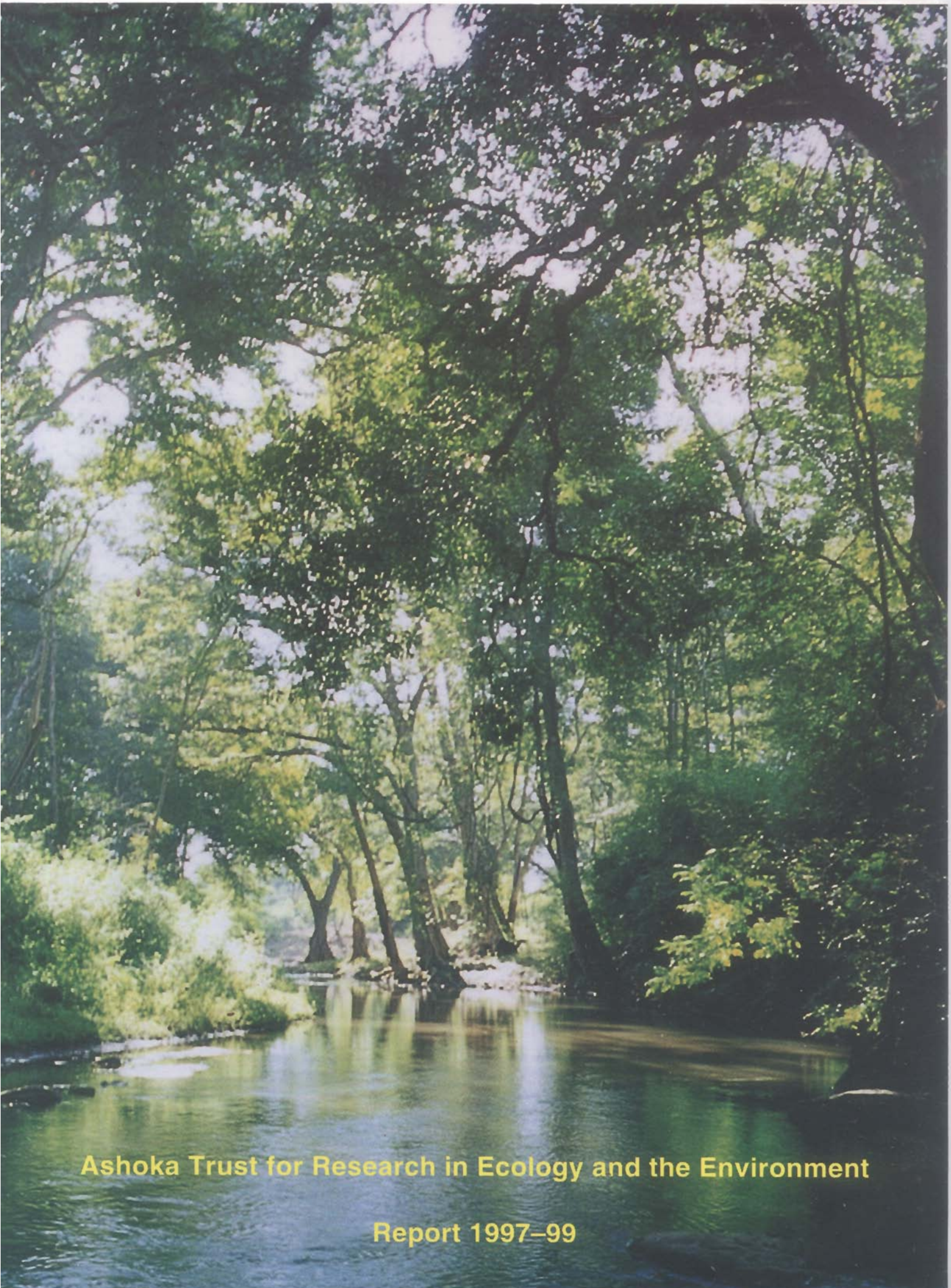


Ashoka Trust for Research in Ecology and the Environment

Report 1997–99

Ashoka Trust for Research in Ecology and the Environment

Our planet is witnessing unprecedented changes in the quality of its environment. Forests are being lost at an unparalleled pace. Soil losses due to erosion are assuming massive proportions. The use of unsustainable and inappropriate technologies is polluting the air we breathe and the water we drink. Emissions of greenhouse gases are changing the climate at a rapid rate. These changes have grave consequences for the health of the earth as well as for the physical and economic well being of human societies. The changes are occurring so rapidly that the responses of public and private institutions are not adequate to meet the environmental and economic challenges that we are encountering today. Ashoka Trust for Research in Ecology and the Environment (ATREE) is a charitable trust dedicated to improving the response to these challenges. The Trust combines public concern over the deteriorating economic and physical environment with a vigorous scientific approach to solving environmental problems. It emphasizes interdisciplinary approaches that will lead to the improvement of the human condition through economic development while conserving our environment and natural resources.

ATREE combines principles of ecology and economics to undertake and promote scientific, educational, and development activities that advance protection of the environment, conservation of biodiversity and sustainable use of resources. The activities range from basic to applied research combined with action. The current areas of concentration are conservation and sustainable management of biodiversity, particularly the impact of land use change and deforestation on ecosystem services, including water and climate, and agricultural productivity; social and economic drivers of land use change; mapping of biodiversity; enterprise based approach to conservation; conservation and management of forest genetic resources; and policy and action related to conservation and use of forests. ATREE provides a platform for innovative work and particularly encourages the professional growth of young men and women concerned with the environment. ATREE also seeks to strengthen the skills of government and non-government organizations.

ATREE fulfills its mandate through research and activities by its own core staff and by providing scholarships, fellowships and small grants to young professionals. Capacity building and human resource development of other organizations is achieved through workshops and training courses.

The geographical foci of ATREE's current work are the two hot spots of biodiversity: the Western Ghats and the Eastern Himalayas.

ATREE is registered as a charitable trust and is managed by an Executive Board. The Executive Director is the chief operating officer of the Trust.

ATREE

Contents

Foreword

The present century could be remembered in the annals of human history as the era in which humans undertook massive transformation of natural habitats and extirpated hundreds, if not thousands, of species. Alternatively, it could be remembered as the century during which we finally recognized the value of wilderness and nature in sustaining all human endeavors and redoubled our efforts to save the environment. The choice is ours.

On the eve of the next millennium, we have the potential to reverse the devastation of habitat loss and pass on to our descendants what we inherited from our ancestors. The reversal will not occur until we take new approaches to conserve the environment and improve the human condition through innovative models of development.

Ashoka Trust for Research in Ecology and Environment (ATREE) was established in 1996 to respond to contemporary environmental challenges. Our programs are driven by the human induced changes of land, air, and water, and the consequences of such changes for our future. We are, of course, also interested in finding the solutions to our environmental problems and ways in which we can sustainably manage our precious natural resources. In the past year we have begun to systematically monitor changes in land use and its impact on forest biodiversity as well as agrodiversity. Emerging information technologies have allowed us to initiate mapping of biological resources, from the level of genes to the level of ecosystems and larger landscapes, and to identify gaps in protection of biodiversity. Working with local communities, we have developed participatory resource management techniques, and are testing the viability of enterprise based approaches to conservation. To bring about more permanent change, we continue to work with government agencies to review and enhance policy framework for management of natural resources. Finally, we have expanded our efforts to strengthen human resources in conservation and sustainable development by initiating a small grants program.

ATREE's present focus on conservation and management of biodiversity will continue as we move to confront other problems in the management of land, water, and biological resources, and in the broad area of poverty and environmental degradation. We will continue to build partnerships with other organizations as well as individuals who share our vision and concerns. We need support and input from them and the readers of this report so that together we can make a difference.

Kamal Bawa
Founder-Trustee

Conservation, Enterprises and Livelihoods

Working with Local Communities to Enhance Rural Income and Conserve Natural Resources

A key question in India, as elsewhere, is how to provide incentives to local communities to conserve and sustainably manage their natural resources. Working with Vivekananda Girijana Kalyana Kendra (VGKK), and Tata Energy Research Institute (TERI), ATREE has helped *Soligas*, the indigenous people of Biligiri Rangan Hills in the Western Ghats, in establishing forest-based enterprises that incorporate principles of conservation and sustainable management.

The *Soligas* have inhabited Biligiri Rangan Hills of South India for millennia. In the Biligiri Rangaswamy Temple (BRT) Wildlife Sanctuary, approximately 4,500 *Soligas* live in 57 settlements, called *podus*. Traditionally, the *Soligas* engaged in shifting agriculture and hunting, and collected a wide range of non-timber forest products. When the Biligiri Rangan Hills area was designated as a sanctuary, shifting agriculture and hunting were completely banned. The *Soligas* were allocated small pieces of land where they could practice settled agriculture. However, extraction of non-timber forest products (NTFPs) still remains the major source of income for the *Soligas*.

Enterprises based on non-timber products were established. These include a honey processing plant to process honey collected by wild honeybees, a food processing plant for wild fruits, and an herbal medicine plant. *Soligas* are managing the enterprises, which have begun to generate profits. In 1998, for example, the Honey Processing Unit showed a profit of Rs 340,000 (US $ 8,500.00); the Managing Committee, consisting mainly of *Soligas*, distributed Rs 100,000 to the community members, including collectors. Although as in any startup business the development of management skills and profitability took time, improvements in production, marketing and management have contributed to the financial viability of the plant. In November 1998, the herbal medicinal unit also launched its own line of products, which are sold through a general agent in Bangalore.

The second major achievement has been the implementation of a sound biological monitoring program including participatory resource monitoring. Our scientific monitoring has involved the preparation of vegetation maps of the entire area; determination of relative abundance of woody species; preparation of distribution maps of major non-timber forest product species; studies on regeneration of NTFPs; assessment of impact of fire and weeds on population dynamics of tree species; work on phenology, pollination, seed dispersal and productivity of various species; and a long-term program to monitor biodiversity at all levels of organization from genes to populations to ecosystems. All the spatial data have been integrated into a geographic information system.

Apart from scientific monitoring, considerable progress was made in participatory resource monitoring designed to estimate production, extraction and regeneration levels of NTFPs. This monitoring was incorporated into the operations of the enterprises. In addition, harvesters are directly involved in monitoring these parameters. At the enterprise level, field assistants are trained to estimate and document production, extraction and regeneration. Similarly, harvesters were exposed to basic protocols of monitoring. Simple manuals to monitor production, extraction and regeneration were prepared for both the enterprise level workers and the community members.

Socio-economic monitoring has been conducted at a variety of levels for various purposes. We have determined the degree to which *Soligas* rely on the harvest of non-timber forest products and other vocations to sustain their livelihoods. Prices,

Honey processing unit

Products from NTFP enterprises

Demonstration of comb-cutting

profits and income obtained by *Soligas* from their traditional marketing co-operative and the newly set up enterprises are being monitored.

Socio-economic activities also include empowering the community to realize social and economic benefits from various government and non-government activities aimed at the welfare of *Soligas*, creating awareness of the enterprises as well as conservation and management issues among *Soligas*, and involving *Soligas* in operating and managing enterprises. A separate organization has been formed by the *Soligas* to operate the enterprises and the associated socio-economic and resource monitoring. Feedback on enterprises and monitoring also constitute an integral part of the socio-economic component of the project.

Work is now in progress to initiate participatory resource management that could involve the *Soligas*, the state forest department, ATREE and VGKK. Participatory resource monitoring is also being strengthened. Plans are being developed to further enhance rural income and conservation in Biligiri Rangan Hills and to apply the lessons learnt there to other areas.

Selected Publications

Lele, S., K. S. Murali, and K. S. Bawa. 1997. Biodiversity Conservation through Community Enterprise: an experiment in the BRT Wildlife Sanctuary of Karnataka, India. In: R. V. Anuradha, A. Kothari and N. Pathak (eds) *Proceedings of the UNESCO Regional Workshop on Community-Based Conservation: Policy and Practice.* IIPA, New Delhi, February 1997.

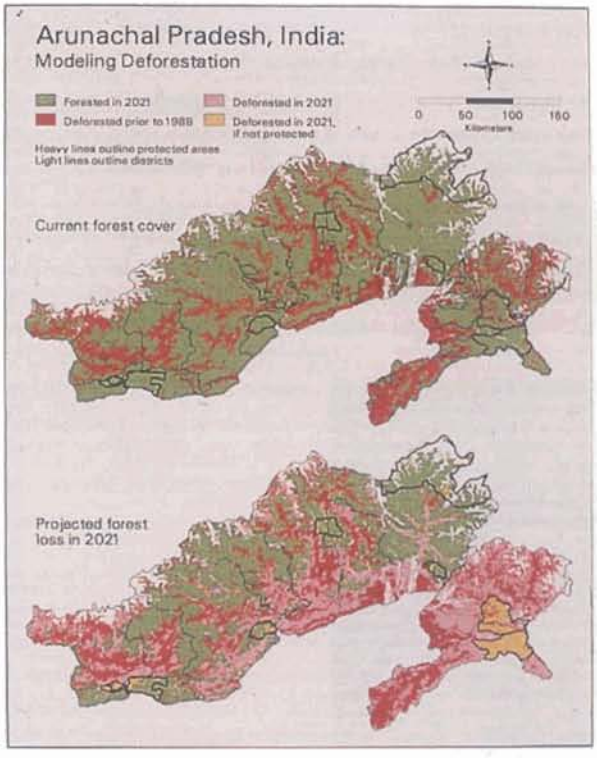
Bawa, K.S., S. Lele, K. S. Murali, and B. Ganesan. 1999. Extraction of non-timber forest products of Biligiri Rangan Hills, India: Monitoring of a community based project. In: Saterson K., R. Margoluis, and N. Salafsky (eds.) *Measuring Conservation Impact: Proceedings from a Symposium at the 1996 Joint Meeting of the Society for Conservation Biology and the Ecological Society of America*, Providence, Rhode Island. Biodiversity Support Program, Washington, D.C.

Deforestation and Land Use Change

Changing Landscapes and their Ecological and Economic Consequences

Land all over India is being transformed at a rapid rate. These changes are driven by a host of economic and social factors. Changes in land use patterns, including changes in land cover have important consequences for conservation of biodiversity, agricultural productivity, regulation of water cycle, climate, retention of soil, and the general well being of human societies. However, the magnitude of land use change, including deforestation, as well as the drivers and consequences of change are poorly understood.

ATREE's program on land use change is currently concentrated in two regions: the Western Ghats and the Eastern Himalayas. The objectives of the program are to assess the extent of change in land cover, particularly deforestation and forest degradation, identify causes of change and examine consequences.



Using remote sensing imagery, archival maps, and ground surveys, scientists associated with ATREE have examined land use change and deforestation in the Western Ghats and Arunachal Pradesh. In addition, land use change and deforestation have been studied in detail in three other areas: Agasthyamalai Hills and Biligiri Rangan Hills in the Western Ghats, and Darjeeling Hills in the Eastern Himalayas. Detailed maps showing the nature and extent of change have been prepared, and statistics on deforestation, forest fragmentation, and conversion of forest land to other types of usage have been compiled.

The data on land use change and deforestation have been assembled into a Geographic Information System (GIS) format. Other layers of information that are being incorporated into GIS include spatial data on roads, population centers, land use, and a wide range of economic and developmental parameters to identify causes of change. Information on the distribution of biodiversity is being added to the GIS to determine the consequences of land use change for the conservation of biodiversity. The analyses based on land use change and the distribution of biodiversity are identifying gaps in the protection of biological diversity and should form the basis for further conservation planning as described in one of the following sections.

Selected Publications

Bawa, K. S. and S. Dayanandan. 1997. Socioeconomic factors and tropical deforestation. *Nature* **386** : 562-563.

Menon, S. and K. S. Bawa. 1998. Deforestation in the tropics: reconciling disparities in estimates for India. *Ambio* **27** : 567-569.

Mapping Biodiversity

Distribution of Biological Diversity

India is one of the top fifteen countries in the world with respect to the total number of plant and animal species. However this biological diversity is threatened by a number of forces, principally human pressure. Continuing loss of forests and other natural habitats is likely to result in substantial loss of biodiversity. Effective conservation of biological diversity requires information about the distribution of biodiversity. Although there are considerable data on the distribution of Indian plants and animals, the data are not current, nor are they incorporated into a Geographical Information System. Moreover, data on distribution only pertains to species.

Biological diversity occurs at several levels: genes, species, groups of related species, and ecosystems or large landscapes encompassing many diverse ecosystems. At present there is no concerted effort in this country to map biodiversity at all these levels.

ATREE's program in mapping biodiversity is designed to develop conceptual and analytical tools to comprehensively map biodiversity. The enormity of the task of mapping biodiversity of a country with the wide range of species seen in India has led ATREE to emphasize developing conceptual, methodological and analytical tools. These tools are then used to undertake mapping with collaborators and other partners.

Scientists associated with ATREE have mapped biodiversity at all levels. Genetic diversity has been mapped for such important forest resources as *amla* and sandalwood. Past and current distribution maps of economically important species such as bamboo have been prepared. Species richness maps of plant genera and families such as Dalbergias, Dipterocarpus, and orchids have been assembled. These maps highlight areas of high conservation value and should provide critical inputs to the development of conservation strategies.

Future activities of this program would include the preparation of maps of a range of taxa in collaboration with other institutions and development of methods to efficiently assemble and analyze spatial information for conservation and management purposes.

Selected Publications

Ganeshaiah, K N 1997. Mapping diversity from ecosystem to genes: Units and hierarchies of conservation. *Proc. Workshop on GIS and Remote sensing in natural resources monitoring*, ATREE-KFD, Bangalore, Dec 1997.

Murali, K S, R Siddappa Setty, K N Ganeshaiah and R Uma Shaanker. 1998. Does forest type classification reflect spatial dynamics of vegetation? An Analysis using GIS techniques. *Current Science* **75** : 220–227.

Ganeshaiah, K N and R Uma Shaanker. 1998. Contours of Conservation - A national agenda for mapping biodiversity. *Current Science* **75** : 292–298.

Ganeshaiah, K.N. and R. Uma Shaanker. 1998. Conservation through mapping: development of nationwide biodiversity atlas. *Proc. Intl. Conf. on conservation of tropical species, communities and ecosystems*, TBGRI, Trivandrum, Dec. 1998.

Three-dimensional view of species richness of Dalbergias

Conservation of Forest Genetic Resources

Protecting Our Genetic Heritage

Landuse change and deforestation also have a significant effect on genetic resources. Yet worldwide concern about the depletion of tropical forests has not been translated into concrete action to assess the magnitude of loss in forest genetic resources, or to determine the consequences of such losses on the economic well being of human societies. ATREE has designed a comprehensive approach to conservation and utilization of forest genetic resources in southwest India, where rural and urban populations are heavily dependent upon the rapidly diminishing forests for a multitude of goods and services.

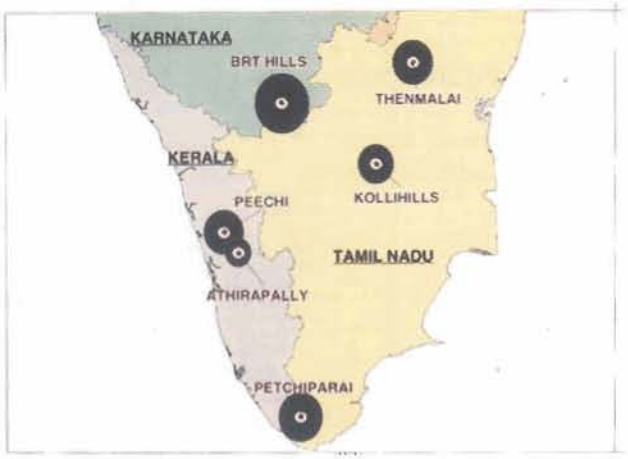
The Forest Genetic Resources Project has three components: biological, socio-economic, and institutional. Following a hierarchical approach, the biological component seeks to determine the conservation status of forests and of important plant species; examine patterns of genetic variation within a wide range of species; and analyze the impact of extraction of forest genetic resources on genetics and demography of extracted species.

The socio-economic component seeks to examine the contributions of forest resources to rural and regional economies and to analyze the impact of rural populations on forest resources. In addition, the size of natural stocks of forest genetic resources that contribute the most to local and regional economies will be estimated. ATREE will also explore the prospect of value addition at the sources of extraction to enhance the value of resources for local communities. Lastly, the institutional component seeks to create an effective institutional framework to address critical issues in policy and development of human resources in conservation and utilization of forest genetic resources.

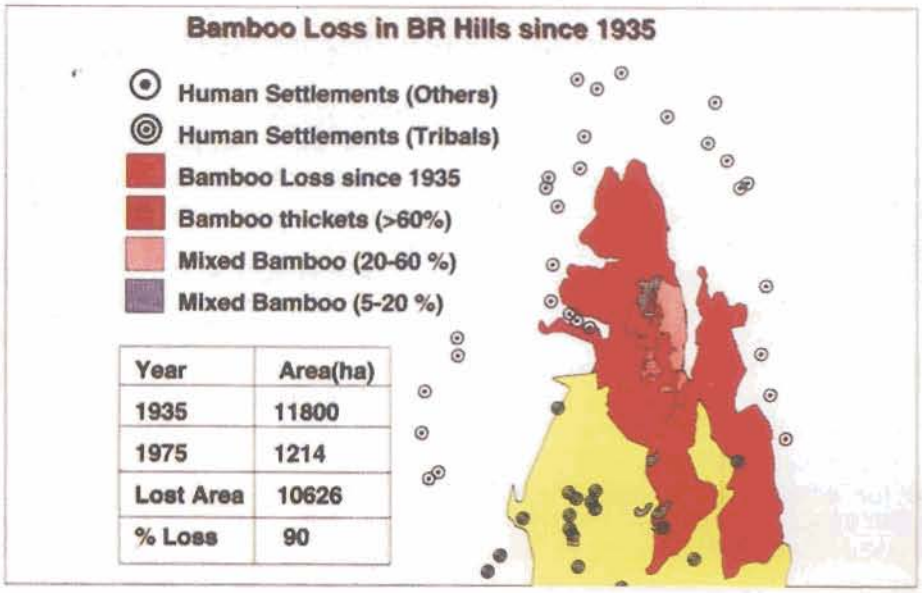
Bamboo is culturally and economically one of the most important species in the country. ATREE scientists have identified centers of high genetic diversity in the Western Ghats. The genetic diversity of nineteen bamboo (*Bambusa arundinaceae*) populations from four forest ranges, including two, Chamarajnagar and Coorg in the south, and the other two, Bhadravathi (Shimoga) and Dandeli (Uttara Kannada) in the northern part of the Western Ghats was estimated using a series of eight isozyme systems. Populations from the northern forest ranges in Uttara Kannada and Shimoga appear to be more diverse and allele-rich than those located in the southern ranges of Chamarajnagar and Coorg. Uttara Kannada district contains one of the largest contiguous forests in the Western Ghats and, despite substantial extraction over the years, is one of the richest regions for bamboo and its *in situ* conservation program.

Genetic diversity of sandalwood (*Santalum album*) was also studied throughout Karnataka. Tree populations in the two districts of Shimoga and Bannerghatta were identified as richest and most promising for *in situ* conservation. An assessment of the impact of human disturbance on the genetic diversity of sandalwood populations in Bannerghatta National Park and BRT WLS indicated that genetic diversity was highest in the undisturbed core zone, with lowered allelic diversity outside. However, allelic diversity was equivalent in the surrounding disturbed and buffer zones, with high and intermediate disturbance levels, respectively. In fact, the buffer zone is probably less protected from tree felling and poaching than disturbed farmland.

ATREE has also been associated in developing conservation plans for the medicinal plants of south India. Over 3,000 species of plants are estimated to be used for medicinal purposes in this



Composite index of Triphala genetic diversity



region. However, because of indiscriminate use of these resources and due to fragmentation of natural habitats, many of these species face the prospect of being threatened with a certain loss of their genetic resources. In collaboration with the Foundation for Revitalization of Local Health Traditions (FRLHT), ATREE initiated a program to identify centers of high genetic diversity of three of the most important medicinal plants (*Phyllanthus emblica, Terminalia bellirica* and *T. chebula*), collectively referred to as *Triphala*. Using isozyme analysis, the genetic diversity of populations of these species in the Medicinal Plant Conservation Areas (MPCA) was determined.

Selected Publications

Uma Shaanker, R. and K. N. Ganeshaiah. 1997. *Impact of anthropogenic pressures on forest genetic resources in south India*. FORGEN, IPGRI, Dec. 1997, pp12.

Uma Shaanker, R. and K. N. Ganeshaiah. 1997. Mapping genetic diversity of *Phyllanthus emblica:* Forest gene banks as a new approach for *in situ* conservation of genetic resources. *Current Science* **73** : 163–168.

Bawa, K.S., R. Uma Shaanker and K. N. Ganeshaiah, 1997, Conservation of forest genetic resources: A research programme for the Western Ghats, India, FORGEN, IPGRI, Dec. 1997, pp. 13–14.

R. Uma Shaanker and K. N. Ganeshaiah. 1998. Conservation of Plant Genetic Resources. In *Biligiri Rangaswamy Temple Wildlife Sanctuary: Natural history, Biodiversity and Conservation* (eds. K. N. Ganeshaiah and R. Uma Shaanker). ATREE-VGKK, Bangalore.

Disturbance and Biodiversity

Unraveling the Impacts of Anthropogenic Pressures

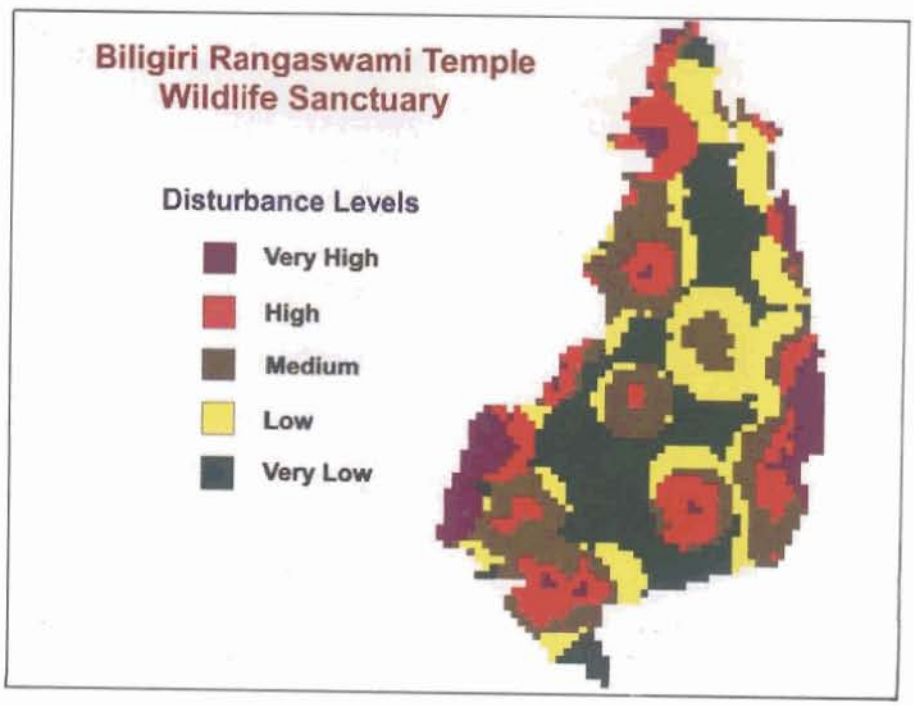
Anthropogenic pressures on forest ecosystems can have dramatic impact on biodiversity. Human impacts often lower the number of plant and animal species in an area. However, biodiversity may also be enhanced if humans create new habitats, and the mosaic of new habitats come to acquire additional species not present in original ecosystems. In general, the effect of low level disturbance from human activities is not very well studied. For instance, our studies have shown that human disturbance reduces the proportion of animal-dispersed species but increases the proportion of the wind-dispersed species.

It is often assumed that any disturbance by human activity leads to a decrease in biological diversity. However, it is not unlikely that certain levels of disturbance would bring about beneficial results while higher levels bring about heavy loss. It might be very important to evaluate the exact relation between the disturbance levels and extent and direction of change in the biological diversity while managing the ecosystems such as Biligiri Rangan Temple (BRT) sanctuary where human habitation in the forests cannot be avoided.

ATREE has initiated a study at BRT sanctuary to study the pattern of changes in the forest ecosystems due to human-induced disturbances such as habitation, harvesting of forest products, grazing, fire and agriculture. The changes are being studied at different levels such as at the focal species, community, habitat and ecosystem. Models are being developed to integrate results at each of these levels to predict the expected changes at the next level and these predictions are being evaluated. With an iterating feedback process, the program expects to develop a final model that can be used to predict the impact of human-induced activities on the structure and landscape of the forest ecosystems.

Selected Publications

Ganeshaiah, K. N., R. Uma Shaanker, K. S. Murali, Uma Shankar, and K. S. Bawa. 1998. Extraction of non-timber forest products in the forests of Biligiri Rangan Hills, India. 5. Influence of dispersal mode on species response to NTFP extraction. *Economic Botany* **52** : 316–319.



Agrobiodiversity

Sustaining the Productivity and Stability of Agroecosystems

Deforestation and land use change may also have severe impacts on agrobiodiversity. Modern agriculture intended to encourage the cultivation of nature, is causing a heavy destruction of biological diversity in several ways. Conversion of grasslands to wastelands due to overgrazing, direct conversion of forest and grass land to agriculture, uncontrolled spread of the mono-specific and mono-genotypic cropping systems, and the use of artificial and environmentally dangerous chemicals such as fertilizers and pesticides, are only some of the ways in which the farming activities impact biological diversity.

Nevertheless, agriculture is one of the few enterprises in which the conflict between environmental concerns and development activities can be bridged through organic farming, sustainable or ecological agriculture. These concepts suggest that high productivity can be attained and sustained without disturbing the natural health of our ecosystem. In this sense, these views and exercises have caused a marked shift in our efforts to reshape the agricultural practices to incorporate concerns about preserving our biological diversity. There is thus an urgent need for ways of harvesting agro-systems without destroying the health of our ecosystems.

The objectives of the project are:

1) To assess the role of biological diversity and intra- and inter-crop diversity in and around agro-ecosystems on productivity and stability of farming systems;

2) To assess the role of ecosystem functioning in shaping the pattern of resource use and enterprise diversity in farming systems adjoining natural ecosystems; and

3) To study spatial and temporal exchange of biological material and other resources in the interface between agroecosystems and natural ecosystems.

This work seeks to determine optimum levels of biological diversity that can and need to be maintained in and around farms without long-term loss to the economy and stability of the farming systems. In addition, the project will offer mechanisms for maintaining intra- and inter-crop diversity on the farming systems as *in situ* reservoirs of germplasm.

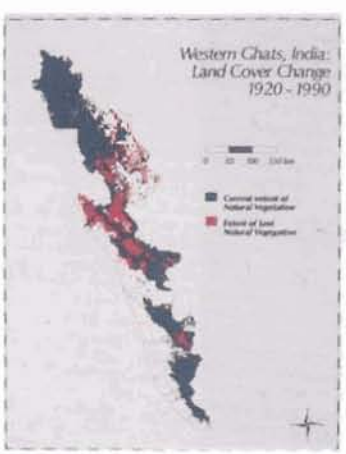
The project also involves documentation of the traditional knowledge base of the *Soligas* of the BRT Sanctuary where there is considerable potential for evaluating the scientific basis for several agricultural practices that are otherwise overlooked and usually neglected by modern agricultural knowledge acquisition systems.

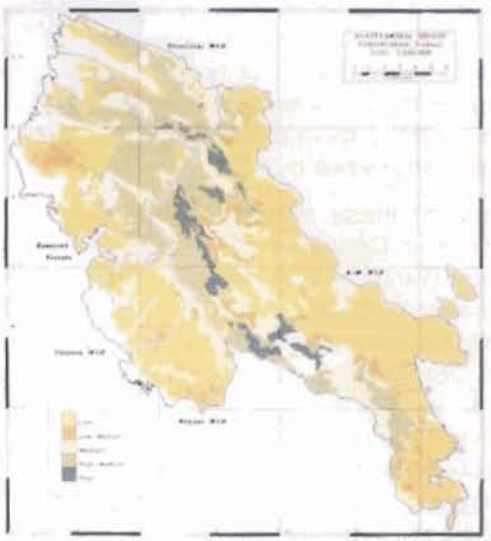
Conservation Planning

Biodiversity Conservation and the Protected Area Network

Protected areas are necessary to safeguard biological diversity in the face of the continuing onslaught on natural ecosystems. Ironically, the maintenance of biodiversity is essential for the long-term well being of humans, who are the major agents of change in natural ecosystems. A network of protected areas is viewed as an effective strategy to protect biological diversity. Although the role of protected areas in conserving biodiversity may seem to be obvious, the premise behind the establishment of most protected areas has been scenic value, tourism, recreation, or administrative convenience. Ideally, protected area networks must be representative of a country's eco-regions and endemic zones. Protected areas should effectively conserve unique and threatened habitats or communities, rare and endangered species, as well as cultural and ethnic diversity.

ATREE's program seeks to examine the adequacy of the existing protected areas in conserving biodiversity, and the degree to which the representative ecosystems or eco-regions are protected. Additional aspects under consideration are the size and patchiness of protected areas, the relative extent of protection in the different states and biogeographic zones, and the relationship between the amount of forests in a state and the extent of protection. We also seek to examine the impact of human populations on the biodiversity of protected areas. Vegetation and other aspects of biodiversity are being mapped in selected protected areas.





Gap analysis is a method usually employing GIS for identifying deficiencies in existing biodiversity protection. We conducted a gap analysis for the Agastyamalai region of the Western Ghats. For our gap analysis project we used intensive field data to create maps of vegetation types, species richness, unique ecosystems, and distribution of endemic flora and fauna. These maps were combined to generate a map of 'conservation value', which was superimposed, with a map of an existing protected area network. This method enabled us to highlight areas of high conservation value that are not adequately protected in the study area.

We also prepared detailed vegetation maps of several protected areas in the Agastyamalai region and the Biligiri Rangaswamy Wildlife Sanctuary. These maps are the most detailed maps of India's protected areas.Work on gap analysis at the national level is currently in progress.

Selected Publications

Khan, M. L., S. Menon and K. S. Bawa. 1996. Effectiveness of the protected area network in biodiversity conservation: A case study of Meghalaya State, Northeast India. *Biodiversity and Conservation* **6** : 853–868.

Ramesh, B. R., S. Menon and K. S. Bawa. 1997. A vegetation based approach to biodiversity gap analysis in the Agastyamalai region, Western Ghats, India. *Ambio* **26** : 529–536.

Enhancing Policy Framework Development

Improving the Long Term Prospects for Conservation

The current trends in loss of biological diversity cannot be reversed without improvement in policies related to conservation of biological resources. Inputs to policy framework for conservation of biological diversity were mainly provided through two meetings organized by ATREE.

The first of these meetings on Ecology, Natural History, and Conservation of Biological Diversity of Biligiri Rangaswamy Temple Wildlife Sanctuary was jointly sponsored by ATREE, Vivekananda Girijana Kalyana Kendra and the Karnataka State Forest Department in September, 1998. The participants in this meeting were primarily from the three sponsoring organizations. Representatives of the *Soligas* also attended the meeting. Other participants were from the University of Agricultural Sciences, Institute for Social and Economic Change, World Wildlife Fund, Biodiversity Conservation Network, Indian Institute of Science and French Institute. The participants discussed, a range of issues in ecology, natural history, human dynamics and property rights, conservation, and management in the light of recent work in the sanctuary.

Five important recommendations related to change in policy emerged from this meeting attended by the Chief Wildlife Warden and the Principal Chief Conservator of Forests (Research) of the Karnataka Forest Department. First, the possibility of participatory resource management involving the local community should be explored in the BRT Sanctuary. Second, the fee for collecting non-timber forest products by the indigenous groups from forest lands should be waived. Third, the administrative structure and functioning of co-operative societies (LAMPS) marketing non-timber forest products should be reviewed. Fourth, in the BRT Sanctuary, *Soligas* may bypass LAMPS and sell their products directly to enterprises owned and managed by them. Fifth, the lease on the coffee estate in the BRT Sanctuary should be reviewed. The Karnataka Forest Department agreed to seriously consider these recommendations.

A second meeting jointly organized by ATREE and the Institute of Social and Economic Change (ISEC) was held in October, 1998. This meeting was also attended by representatives the Karnataka Forest Department (KFD). The goal of this workshop was to increase the dialogue and interaction between the researchers from ISEC and ATREE on the one hand and the forest managers, planners and policy makers of the KFD on the other. Specifically, an attempt was made to: briefly present the results of policy relevant research on forest use and biodiversity conservation that has been conducted over the past several years in the Western Ghats by researchers at ISEC and ATREE, elicit specific comments from the audience, particularly the invitees from the Karnataka Forest Department, on the research and its policy implications, invite specific suggestions for ways in which the next phase of the research, which is in the form of a collaboration between ATREE-ISEC, can be made more relevant to the needs and interests of the Karnataka Forest Department and thereby effectively contribute to improvements in forest and biodiversity conservation in the region.

Key ideas that emerged from the meeting were as follows: A suggestion was made for the formation of an NTFPs Working Group that would combine experience from research and KFD's own efforts and carry out further experiments and make policy recommendations. KFD officials felt that informal collaboration on these lines can begin and a formal group may be formed as and when felt necessary.

It was agreed that future research should include more studies on the level of local people's dependence on forests for income and also for subsistence (including food). The need to continue studying and proposing strategies and institutional arrangements for enhancing people's willingness to participate in forest management and conservation was accepted. The need to look at strategies for forest conservation through the development of non-forest lands was agreed upon as an area that requires greater research attention.

The need to continue efforts for communicating research findings to foresters was stressed. As Dr. Rai of the Forest Department put it, "We can be disseminators of your research results". It was also agreed that communication efforts need to encompass other key audiences such as politicians. A suggestion that was immediately adopted was to prepare a short note highlighting the pace and manner of land-cover change in the Western Ghats over the 1920–1998 period and to circulate the note and maps to forest ministers of all state governments in the region, to the central ministry, and also other forest department heads.

ATREE also co-sponsored an international conference on "Medicinal Plants for Survival" held at Bangalore in February 1998 and was one of the co-signatories to the Declaration of the International Conference on Medicinal Plants that was released as an outcome of the Conference. The Declaration reiterated that the conservation of medicinal plants and revitalization of traditional knowledge based on them should be matter of international priority. It expressed concern over the loss of medicinal plants, their habitats and of local control over natural resources and their management. The Declaration also made several recommendations on conservation, trade and enterprise and resource rights related to medicinal plants.

Selected Publications

Ganeshaiah, K N and R Uma Shaanker (eds.). 1998. Biligiri Rangaswamy Temple Wildlife Sanctuary: Natural History, *Biodiversity and Conservation.* ATREE-VGKK, Bangalore.

Foundation for the Revitalization of Local Health Traditions. 1998. *Declaration of the International Conference on Medicinal Plants.* FRLHT, Bangalore.

Human Resource Development

Building the Framework for a Better Future

ATREE recognizes that a key requirement for a sustainable future is well-trained individuals and strong institutions that can meet the challenges of tomorrow as well as those of today. Human resources must be strengthened not only within ATREE itself, but also in other organizations. Moreover, the capacity of both government and non-government organizations must be enhanced to meet environmental challenges.

ATREE provides direct support to deserving individuals in the form of scholarships and fellowships so that these individuals can realize their full potential. ATREE also organizes workshops and training courses. During the year under review, two scholarships were provided, one to Jadeya Gowda and the other to J Ramachandra of the *Soliga* community. Both are M.Sc. students, one in agriculture, and the other in biology. Research support was also provided to Jadeya Gowda to complete his work on the farming systems of the *Soligas* in Biligiri Rangan Hills.

ATREE also organized two workshops, one on the applications of geographical information systems and remote sensing techniques in natural resource management, and the other on watershed management.

The first of the workshops on GIS and remote sensing and their use in natural resource management was sponsored by the Wildlife Conservation Society. The goal of the workshop was to promote the use of low-cost, PC-based GIS and remote sensing technologies to a wide audience working in the field of conservation, and by doing so to strengthen their abilities to monitor natural resources and influence environmental policies.

The event consisted of two main parts. The first was a symposium where speakers presented different applications of GIS and remote sensing technologies. The range of topics covered in these presentations was very broad, describing the types of sensors aboard satellites and how these could yield data useful for conservation work in many fields, such as watershed and forest management, observation of land use change, and assessment of habitat for elephant reserves, among many others. This broad exposure to the multitude of possibilities of applications of GIS and remote sensing technologies for conservation work was followed by a six and a half day, intensive, hands-on training for local organizations. Participants from over twenty institutions, many of which were NGOs working at the community level, gained valuable exposure and experience in these technologies and their applications.

Participants at the GIS workshop

Working session (GIS)

Field visit during watershed workshop

The second workshop was organized in collaboration with the India-Canada Environment Facility (ICEF). The objectives were to evaluate the impact of ICEF watersheds and land use projects on water retention, soil conservation, agricultural and forest productivity, biodiversity, ecosystem resilience and stability, and social capital. It also sought to evaluate the effectiveness of GIS and remote sensing imagery in project performance and in addressing goals, such as biodiversity conservation; to outline criteria and indicators of success in watershed management, particularly in the context of a landscape ecology approach and to develop a program that would enhance the capacity of institutions to network, assess, and monitor progress.

The participants stressed the need for a coordinated and comprehensive approach to watershed management. It was pointed out that monitoring in watershed projects can be improved by formulating specific questions and there is a great scope to bring in ecological approaches to watershed monitoring and management, including the use of remote sensing imagery and geographical information systems. There is also a need to assist government and non-government organizations in revising their current paradigms and models and enhance their training and capacity.

Small Grants Program

Encouraging Individual Efforts and Ideas

India is a large country endowed with exceptional individuals and institutions. However, often lack of resources prevents young men and women to fully utilize their abilities to undertake creative work. ATREE seeks to support and encourage the work of imaginative and dedicated individuals and organizations by providing small grants for projects that meet the long-term goals of environmental conservation.

ATREE's Small Grants Program is largely focussed on the Eastern Himalayan region, though a few grants are also awarded in the Western Ghats. The Eastern Himalayan region has begun work in Sikkim, Arunachal Pradesh and Northern West Bengal and expects to expand its activities to other parts of the region in the coming months. The Eastern Himalayan region is not only biodiversity-rich but is culturally very diverse too. However, a variety of factors threaten the biodiversity of the region. Another challenge in the area is to improve the quality of living of the people of the region.

Our program is designed to fulfil both these objectives. Specifically it will concentrate on the following areas:

1) Sustainable natural resource use

2) Capacity building of local institutions

3) Strengthening of policy framework

4) Environmental education

5) Conservation-based enterprises

6) Surveys and collection of information to strengthen biodiversity conservation

A beginning has been made with biological surveys, low-cost pollution monitoring, environmental pollution, monitoring of biodiversity, legal and policy framework for conservation, rural health and environmental protection. In addition to making grants the program provides technical inputs to individuals and organizations and helps build up scientific and technical capacity. This work is and will continue to be done in co-operation with official agencies such as forest, revenue and rural development departments, education institutes such as schools and universities, and non-governmental groups including voluntary bodies, professional associations, corporate sector, independent experts and concerned individuals.

Among the outputs expected are micro-enterprises including eco-tourism which can provide people with income and yet reduce dependence on timber and other threatened resources; strengthening of the existing protected area network and identification of new areas for protection; reinforcement of traditional conservation practices such as sacred groves; in-depth policy review and recommendations for an appropriate conservation policy for the area; manuals for policy makers, enforcement agencies and the communities on various aspects of biodiversity conservation; and establishment of community gene-banks for effective conservation.

This is a relatively new area for ATREE which is proposed to be strengthened and expanded in the coming years.

Funding Organizations and Collaborators

Funding Organizations

1) **Biodiversity Conservation Network, World Wildlife Fund–US**
   Washington DC, USA.
2) **Center for International Forestry Research**
   Jakarta, Indonesia.
3) **Conservation Food and Health Foundation**
   Boston, USA.
4) **Foundation for the Revitalization of Local Health Traditions**
   Bangalore, India.
5) **India-Canada Environment Facility**
   New Delhi, India.
6) **International Plant Genetic Resources Institute**
   Rome, Italy; Kuala Lumpur, Malaysia.
7) **John D and Catherine T MacArthur Foundation**
   Chicago, USA.
8) **Wildlife Conservation Society**
   New York, USA.

Collaborators

1) **French Institute**
   Pondicherry, India.
2) **Foundation for the Revitalization of Local Health Traditions**
   Bangalore, India.
3) **Institute of Social and Economic Change**
   Bangalore, India.
4) **Karuna Trust**
   Yelandur, India.
5) **Salim Ali School of Ecology and Environmental Sciences**
   Pondicherry University, Pondicherry, India
6) **Soliga Abhivrudhi Sanghas**
   Chamarajnagar District, India.
7) **Sri Biligiri Soliga Kiru Aranya Utdadana Samskara Sangha**
   BR Hills, India.
8) **University of Agricultural Sciences**
   Bangalore, India.
9) **University of Massachusetts**
   Boston, USA.
10) **Vivekananda Girijana Kalyana Kendra**
    BR Hills, India.

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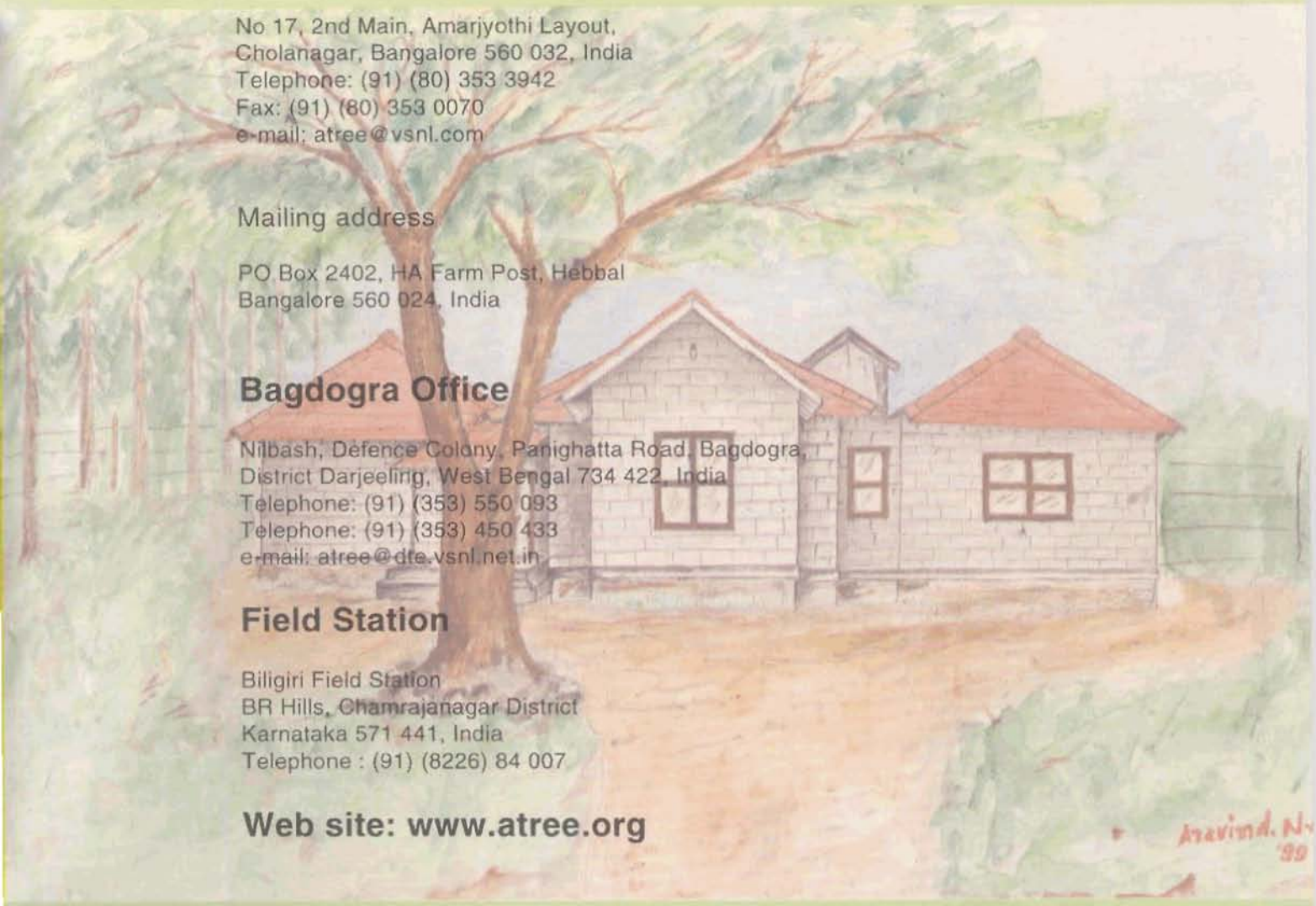

Front Cover : Nirdurgi Halla, BRT (Photo: R. Ganesan)

Inside Cover : Biligiri Field Station, BR Hills
(Illustration by Aravind, N. A.)

Back Cover : Three-dimensional view of False Colour Composite derived from IRS 1C imagery