlands that are fed by the Tamarabarani river.

**Governance**

A proposal has been sent to the district collector of Tirunelveli district as well as the Tamil Nadu Forest Department in Tirunelveli and Chennai for making Vagaikulam, a Community Conservation Reserve.

**Publications**

Seshadri, K. S., Vivek Chandran, A., and K. V. Gururaja. 2011. Anurans from wetlands of Puducherry, along the East Coast of India. *Check List* 8(1): 023–026,.

Seshadri, K. S. and T. Ganesh. 2011. Faunal mortality on roads due to religious tourism across time and space in protected areas: A case study from south India. *Forest Ecology and Management* 262: 1713–1721.

Goswami, R., and T. Ganesh. 2011. Conservation amidst political unrest: the case of Manas National Park, India.*Current Science* 100(4): 445–446.

Vivek, R., and T. Ganesh. 2011. Birding high: Ornithological studies in the canopy. *What's up?* 17(2): 2–3.

Mathivanan, M. and T. Ganesh. 2010. Rodents in paddy fields: pros and cons of some indigeneous ways to control them. *Small Mammal Mail* 2(2):, 11–12.

Ganesh, T., R. Ganesan, M. Soubadra Devy, and Jahnavi G. Pai. 2009. *Treasures on Tiger Tracks - A Bilingual Nature Guide to Kalakad Mundanthurai Tiger Reserve.*

**Talks and presentations**

Devy M.S. and Jahnavi G. Pai were invited for special talks, Securing pollination systems of India: Can we stop with biology? At National Seminar on Forest resources pollen diversity utilization and conservation, 9–11 March 2011, G.K.V.K., Bengaluru.

Mathivanan, M. 2009. Living on the edge: conservation education in forest fringe village, Global Conference on Environmental Education, organized by Indian Environmental Society in Goa, 4–8 November 2009.

Ganesan, R. 2010. Approaches in biodiversity conservation by ATREE in Agasthyamalai forests, Department of Ethnobotany, University of Hawaii, Hawaii.

Devy, M. S. 2010. Joys of pollinator presence and woes of pollinator absence in Western Ghats, India. A talk with students and faculty of Department of Ecology, University of Life Sciences, As, Norway.

Ganesh, T. 2010. The forests and its neighborhood: issues around protected areas in India. A talk to students and faculty of Department of Ecology, University of Life Sciences, As, Norway.

Ramachandran, Vivek. Bird communities in structurally diverse habitats in Kalakad–Mundunthurai Tiger Reserve – A canopy centric approach, Students Symposium, 5th International Canopy Conference, Bengaluru, October 2009.

Ramachandran,Vivek. Vertical stratification of small mammals in a rain forest of the southern Western Ghats, India, Vertebrate Symposium, 5th International Canopy Conference, Bengaluru, October 2009.

Ramachandran, Vivek. Canopyscape: Current trends in canopy research and exploration, organized as part of the 5th International Canopy Conference under the aegis of the Academy of Conservation Science. 25 October 2009.

K. Abhisheka, Art as a medium for conservation education in a fringe village of Kalakad Mundanthurai Tiger Reserve, Global Conference on Environmental Education, organized by Indian Environmental Society in Goa, 4–8 November 2009.

**Invited**

Mathivanan was invited as a chief guest to National Environment Awareness Campaign 2011 on Biodiversity Conservation. Eco Club and National Green Corps, St. Xavier's Hr. Sec. School, Palayamkottai organized this event on 14 March 2011.

M Mathivanan and Patrick David were invited as chief guests to Kalasalingam University, Srivilliputhur for Envira-2011, environmental festival. Mathivanan gave a lecture on water birds and wetland conservation. Patrick David served as judge for the photo and art competition, 16 February 2011.

Mathivanan was invited as a guest for 'Eco development project activities review meeting' held on 24 June 2011 at Vickirama Singapuram, and chaired a session on the training programmes provided by the Eco development project.

**Awards**

K S Seshadri, who is currently pursuing a Master's in Ecology, has received the prestigious Conservation Leadership Programme award to continue his work on amphibians in association with ATREE, ACCC.

**Interns**

Cloe Lucas. A student of agriculture and environment from France. She worked on estimating the importance of owls in rodent control in paddy fields and their utility to farmers in and around Singampatti ACCC.

Smrity Das. An intern from Jamshedpur who was studying habitat selectivity of millipede in the ACCC.

Erick. A master's student from the University of Life Sciences, Norway. He studied the community of dung beetles across various cattle density gradients outside the forests around ACCC.

Ratee Shreshta. A master's student from University of Life Sciences, Norway. She is determining the biomass change in the forest after eco-development program in KMTR.

Preeti. An integrated master's student from ISSER, Trivandrum working on amphibian ecology in the rain forest.

## Courses conducted

Conservation Science, 15 to 23 August 2010
Field experience for agricultural university students

## Natham

### Main community

Valaiyars (non-tribe, forest-dwelling, traditionally gathering and hunting community). The Valaiyar community forms the main citizenry of the forests and foothills of Karandai. They have been residents of this region since about 5 centuries and live mainly by hunting and agriculture. Traditional systems have prevailed in the hilltop villages, mainly because of remoteness – lack of roads and access, and therefore, poor intermingling with outside influences.

### Overall picture

The Valaiyar community has been notified as the most backward of tribes. There are no outward signs of poverty, but occupation is mainly for fulfilling a subsistence-level need, especially in the hilltop villages. There is a clear demarcation of agricultural systems and practices, and livelihood systems, in the hilltop and foothill villages. The foothills are more commercialized and evolving at a different pace and manner from the hill villages because of proximity to the road and trade.

Agriculture forms the basis of the economy. Prevailing agriculture practices point to conservation of traditional systems and knowledge in the hill villages, but not in the foothills. Acceding to outside influences and market demand, the foothills have moved away from their traditional crop mix to commercial crop cultivation. Changes in customary practices are evident. Organic farming practised in the hill villages has been replaced with chemical fertilizers. Hybrid seeds replace native varieties, and diverse cropping has been replaced with mono-crop cultivations that have a market.

Changes in livelihood patterns are more marked, with villagers opting for migratory work, apart from other options of livestock rearing and NTFP collection. Collection of medicinal plants for commercial purposes is a new development in the foothills, initiated by women NTFP collectors.

### Objectives

- Create conservation awareness among landscape stakeholders.
- Build conservation capacities of communities.
- Facilitate and promote community exchange of information and ideas.

- The CCC will also provide researchers, educators, development professionals, government departments, NGOs, Panchayat functionaries, micro-financial institutions and local traditional institutions, a forum to engage in complementary planning and action towards the sustainable management of natural resources in the landscape.

**Research**

ATREE researchers are studying the traditional capacities of different farming communities in
adapting to climate change. They are documenting the local perception of climate change and its impacts on agricultural practices. Preliminary insights suggest that hill-top rainfed farmers are switching from growing diverse millets to tree-based cash crops such as cashew, mango, and tamarind. Such changes in land-use are fuelled by reduced, delayed, and erratic rainfall caused possibly by climate change. Farmers almost unanimously agree that rainfall has reduced and become more unpredictable. However, changes in farming are also compounded by increasing shortage of labour, cash, or credit. Migration to cities where cash incomes are higher reduces labour availability.

The recent implementation of a centrally sponsored scheme to provide employment to every rural household during the dry summer months has reduced the availability of labour for irrigated crops and vegetables. As the study progresses, it will reveal differences in the adaptive capacities and practices among hill-top rainfed farmers; plain-farmers, who have access to canal water; and rainfed plain-farmers, who have access to tube-wells. A better understanding of farming practices that are resilient to climate change would provide policy makers the necessary insights in shaping and strengthening relevant agricultural policies.

**Capacity building**

- Training has been organized for medicinal plant gatherers of our CLP villages on sustainable harvesting technology
- Orientation training programme on climate change and agro biodiversity
- Technical training organized for the mango farmers on organic input production, sustainable harvest techniques, nursery techniques, NTFP processing and marketing skills, organic input production, biodiversity conservation
- Meetings also held on awareness generation – Forest Rights Act, government schemes, etc.

**Workshops**

- Presented NTFP-based livelihood and market access to the federation members (both women and men) from Just Change, Kerala at CCC, Natham
- Presented biodiversity conservation, livelihood promotion and market access to 70 students from various schools at Sevaiyur

**Field consulting**

- Medicinal plant-based community enterprise activities through gatherer groups of Natham region
- Forming CBOs and CBEs
- DBT temple kit project

- Established nursery at the foothill of Alagarkoil
- Started shop which sells all forest products such as herbal powder, raw drugs, and honey through Village Forest Committees
- Rapport with FD, local community, and local students

**Conservation education**

- Identified potential 25 schools in and around CCC region
- Mapping of sacred groves close to schools

# RESOURCES FOR CROSS-DISCIPLINARY PERSPECTIVES

## LABS AND RESOURCES

As a knowledge institution, ATREE makes available the services of some of these resource groups and labs to other organizations.

**Ecoinformatics** Lab facilitates geospatial analysis to address environmental conservation questions. It has been conceived as a knowledge hub for application of geospatial technologies in interdisciplinary conservation and development research.

**Biosystematics Lab** manages a vast collection of insects and freshwater molluscs, as well as a growing herbarium of plants from the Western Ghats. The lab provides taxonomic services and training and capacity-building through the Academy.

**Conservation Ecology and Genetics Lab** facilitates field-driven research in conservation and environmental programmes.

**Field Outreach Wing** links research with stakeholders in a two-way exchange through its unique field-based extensions of the Academy called CCCs.

**The Library** has a growing collection of books and periodicals. It has more than 3192 books, subscriptions to 46 printed national and international journals, access to archives of 119 titles in 21 disciplines, and another 130 titles of 29 journals in botany, ecology, and social sciences offering online access to more than one million pages of historic literature through JSTOR, 426 audio-visual content, 318 reports, and more than 927 bound volumes of journals.

## ECO-INFORMATICS LAB AND INDIA BIODVERSITY PORTAL

The Eco-informatics Lab has been set up as a resource lab to facilitate geospatial analysis to address social and environmental questions related to environmental conservation. As a multi-disciplinary technology, GIS/RS systems offer powerful tools for both social and natural scientists to undertake cutting-edge research. The Lab actively collaborates with researchers within and outside ATREE to build comprehensive spatial information about India's environment. The broad objectives of this facility are as follows.

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- Provide support in spatial analysis for the social, ecological and interdisciplinary research and outreach activities conducted at ATREE
- Assemble, organize, and disseminate information (ecological, biophysical, and socio-economic) in appropriate formats for a wide range of users interested in conservation and management of natural resources
- Conduct capacity-building activities for environmental professionals in spatial analytical tools and modelling

- **Environmental databases to support conservation research**

Environmental and socio-economical data on India's ecosystems are collected by several organizations and individuals for a multitude of purposes. However, while this data is potentially an extensive data resource, the lack of organization and coordination reduces our capacity to address several conservation questions. Currently, integrated data and information systems in the country are so underdeveloped that the available information cannot be effectively applied to address environmental questions at any scale, from the microlevel to the larger level. The eco-informatics lab is developing open access data archives to facilitate conservation research and civil society action.

## India Biodiversity Portal

The Ecoinformatics Lab coordinated a multi-institutional effort to launch the India Biodiversity Portal as an open access mechanism of obtaining and viewing biodiversity data in the public domain, making it an attempt to provide biodiversity information to the general public on an easily accessibly platform.

The portal was built on an open-source software base, and seeded with several datasets to initiate participation. These include natural science data (wildlife, biogeography, etc.) as well as social science data (census records, community conservation projects, etc.). This was also an attempt to make available the technological expertise of the Eco-informatics Lab in a simple accessible format for lay people, scientists, and students alike to enter their observations and data for compilation and retrieval. The portal could be accessed at http://www.indiabiodiversity.org/

**Ongoing activities**

The primary organization of the portal focused on developing spatial content on biodiversity and allied datasets. In the past few months, a review of the portal has suggested that the focus needs to be shifted to encourage citizen participation by ameliorating the non-spatial content. This would involve developing and enabling the viewing and exchange of textual information, taking several forms such as popular and research articles, blogs, databases and specific information pages for individual species. Progress towards this has been made as well as for increasing visibility, participation, and enrichment of content of the portal. The portal was relaunched in 2011.

More research is currently on towards making the databases compatible with global standards of species and specimen databases ratified by international agencies for database storage, retrieval and access, making them portable on the web for use by anyone, including advanced researchers as well as the general public.


The team is working on a new and more user-friendly website for data entry and retrieval, as well as increased viewership. The following enhancements are expected to be incorporated shortly:

- Enhanced home page and general structure of the website
- Rich information about individual species ecology, taxonomy and conservation status
- A 'Knowledge Base' consisting of datasets, articles, environmental laws and policies, various study reports, etc.
- Discussion forums and news archives
- Enhanced facilities for citizen participation in content development

**Outputs/outcomes**

- The portal currently holds more than 100 spatial layers on various aspects of India's biodiversity and environment. The collection is publicly accessible under various Creative Commons licenses. Currently, no other facility in the country offers such comprehensive spatial dataset in public domain and the portal has evoked tremendous interest in the environmental fraternity.
- The component source code of the current version of the Portal had been released and is open for public download and use. A one-day workshop on the use and deployment of this application was organized for providing an insight into its myriad possibilities and capabilities on 4 May 2010 at ATREE, Bengaluru office premises. A compact group of 12 participants from various organizations participated in the workshop. The workshop had a practical session on deployment of portal and discussed its major features and architecture.
- A multi-institutional consortium had been formed to manage the Portal and also advocate the cause of open access to scientific data.
- ATREE Ecoinformatics Lab will develop the *Karnataka State Biodiversity Atlas*.

**Additional Support**

The Portal initially received support from JRS Biodiversity Foundation, Philadelphia, USA; and Rohini Nilekani, Bengaluru, India, in addition to JTT. Currently, all activities are being supported only through JTT grant.

## Vembanad Information System

The Ecoinformatics Lab is collaborating with Vembanad CERC to develop a publicly accessible web-based information repository focusing specifically on knowledge about the Vembanad lake and its associated socio-ecological systems. The system will disseminate ecological, socio-economic and cultural information regarding the landscape with various agencies in addition to the information generated through the CERC and Ecoinformatics Lab.

The information system will act as the primary information dissemination facility for various resource monitoring exercises of CERC. The system will facilitate the participatory development of water quality information generated through the community monitoring programme, *Jaladarpanom*. The Lab is collaborating with CERC programmes on mapping of various natural resources such as clam deposits, fish habitats, etc.

**Outputs/outcomes**

Around 15 GIS layers representing various aspects of the Vembanad socio-ecological system have been developed and textual content regarding these themes are currently being finalized. A robust, user-friendly platform based on open source webgis technologies is being developed. The Portal is expected to be launched soon.

**Other Support**

The Portal has received core funding from Kumari Shibulal, and additional support from JTT.

## Species and Specimen Databases

The Lab, in collaboration with the National Institute of Biodiversity (INBio), Costa Rica conducted a one-day workshop on 'Maintaining Digital Species and Specimen Databases' on 7 May 2010. The workshop brought together taxonomists and software developers from various organizations and discussed various options to develop such databases, and the global standards to follow. As a follow-up of this workshop, the Lab is collaborating with taxonomists to build specimen databases of ATREE's insect museum, mollusc collection and plant herbarium. As a pilot project, we are building the database for the insect museum. An open source software 'Ara' which is developed by the INBio is being installed, customized, and tested.

**Interdisciplinary nature**

These initiatives contribute to the development of a much-needed open access 'environmental knowledge base' which could be beneficial to all streams of conservation research within and outside ATREE. The public participatory model envisions overcoming hurdles for access to proprietary data repositories.

## ➢ Spatial databases for Community Conservation Centres

The Ecoinformatics Lab has initiated a process to develop a comprehensive geo-spatial database for our CCCs. In its final form, this database will contain extensive, geo-referenced and spatially explicit information about the distribution and patterns of environmental and social aspects of the CCC regions.

**Ongoing activities**

The Lab is currently developing basic information layers such as land cover, land use, hydrology, topography, demography, etc. for each of these areas. There is a special focus on themes or phenomena characteristic to each landscape. In addition to that, the database will represent various aspects of socio-environmental information already available at CCCs into spatial formats. We are currently exploring possibilities to include stakeholder perceptions about natural resource distributions and usage in maps through participatory processes.

The land cover and land use layers for various CCCs are being developed using satellite imageries. This will eventually lead to an analysis of the patterns of landcover change in these areas. The analysis will specifically explore the effects of urbanization in Kanakapura and Vembanad regions. The Lab is also collaborating with the Natham CCC to develop maps depicting the widespread usage of the insecticide endosulfan and associated health hazards.

**Interdisciplinary linkages**

These spatial databases are expected to facilitate the inter-disciplinary studies by allowing the accurate overlay of information of interest, and juxtaposition and analysis of relevant phenomena.

## ➢ Support to various programmes

The Lab is providing support in geospatial analysis to various researchers in ATREE. The facility is extensively used by both natural and social scientists in their respective studies. As a centralized resource, the Lab facilitates the use of advanced remote-sensing and GIS technology in various interdisciplinary studies conducted in ATREE. Some of the important activities are listed below.

**Mapping changes in crop pattern**

The Lab is working with the Ecological Economics group to map change in crop pattern in 14 locations in various agro-ecological zones in Karnataka. Specifically, the lab analyses the changes in both extent and nature of agriculture in pre-and post-economic liberalization in the early 1990s. The study, with the aid of satellite images, evaluates the shift from food crops to plantation crops, conversion of cropland for other purposes and expansion of fallow lands. Economists use the findings to analyse the impact of economic policies on rural agriculture.

**Developing techniques to map forest fire**

The Lab is collaborating with a team of forest ecologists in ATREE to develop a technique to map forest fires in the Western Ghats. The study has evaluated the efficiency and

appropriateness of certain widely used techniques in the context of Western Ghats. It was noticed that some of the widely used datasets such as MODIS active fire product is not appropriate for many management and research purposes in Western Ghats. A manuscript is being prepared highlighting the results of this study. Further exploration of various methods is currently in progress.

**Assistance to Western Ghats Ecology expert panel**

The Lab is working with other scientists in ATREE, and collaborative organizations, to develop criteria to identify and map Ecologically Sensitive Areas (ESAs) in Western Ghats. Several spatial datasets developed through various programmes in ATREE are being compiled for this purpose. We are also analysing the patterns of change in Western Ghats in the last 10 years using satellite imagery.

**Other activities**

The Lab has been supporting several researchers and students within and outside ATREE by providing relatively open access to the large spatial datasets developed through ATREE programmes. In addition to ATREE faculty and Ph D students, the regular users of this facility include grantees from the CEPF grant programme, MSc and Ph D students of various institutes. We are currently planning a webgis-based spatial data archive to enhance the access of our spatial archive to ATREE community.

**SMALL GRANTS**

## ATREE–Jamsetji Tata Small Grants

The ATREE small grants are given to advance conservation and environmental sustainability. Six grants were supported in 2009 and nine in 2010 (as of 31 March 2010). Examples of work undertaken under the grant projects range from a study on socio-economic impact of ban on timber felling in Arunachal Pradesh; to a pocket pictorial guide to frogs and toads of the Western Ghats.

Project proposals for funding vary from Rs. 50,000 to Rs. 1 lakh for a duration of 1 year.

| Year | Area of research | No. of grantees |
|---|---|---|
| 2009 | Conservation Science | 4 |
| | Policy and Governance | 2 |
| 2010 | Conservation Science | 7 |
| | Policy and Governance | 2 |
| 2011 | Natural Science | 8 |
| | Social Science | 7 |
| | Total | 30 |

## Beneficiaries of JTT Small Grants

### Small Grants Programme – 2009

**Grantees under Conservation Science**

| Name | Title of the project |
|---|---|
| Elango M S | Application of local folklore as a medium of conservation education and outreach in biodiversity rich area |
| Vinayaka K S | A study on diversity and conservation of lichens in Bhadra Wildlife Sanctuary, Karnataka |
| Jafer Hisham | Enviromental education for bird conservation on Pitti Sanctuary, Lakshadweep, India. |
| Niranjan Kumar | Ecological water requirement for the BRT sanctuary watershed for its long-term sustainability. |

**Grantees under Policy and Governance**

| Name | Title of the project |
|---|---|
| Seema Mundoli | Impacts of government policies on sustenance of tribal people in the Eastern Ghats |
| Kamal Medhi | Conservation implications of the Sixth Schedule of the Constitution: An investigation in the context of private mining in the state of Meghalaya, India |

**Small Grants Programme – 2010**

**Grantees under Conservation Science**

| Name | Title of the project |
|---|---|
| Shabani Nag | Studies on reptilian diversity at Fambong Iho Wildlife Sanctuary and adjoining areas, East Sikkim |
| Gururaj K V | Pocket pictorial guide to frogs and toads of the Western Ghats |
| Avinash Isaac Vanjare | Taxonomic studies on high altitude freshwater Rotifera of the Western Ghats, India |
| Seema Mishra | Exploration of AM Fungi from mangrove forest of western coast in and around Mumbai |
| Shiva Prakash K N | Conservation assessment of *Indrella ampulla,* endemic to Western Ghats, India |
| Dr. Gopinath | State of ecological services of sacred grooves in the light of Biological Diversity Act with special reference to Kolli Hills, Tamil Nadu, India |
| Ramesh S | Assessment of physico-chemical and biological pollution levels in the river Tamiraparani during pre- and post-Aadiammavasai festival and improvement of water quality through public movement |

**Grantees under Policy and Governance**

| Name | Title of the project |
|---|---|
| Dr. Arunachalam | A study on socio- economic impact of the ban on timber felling in Arunachal Pradesh |
| Vinayaka | Wildlife reserves versus sacred groves: Conservation assessment from people's perspective |

**Small Grants Programme – 2011**

**Grantees under Natural Science** (*Finalized, sent agreement letters and released the first installment)*

| Name | Title of the project |
|---|---|
| Arun N K | A study of dependency of birds, butterflies and insects on the forest trees and shrubs of Melagiri Forests; and exploring the possibility of selecting candidate species for enhancing urban biodiversity |
| Dayanand Nejakar | Diversity of Xylariales in Sharavati Wildlife Sanctuary, Karnataka |
| Karthick Balasubramanian | Illustrated guide to freshwater diatoms of the Western Ghats |
| Kiran Salagame | *What in the name of God* – A documentary on the impact of a temple festival on the forests of Kalakad Mundanthurai Tiger Reserve |
| Kumar R/Mahesh | Preparation of education material in local language and dissemination in schools to support the conservation of blackbuck (*Antilope cervicapra*) and its habitat outside protected areas in southern Karnataka |

| | |
|---|---|
| Naveen N L | Determinants of diversity and distribution of stored grain insects in the Biligiri Rangaswamy Temple Wildlife Sanctuary, Karnataka |
| Shaji C P | A taxonomic study And preparation of a field guide on barbs of the genus *Puntius* in Kerala |
| Vijaya Kumar | Status survey of slender loris, *Loris Lydekkerianus* (Family: Lorisidae, Genus: Loris) in Chennai, Tamil Nadu |

**Grantees under Social Science**

| **Name** | **Title of the project** |
|---|---|
| Khoiyangbam Raju Singh | Community-protected Area interface in Keibul Lamjao National Park, Manipur – An Environmental Assessment |
| Yogesh Gairola | Socio-economic assessment of Ringal (Hill Bamboo) and development of manual on standard procedures for its sustainable extraction and cultivation in the context of Naidi community of District Uttarkashi, Uttarakhand |
| Asmita Kabra | To study the impact of conservation-induced displacement on livelihood and coping strategies of the host community |
| Pranieta Mudaliar | Socio-economic evaluation of watershed development programmes in India |
| Nirmala Vilasini | Critiquing developmental projects by studying the impact of AHADS* project on the tribals of Agali, Attappady, Kerala |
| Rucha Ghate | Assessing impact of a relocation on forest dependence and forest health |
| Susha Sukumaran | Climate change impacts and adaptation strategies in rice production |

## Other grants

1. ATREE NE Small Grants 2010
2. The ATREE Northeast small grants programme: supported by the National Geographic Society (Committee for Research and Exploration) and the John D and Catherine T MacArthur Foundation.
3. ATREE–Ford Foundation Small Grants in the Eastern Himalayas
4. CEPF – Eastern Himalayas
5. CEPF – Western Ghats

# INFRASTRUCTURE SUPPORT

## BUILDING CONSTRUCTION

### ATREE Main Office

The ATREE building at Srirampura, Bengaluru serves as headquarters and nodal office for the teams working on the peninsula – Western Ghats, Vembanad, KMTR, Kanakapura. It also serves the requirements of the Ph D programme infrastructure – classes, faculty offices, and library. ATREE moved into its new campus in February 2009.

This is a green building, awaiting LEED certification (Leadership in Energy and Environment Design, a green building rating system developed by the United States Green Building Council). Well-lit and well-ventilated rooms help minimize energy requirements. A waste water treatment plant has been installed to process waste water in a state-of-the-art anaerobic system; this would be reused for flushing and watering the garden. Solar power installation has been postponed since the present budget does not support this.

## Community Conservation Centres

The Natham CCC building is complete. Vembanad CERC operates out of a building for which the rent is covered by donor, S D Shibulal.

**Status of other building sites**

**BRT**

Work in progress at BRT

The foundation of the building for BRT CCC has been laid, and the schedule for completion has been fixed for March 2011. Eco-friendly materials will be used.

**Kanakapura**

*CCC Advisory Board at the site*

Foundation of CCC building has been completed and the next stage of work will be beginning soon. A variety of seedlings are being raised in the nursery for restoration work in schools, agricultural, and non-agricultural lands.

**MM Hills**

The foundation for the CCC building has been laid; other work will start in mid-December 2010.

The land supports 18 native tree and shrub species, which are frequently used in ethnic food and medicine. To this, the team has added medicinal plants -- *Cymbopogon citratus* (lemongrass), *Adhatoda viscosa* (Adusoge), and *Withania sominifera* (Ashwagandha). More species will be planted as part of the *ex situ* conservation of medicinal and rare plants at MM hills.

**Agasthyamalai**

The ACCC building has been made with eco-friendly material. It started functioning from 14 July 2010.

The new office, which has a community hall and office space, is made of rammed earth wall and the wood used for doors, windows and pillars

are from the palm trees that grow locally in the region. The building uses very little cement except for a small portion for the RCC roof. The accommodation for trainees is half complete, but is partly functional and can accommodate about 10 people comfortably. As you can see, the office is located close to the hills of the KMTR, outside the reserve. It is also just outside two major villages of Singampatti that have been the focus of our community-based conservation work.

**Online Connectivity**

In May '09, ATREE shifted from BSNL ADSL broadband to a dedicated lease line from Bell Teleservices India Pvt Ltd. This freed ATREE from recurring problems with outages, fluctuations in speed, interruptions due to cable damage and apathy of single-vendor services in the new locality. The current arrangement, obtained at a subscription of Rs. 3.6 lakhs per annum provides uninterrupted connectivity without fluctuations in speed, plus better speed. This has helped improve quality of facilities to researchers and students, and productivity.

**Transport**

Purchased Swaraj Mazda for office transportation.

# ANNEXURES

## ANNEXURE 1: PUBLICATIONS

**From Suri Sehgal Centre for Biodiversity and Conservation**

**Books**

Ganesh, T., R. Ganesan, M. Soubadra Devy, and Jahnavi G. Pai. 2009. *Treasures on Tiger Tracks — A Bilingual Nature Guide to Kalakad Mundanthurai Tiger Reserve.*

Soubadradevy, M T. Ganesh, and Amrita Tripathy. 2012. *Forest Canopies of South Asia: A Glimpse*.

Kamaljit S. Bawa, Richard B. Primack, and Meera Anna Oommen. 2011. *Conservation Biology: A Primer for South Asia*.

**Books funded by JTT and due in 2012**

Ganesh, T., Allwyn Jesudashan and Mathivanan. *Wetlands Birds of Tirunelveli District*.

Priyadarsanan, D.R., M. S. Devy, K. A. Subramanian, and N. A. Aravind. *Invertebrate diversity and conservation in the Western Ghats*.

Gladwin Joseph, S. C., R. Ganesan, A. Kavitha, N. Deepthi, and R. Ganesan. *Common Dryland Trees for Ecological Agriculture in Karnataka: A Bilingual Field Guide*.

Kamaljit S. Bawa and Sandesh Kadur. *Coffee table book on Eastern Himalayas.*

**Journals**

Kamaljit S. Bawa and Karthik Shankar, *Conservation and Society.*

**Articles**

1. Anitha, K., Shijo Joseph, Robert John Chandran, E.V. Ramasamy, and S. Narendra Prasad. 2010. Tree species diversity and community composition in a human-dominated tropical forest of Western Ghats biodiversity hotspot, India. *Elsevier B.V.* doi:10.1016/j.ecocom.2010.02.005
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**From Centre for Environment and Development**

**Documentary film due in 2012**

Nitin Rai and Moving Images. BRT: From Wildlife sanctuary to Tiger Reserve

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**Book chapters**

1. Badiger, S., S. Gopalakrishnan, and I. Patil. 2011. 'Contextualizing rural–urban water conflicts: Biophysical and socio-institutional issues of domestic water scarcity', in V. Narain, C. Gurung Goodrich, J. Chourey, and A. Prakash (Eds.), *Water in a Globalizing World: State, Markets and Civil Society in South Asia*. Routledge India Publishers, New Delhi (in press).
2. Badami Rao, D. and S. Badiger. 2011. 'Understanding emerging independent regulatory frameworks: lessons for reforming Karnataka's water governance', in V. Narain, C. Gurung Goodrich, J. Chourey, and A. Prakash (Eds.), *Water in a Globalizing World: State, Markets and Civil Society in South Asia*. Routledge India Publishers, New Delhi (in press).

**Teaching and training activities**

1. Bejoy Thomas and Shrinivas Badiger organized a certificate course on Perspectives in Environment and Development: Concepts and Debates at ATREE between 9 and 16 March 2011. Nine faculty members from CED, including CED Seema Purushottaman, Siddhartha Krishnan, Ashokankur Datta, Nitin Rai, Siddappa Setty, Swati Shresth, Bejoy Thomas and Shrinivas Badiger contributed to session topics.
2. Shrinivas Badiger supervised Pranietha Mudliar, a master's student in environmental sciences (registered at University of Pune) on the thesis topic 'The Quest for Equity – Looking beyond People's Participation in Watershed Development Projects', January–June 2011.
3. Shrinivas Badiger supervised an intern – senior student Emma Karki in Environmental Sciences at the Mills College, Oakland, CA from 03 June–30 July 2010 during which she assisted the research team in preliminary site selection for water quality sampling and trial testing of standard drinking water quality parameters in the Vembanad–Kuttanad region.
4. Shrinivas Badiger is supervising an intern Narendra Killada Varma who is working on a research project assessing downstream impacts of upstream watershed development

programmes.

5. Bejoy Thomas supervised a research intern Elizabeth Cheeran, Master's student in Disaster Management at Tata Institute of Social Sciences, Mumbai during February–March 2010. Cheeran assisted Bejoy in a pilot study on social implications of climatic variations among paddy farmers in Kuttanad and fishers around Vembanad lake in Kerala during March 2010.

**Workshops organized**

1. Lele, S. 'Brainstorming Workshop on Proposed National Environmental Protection Authority'. (co-organized with Centre for Policy Research, New Delhi and Prayas, Pune) and sponsored by Ford Foundation. New Delhi, 06 November 2009.
2. Badiger, Shrinivas and Divya Badami Rao. 'Emerging Water Regulatory Frameworks and Related Reforms in Water Governance in Karnataka.' United Theological College, Bangalore, 02 September 2009.
3. Rai, N., and Sushmita Mandal. 'Collaborative management of Protected Areas & Forests', Mysore, 22–23 February 2010.

**Presentations at Workshops/Conferences**

1. Badiger, S. 2011. Agricultural Land-use Change and Cropping System Choices in Western Ghats Catchments: Hydrological Regime Changes and Implications for Food Security and Livelihoods. Brainstorming Workshop on Land Use Policy for the Western Ghats. Organized by CES-IISc and WGEEP. 03 March 2011. Bengaluru, India.
2. Badiger, S. 2011. Regulatory Frameworks in Water Sector and Related Reforms: Paradigms and Possible Implications. National Workshop on Water Supply and Sanitation Law and Policy Reforms in Karnataka – Equity, Sustainability and Human Rights. Organized by IELRC, ELRC and NLSIU. 03-04 January 2011. Bengaluru, India.
3. Smitha, G., I. Patil and S. Badiger. 2010. Identifying Contextual Strategies to Address Urban Drinking Water Shortages – A Case of Bailhongal, Karnataka. International Conference on Urbanism and Green Architecture. NIT-HP and IIA-India. 30–31 October 2010. Hamirpur, India.
4. Badiger, S. 2010. Modelling Impacts of Cropping System Choices and Land Use Change on Hydrological Regimes at Sub-Basin Scales. Organized by ATREE, INSEE and LUPIS. 23–24 June 2010. Bengaluru, India.

**Participation in Workshops/Conferences**

1. Badiger, S. (Discussant). Capacity Building Workshop on 'Water Law and Policy in India'. Organized by ELRC-Delhi and District Agriculture Training Centre, Dharwad. 20–21 August 2010.
2. Badiger, S. (Participant). National Consultation Meeting on 'Revision of National Water Policy'. Organized by the Ministry of Water Resources-GoI. 11–12 January 2011. New Delhi, India.
3. Badiger, S. (Participant). National Consultation Workshop on 'Water Regulatory Authorities (WRAs) in India: Rethinking the Current Models'. Organized by IIT-Bombay and TISS. 30 April 2011. Mumbai, India.
4. Badiger, S. (participant). National Consultation meeting on 'Delivery of public services:

Meeting the expectations of public service delivery while ensuring efficiency and equity', organized jointly by the Planning Commission-GoI and the Ford Foundation. 21 June 2011, New Delhi, India.

5. Thomas, Bejoy. 2011 February 'Poverty and vulnerability in the context of environmental change' at refresher course in Environmental Science, UGC-Academic Staff College, University of Calicut, Kerala

**Other Professional Activities**

CED faculty and staff have served as reviewers in various contexts, including for papers submitted to journals such as *Conservation & Society*, *Earth Interactions*, *Geophysical Research Letters*, *Ecological Economics*, *Economic and Political Weekly*, and *Journal of Peasant Studies*. The Centre's faculty members were also invited to be part of various academic committees and other associations as listed below:

Thomas Bejoy, September 2010. Part of a team led by CERC/ATREE that piloted the draft BPL census methodology in a village panchayat in Alappuzha, Kerala, for the Ministry of Rural Development.

**ANNEXURE 2: INTERDISCIPLINARY STUDENT RESEARCH**

The doctoral programme envisions building capacities for seeking answers to environmental problems from across disciplines. The research undertaken by students is itself spread across disciplines, as will be seen below, and they are encouraged to have a diverse advisory committee for their Ph D research.

**Name of the student: Amit Kurien**

**Thesis Title:** Investigating pattern and causes of deforestation and forest degradation in Meghalaya.

**Synopsis:** Amit's study focuses on the causes and consequences of forest loss and other changes in the landscape of Meghalaya. The work focuses on determining the factors that cause changes in forest use practices that are leading to forest loss or degradation, and the resulting consequences to biodiversity and productivity. The work integrates an ecological field component supported by a land survey mapping and remote-sensing component, besides a social science component that involves using questionnaires and interviews to understand reasons and motivations for forest loss.

**Guide:** Sharachandra Lele (Sustainability Science)

**Advisory committee:** To be formed

**Name of the student**: **Barkha Subba**

**Thesis Title:** Community ecological studies of amphibians of Sikkim Himalaya

**Synopsis:** Barkha's work consists of assessments of the threat to amphibians due to habitat destruction, anthropogenic pressure and changing climatic conditions in the high altitudes of Sikkim. She is also studying the use of amphibians by the indigenous communities for food and medicinal purposes and the consequence of this on the amphibian population.

**Guide:** Ravikanth G (Conservation Genetics and Molecular Phylogeny)

**Advisory committee:** Aravind N A (Freshwater Ecology and Conservation); Gururaja K V (Amphibian Ecology and Conservation); Ganesan R (Plant Taxonomy)

**Name of the student: Bharath Sundaram**

**Thesis Title:** Patterns and process of *Lantana camara* persistence in south Indian tropical dry forests

**Synopsis:** Bharath is working on invasive species that are regarded as one of the primary drivers of biodiversity loss in the world, with significant negative effects on both ecosystem functioning and provisioning of ecosystem goods and services. Although biologists often use ecological monitoring to track forest dynamics, we rarely make use of opportunities to tap sources of information embedded in peopled landscapes. The biological monitoring approach is used to examine the patterns and processes of the invasion of *Lantana camara*, in tropical dry forest landscape in the Western Ghats, India. Perspectives of the Soliga people, who have lived in the same landscape for centuries, regarding the spread and effects of *Lantana camara* is also studied. By juxtaposing results obtained from biological and social sources, he examines concordance and discordance between these two kinds of data, and gains a better understanding of lantana invasion.

**Guide:** Ankila Hiremath (Forest Ecology and Management)

**Advisory committee:** Gladwin Joseph (Forest Physiology); Jagadish K (Watershed Hydrology and Landscape Ecology); Seema P (Ecological Economics)

**Name of the student: Chetana H C**
**Thesis Title:** Identifying socio-ecological constraints in natural regeneration of native tree species in abandoned tea plantations in the Western Ghats, India
**Synopsis:** Protected areas in India comprise large plantations of tea, coffee, and cardamom. Due to poor market prices or expiry of lease of the land, these plantations are increasingly being abandoned. It is necessary to work around the complex ecological, social and legal constraints to restore such lands, enabling them to harbour biodiversity. Chetan's research will address the socio-ecological constraints of restoration in abandoned tea plantations in the Western Ghats, and determine what land management efforts are needed for quick restoration of native species. His study is likely to give comprehensive information to forest managers, policy makers and government ministries for conserving such landscapes.
**Guide:** Ganesh T (Forest Ecology)
**Advisory committee:** Ganesan R (Plant Taxonomy); Robert Chandran (Tropical Forest Ecology and Management); (Tropical Forest Ecology and management); Siddhartha Krishnan (Environmental Sociology)

**Name of the student: Paramesh M**
**Thesis Title:** A study on functionality and conservation of wildlife corridors in Mysore–Nilgiri landscape of Western Ghats, India
**Synopsis:** Paramesh's dissertation work is based on interdisciplinary approach towards biodiversity conservation. His approaches for conservation and restoration of wildlife corridors in Mysore–Nilgiri landscape, Western Ghats is through identifying the issues from ecological, economic and sociological angles. So far, researchers have highlighted one or two facets, especially from wildlife side, of a multifaceted conservation problem. Farming community and forest dependents including the tribal population who live in the farmland–corridor–forest landscape and the wildlife are in greater conflicts leading to loss of life on both sides. These forest fringe communities will be the major beneficiaries along with wildlife through Paramesh's expected research outputs on corridor landscape restoration and management. Through his doctoral dissertation, he aims to understand the socio-ecological status of the wildlife corridors so as to propose ecologically suitable and socially acceptable future directions towards wildlife conservation.
**Guide:** Ganesan R (Plant Taxonomy)
**Advisory committee:** Ganesh T (Forest Ecology) Bejoy Thomas (Developmental Economics)

**Name of the student: Radhika Khanade**
**Thesis Title:** Study of woody species communities using functional trait-based approach along the elevational gradient in Sikkim Himalaya
**Synopsis:** The larger goal of the project on which Radhika is working involves conservation of biodiversity and bioresources of Sikkim. The study aims at serving technological and scientific innovations for the use of bioresources in a sustainable manner. She also aims at developing education and outreach programmes to build capacity of local institutions and communities to apply science and technology for the enhancement of local livelihoods and economic well-being, as well as for the conservation of the resource base.
**Guide:** Robert Chandran (Tropical Forest Ecology and Management)
**Advisory committee:** To be formed

**Name of the student: Rajkamal Goswami**
**Thesis Title:** Hunting in protected and other forests on Northeast India and its implications on primate conservation
**Synopsis:** Rajkamal is trying to test the relevance and effectiveness of existing regimes of protection across the three semi-autonomous administrative tribal councils of Meghalaya. The interdisciplinary aspect of the project will specifically address: (1) To what extent traditional values have declined due to influences of modernity, changes in religion and globalization. (2) What kind of biodiversity gets conserved across the current protection regimes? (3) Investigate if any conflicts related to conservation issues exist between the tribal group's institutions with those of government and quasi-government ones and how do these conflicts influence the overall conservation activities and outcomes.
**Guide:** Ganesh, T. (Forest Ecology)
**Advisory committee:** Seema P (Ecological Economics); Siddartha Krishnan (Environmental Sociology); Bibhab Talukdar (Ecologist)

**Name of the student: Ravi Ramalingam**
**Thesis Title:** Studies on insect community responses to habitat restoration efforts in tropical forests of Western Ghats.
**Synopsis:** There is a wide range of circumstances in which ecological restoration is attempted around the world, with scale of operation ranging from local, regional, and national levels (for example, restoration projects ranges from small experimental plots (biocentric approach) to large-scale developmental projects that include restoring the degraded forest landscapes (anthropocentric approach). Further, monitoring projects are often incorporated into such restoration projects for evaluating the progress and attainment of project goals. However, such evaluation programmes are developed based solely from biocentric restoration projects, e.g., mine site rehabilitation, wasteland reclamation, etc., which cannot be readily implemented in a community-driven restoration projects. Hence, in an attempt to develop rapid assessment techniques to evaluate biodiversity recovery in a community-based restoration of degraded forest landscapes, he is studying the insect community responses to habitat restoration efforts in the Attappady hills, Western Ghats.
**Guide:** Priyadarsanan D R (Insect Taxonomy and Conservation)
**Advisory committee:** Gladwin Joseph (Forest Physiology); Jagadish K (Watershed Hydrology and Landscape Ecology); Ganesan R (Plant Taxonomy); Vinod K Uniyal (Wildlife Biologist)

**Name of the student: Savitha Swamy**
**Thesis Title:** Study of urban green spaces in Bangalore as socio-ecological systems for identifying mechanisms for their long-term sustainability
**Synopsis:** Savitha's study aims to understand the ecological aspects – the diversity of birds, butterflies, invertebrates and the vegetation composition and social aspects – people's attitude and perception towards neighbourhood parks, their attachment levels and how they utilize the park and benefit from the ecosystem services that the parks provides to them, in Bangalore city. These parks are essential green spaces within the city and it is important that they are conserved and protected as they provide various services to society. As there is lack of space in developing green spaces in an ever-developing city, it is important to enhance

those that exist as they would function at a higher scale. Hence, to do so, to begin with it is important to identify the various managements that exist around these parks, their strengths and weakness and their collaborations with other institutions. This will help in developing a co-management framework around neighbourhood parks, involving multiple stakeholders in order to enhance and make it a resilient system.
**Guide:** Soubadra Devy (Forest Ecology and Conservation)
**Advisory committee:** Seema P (Ecological Economics); Harini Nagendra (Landscape Ecology)

**Name of the student: Tenzing Ingty**
**Thesis Title:** Impacts of climate change on the patterns of natural resource utilization by the indigenous communities in the alpine regions of the Eastern Himalayas and the resultant response based on their traditional ecological knowledge.
**Synopsis:** Tenzing is studying the impacts of climate change on the patterns of natural resource utilization by indigenous communities in the alpine regions of the Eastern Himalayas, and their response based on their traditional ecological knowledge. He will try to understand this at two levels. (1) How has climate change impacted the social structure and their responses? (2) How has climate change impacted vegetation structures (primarily pasture lands – habitats used by agro-pastoral communities) and the resultant response? The response of alpine pastures will in part be shaped by grazing pressure. Thus, he will address two main questions under a second objective. (a) What is the effect of grazing on plant diversity in alpine pastures? (b) How is plant diversity responding to climate change?
**Guide:** Kamaljit Bawa (Conservation Science)
**Advisory committee:** To be formed

**Name of the student:** Urbashi Pradhan
**Thesis Title:** Fragmented landscape, biodiversity, and ecosystem services: A study of pollinators outside Kanchenjunga Biosphere Reserve in Sikkim
**Synopsis:** Urbashi will be performing landscape analysis to see if spatial arrangement of fragmented forest patches provides better pollination service to Sikkim mandarin orange. She will perform vegetation sampling and assess disturbance in forest patches to access major bee food plants and to assess present condition of these patches. She will also conduct pollination experiments on oranges in the orchards to study the contribution of bees for better fruit yield and will do an economic evaluation of the pollination service. She will also collect social data to see people's dependency upon orange as a cash crop and to assess their perception regarding pollination, pollinator, biodiversity and conservation outside protected area in Sikkim.
**Guide:** Soubadra Devy (Forest Ecology and Conservation)
**Advisory committee:** Ganesan R (Plant Taxonomy); Jagadish K (Watershed Hydrology and Landscape Ecology)

**Name of the student: Vidhyadhar Atkore**
**Thesis Title:** Impact of small dams on the fish communities of the Western Ghats, India
**Synopsis:** Vidhyadhar's research focuses on ecology and conservation aspect of impact of small dams on fish assemblages in the Western Ghats. Freshwater fishes are one of the highly sensitive and threatened animals. The development activities such as dams, bunds,

pollution, over harvesting, etc. are the major threats. His research will look into the impact of small dams constructed mainly for irrigational purpose on the fish communities in the central and southern Western Ghats.

**Guide:** Jagadish K (Watershed Hydrology and Landscape Ecology)

**Advisory committee:** Kartik Shankar (Macro Ecology); Rajeev Raghavan (Icthyologist); Srinivas Badigar (Water and Livelihoods)

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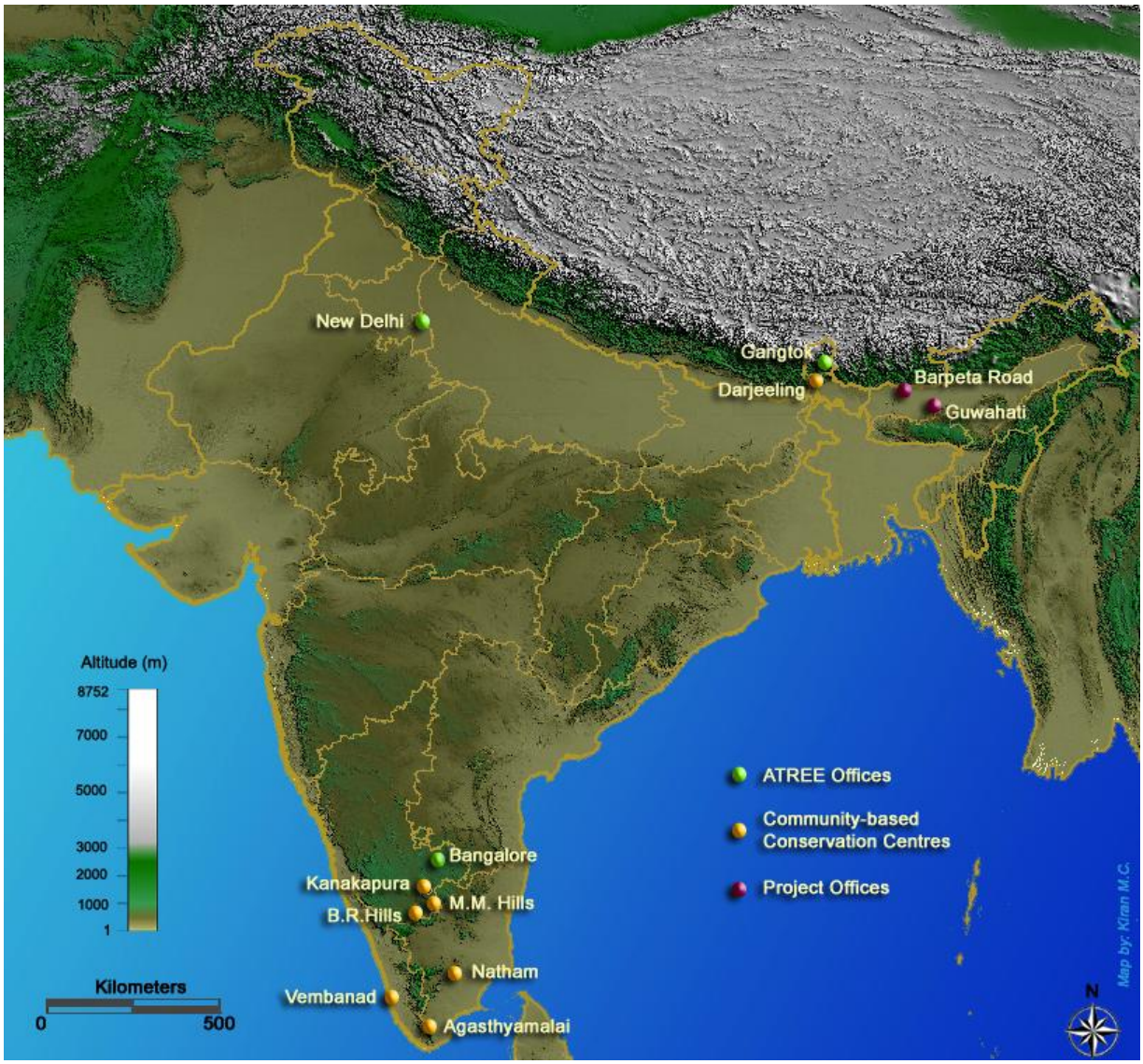


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