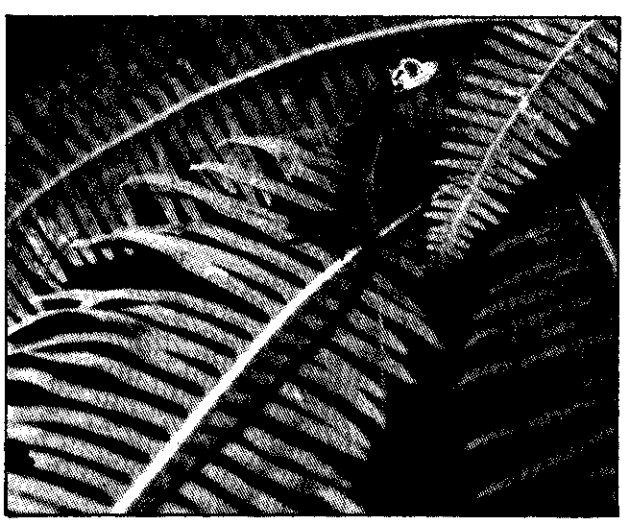
The Project Tiger, launched in 1973 has succeeded in stabilising and increasing the tiger population in the country.

The statement on 23 Tiger Reserves is tabulated in Table 15.

Table 15 : Tiger Reserves

Name	State	Area in Sq. km.
1. Bandipur	Karnataka	866.00
2. Corbett	Uttar Pradesh	1316.00
3. Kanha	Madhya Pradesh	1945.00
4. Manas	Assam	2840.00
5. Melghat	Maharashtra	1597.00
6. Palamau	Bihar	1026.00
7. Ranthambore	Rajasthan	1334.00
8. Simlipal	Orissa	2750.00
9. Sunderbans	West Bengal	2585.00
10. Periyar	Kerala	777.00
11. Sariska	Rajasthan	866.00
12. Buxa	West Bengal	759.00
13. Indiravati	Madhya Pradesh	2799.00
14. Nagarjunasagar	Andhra Pradesh	3568.00
15. Namdapha	Arunachal Pradesh	1985.00
16. Dudhwa	Uttar Pradesh	811.00
17. Kalakad Mundanthurai	Tamil Nadu	800.00
18. Valmiki	Bihar	840.00
19. Pench	Madhya Pradesh	758.00
20. Dampa	Mizoram	500.00
21. Panna	Madhya Pradesh	542.00
22. Bandhawgarh	Madhya Pradesh	1162.00
23. Taroba	Maharashtra	620.00
Total		33046.00



Project Elephant, launched in 1991-92 aims at ensuring long-term survival of viable population by restoring the lost and degraded habitats of elephant, mitigating man-elephant conflicts and establishment of a database on the migration and population dynamics of elephants. It integrates the concerns of improving the quality of life of people living around elephant habitats while maintaining viable population of elephants.

Rhinos have been given special attention in selected sanctuaries and national parks in the North-East and North-West India.

All these programmes, though focussed on a

single species, have a wider impact as they conserve habitats and a variety of other species in those habitats.

Several non-government organisations in the country are engaged in specific areas or target species based *in situ* conservation measures through external or national assistance or through a combination of assistance from both. An example is *in situ* conservation for medicinal plants by Foundation for Revitalisation of Local Health Traditions (FRLHT) in the southern states of the country. In addition, a large number of State Government organisations are engaged in developing strategies and undertaking *in-situ* conservation, for example, Tropical Botanic Garden and Research Institute (TBGRI) in Kerala.

4.3.2 Gaps

The current protected area network is unevenly distributed over States and biogeographic regions. For example, many biotic provinces are not adequately covered, Ladakh, South Deccan, Gangetic Plains, Assam hills, and Nicobar Islands have less than 1% of their total area under such protection, though these constitute some of the biodiversity rich areas of the country. The Wildlife Institute of India, based on a comprehensive review of the existing network argued for a need to identify new protected areas in different parts of the country. Many National Parks and Wildlife Sanctuaries are yet to complete legal procedures prescribed under the Wildlife (Protection) Act 1972 and in several areas, issues relating to settlement of rights are yet to be resolved. This impedes proper management of these areas, though steps are afoot to complete the process. Even the areas where legal measures have been completed, require consolidation and strengthening of efforts with a system of sharply focussed priorities. Formulation of management action plans needs to take these aspects into account. These projects are inadequate in essential equipment and professional staff and lack in maps and other requisite infrastructure base. Monitoring of activities and projects as a result is not upto the expectation.

As of now, attention in the protected areas is focussed on conservation of large mammals. Formally no attention is usually paid to conservation of plants in general and lower groups of plants and animals in particular. Very few protected areas undertake research activities, and where undertaken, such activities do not address the functional properties of ecosystems. Identification of indicator species which serve as early warning system of habitat changes is lacking. Consequently, there are gaps in information on several biological and managerial parameters.

In accordance with the present status of survey and data in the country, India has 26 centres of endemic species (Box 7). Barring three, all the other centres are not covered under any regulated measures. Only three centres fall within the protected areas.

Box 7 : Endemic centres of plants in India

1. Karakoram & Ladakh Kashmir Himalayas
2. Kumaon-Garhwal Himalayas
3. Siwaliks
4. Terai
5. Sikkim Himalaya
6. Arunachal Pradesh of Eastern Himalaya
7. Lushai hills
8. Tura-Khasi hills
9. Aravalli hills
10. Chotonagpur plateau
11. Panchmarhi-Satpura ranges
12. Simlipal & Jeypore hills
13. Baster & Korapur hills
14. Visakhapatnam hills & Araku Valley
15. Tirupati-Cuddappa hills
16. Marathwada hills
17. Saurashtra-Kutch
18. Mahabaleshwar-Khandala ranges of Western Ghats
19. Agumbe-Phonda ranges of Western Ghats
20. Ratnagiri & Kolaba ranges of Western Ghats
21. Nilgiris, Silent Valley & Wynad of Western Ghats
22. Anamalais of Western Ghats
23. Palni-Yercaud
24. Kalakad & Agastyamalai hills of Western Ghats
25. Andaman Islands
26. Great Nicobar Island

4.3.3 Action points

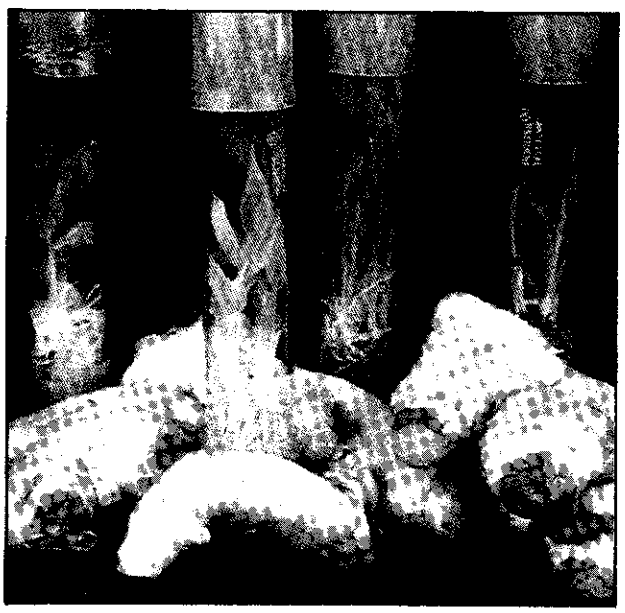
- Expand protected area network based on the recommendations of the Wildlife Institute of India, so as to cover all biogeographic zones of the country.
- Explore options for expanding/strengthening the network of protected areas through identification of buffer zones, corridors etc.

- Provide manpower, essential management tools, equipment, infrastructural facilities and requisite funds for ensuring effective management of protected areas.
- Expedite formulation of management plans for all protected areas based on survey of natural resources and socio-economic profiles in and around these areas.
- Develop and implement ecodevelopment projects adjacent to all the protected areas in

order to meet the demands of local people and also to involve them in conservation efforts.

- Establish self-sustaining monitoring system for overseeing the activities and effectiveness of the protected area network.
- Strengthen research programmes in protected areas, biosphere reserves and fragile ecosystems by involving local research institutions, college and universities, so as to develop baseline data on biological and managerial parameters, and functional properties of ecosystems.
- Device effective management and conservation techniques for the forest preservation plots to ensure conservation of representative areas of different forest types.
- Ensure conservation of biodiversity outside the protected area network, on private property, on common lands and water bodies.
- Ensure conservation of biodiversity rich areas which are prone to high risk of loss due to natural or biotic factors.
- Identify hot spots of agrobiodiversity under different agro-ecozones and cropping systems and strengthen research programmes for their conservation.
- Minimise and eliminate activities leading to loss of biodiversity, including habitat destruction, over-exploitation, pollution and introduction of exotics.
- Intensify measures for restoration of degraded habitats.
- Strengthen and reinforce impact assessment requirements and parameters for location of activities in or around biodiversity rich areas.
- Strengthen research programmes in designated areas for scientific management.
- Reintroduction and establishment of viable populations of threatened species.
- Intensify measures for restoration of degraded areas to meet demands of daily subsistence needs of local populations.

- Ensure that survey, collection and bioprospecting of biological resources is undertaken with minimal damage to the habitat.
- Provide incentives for *in situ* conservation whenever there is a threat of such conservation being endangered by other economically remunerative cultivars by people.
- Start mechanisms for inter-sectoral consultations to identify programmes and activities leading to habitat destruction and over exploitation of biological resources to design strategies of addressing these dangers.
- Initiate mechanisms for intersectoral consultations to understand the behaviour of exotic and alien species to understand their impact on habitats and biodiversity and to design strategies for safeguarding against adverse impacts.
- Reduce threats to biodiversity within protected areas arising out of inappropriate land use outside their boundaries.



4.4 *EX SITU* CONSERVATION

4.4.1 Current status

To complement *in situ* conservation, attention has been paid to *ex situ* conservation measures. According to currently available survey, Central Government and State Governments together run and manage 33 Botanical Gardens. Universities have their own botanic gardens. There are 275 zoos, deer parks, safari parks, aquaria etc. A Central Zoo Authority was set up by Government of India to secure better management of zoos. A scheme entitled Assistance to Botanic Gardens provides one-time assistance to botanic gardens to strengthen and institute measures for *ex situ* conservation of threatened and endangered species in their respective regions.

A great deal of attention has been paid to the genetic conservation of cultivated plants and domesticated animals. While zoological parks have been looked upon essentially as centres of education and recreation, they have played an important role in the conservation of species such as Manipur Thamin Deer and the White-winged wood duck. Notable examples of successful captive breeding are those of Gangetic gharial, crocodiles, turtles and white tiger.

Collection and preservation of genetic resources is done through the National Bureau of Plant Genetic Resources (NBPGR), New Delhi for wild relatives of crop plants, the National Bureau of Animal Genetic Resoruces (NBAGR), Karnal for domesticated animals; and the National Bureau of Fish Genetic Resources (NBFGR), Lucknow for economically valuable fish species. The Indian National Gene Bank of the NBPGR at present

comprises a seed repository holding nearly 1,45,000 accessions, a tissue culture repository maintains 800 accessions and 1,000 samples cryopreserved in liquid nitrogen. These Bureaus are assigned the task of collecting germplasm and maintaining germplasm banks, e.g., seed banks, field gene banks, etc. for short and medium term preservation. They also supply these on request to Indian and foreign agencies for research purposes only.

The Department of Biotechnology has initiated several important programmes of relevance to *ex situ* conservation such as germplasm facilities, tissue culture pilot plants, biocontrol agents, biofertilizers, clean technologies and bioinformatics.

Under the G-15 Gene Banks for Medicinal and Aromatic Plants (GEBMAP) initiative, three national gene banks have been established at Central Institute of Medicinal and Aromatic Plants (CIMAP) in Lucknow, NBPGR in Delhi and Tropical Botanic Garden and Research Institute (TBGRI) in Trivandrum.

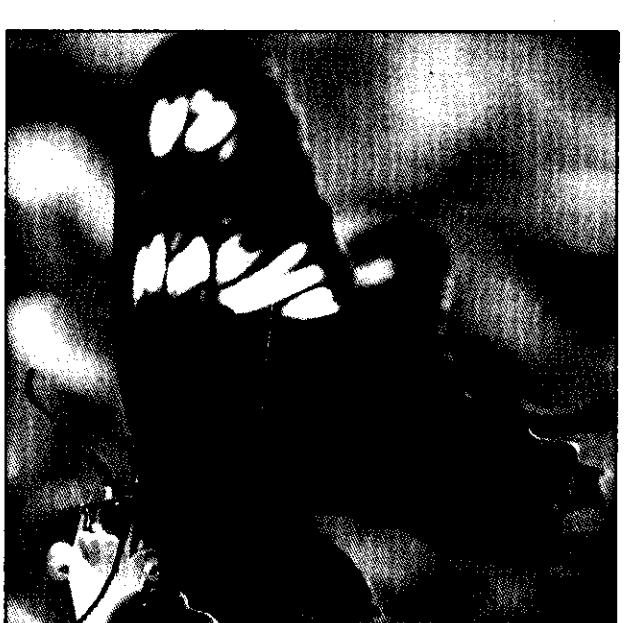
4.4.2 Gaps

In comparison to the large geographical area of the country, and its rich biological diversity in different biogeographic zones, *ex situ* conservation bases are less in extent. Some of these are inadequate in size and many do not have the requisite facilities to undertake conservation of threatened species. Moreover, many of these *ex situ* centres are involved in conservation activities in an implicit rather than an explicit manner, perhaps because their role is limited to recreation. Central Zoo Authority has been set up to oversee management of zoos, but there is no similar set up for botanic gardens.

Further, there is only one national botanic garden, the Indian Botanic Garden at Howrah. Considering the variety of phytogeographic regions, there is a need for setting up more such gardens in different regions. A National Botanic Garden for the Indo-Gangetic Plain region is being set up at NOIDA. Of late, botanic gardens are not attracting investments as priority area, because of a decline in the interest in taxonomy and biosystematics.

The current efforts of collecting and preserving the genetic resources in *ex situ* conditions are inadequate and are restricted mainly to improved high yielding varieties. Unfortunately, similar attention is not paid for conservation of traditional varieties/land races and breeds, particularly so in case of animals, many of which are therefore being replaced by hybrid breeds. Since these traditional varieties and breeds provide a valuable pool of genetic resources, it is necessary to conserve them.

Since a number of forest trees are commercially valuable either because of their timber or other minor produce *viz.*, gums, resins, soap nut, honey, 'imli', 'amla' etc., there is a need to identify and characterise the best or the elite varieties available which should be conserved on a priority basis.



4.4.3 Action points

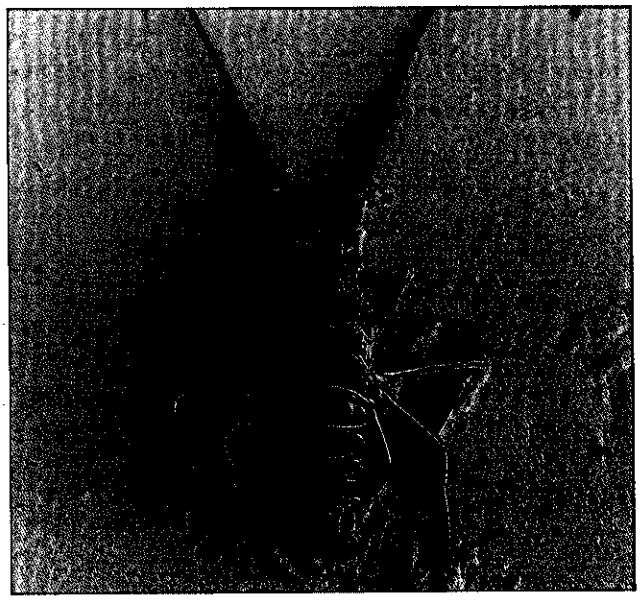
- Develop healthy linkages between *in situ* and *ex situ* conservation measures.
- Consolidate, augment and strengthen the network of *ex situ* centres of zoos, botanic gardens, herbaria, aquaria etc.
- Strengthen existing measures for conservation of crop and livestock diversity, giving special emphasis to conservation of traditional varieties and breeds.
- Accord priority to on-farm and on-orchard conservation programmes.
- Study feasibility of establishment of private zoological parks, botanic gardens and other *ex situ* facilites.
- Develop *ex situ* gene banks at field level as well as laboratory level.
- Encourage cultivation of plants of economic value and promote development of elite varieties of such plants.
- Undertake inter-sectoral studies to establish economic potential of *ex situ* conservation and design strategies for promoting such conservation.
- Explore possibilities of *ex situ* conservation in permafrost areas.
- As part of the national data base system, create a data base for *ex situ* collections/conservation.
- Establish a Central Authority for botanic gardens to secure their better management on the lines of Central Zoo Authority.
- Provide for training of personnel and mobilise financial resources to strengthen captive breeding programmes for endangered species of animals.

4.5 SUSTAINABLE USE OF BIOLOGICAL DIVERSITY

4.5.1 Current status

Sustainable use of biological diversity is emphasised in policy statements of the Government, notably the National Conservation Strategy and the Policy Statement on Environment & Development, the National Forest Policy, and the National Wildlife Action Plan. Several initiatives have been taken to implement various aspects of these policy statements. Sustainable utilisation underscored in these policy statements recognises the interdependence of local communities and people on biological resources, and emphasise the need to draw upon the existing resources keeping long term conservation in view. In accordance with appreciation of the needs and the local situations, pressure from biodiversity rich areas and resources is to be diverted by bringing additional areas under green cover to satisfy local demands, by encouraging environment friendly substitutes to meet the needs, by promoting energy-efficient devices, by creating awareness and an environment to restrict use and extraction of only desired part of component rather than the entire organism. Remedial actions for restoration of degraded areas have been undertaken through ecorestoration programmes by involving local people. Special attention has been given to coastal zone through Coastal Zone Regulation Rules, 1991 under Environment Protection Act.

To adopt economically effective and socially viable incentives for conservation and sustainable use of biological diversity, strategies such as use of items like wood substitutes, alternative energy sources (biogas, wind mills, solar cookers, wave energy, fuel efficient stoves, etc.), establishment of nurseries, tree planting , stall feeding, water harvesting, and pollution abatement measures are being implemented.



4.5.2 Gaps

Current efforts at promoting conservation and sustainable use notwithstanding, a need to further integrate the sustainable use concept in all the relevant economic sectors such as animal husbandry, fisheries, forestry, industry etc. still persists. Whether this need can be met through imposition of disincentives for non-sustainable use in these sectors or through some regulatory systems, is an issue which bears serious analysis and assessment. It appears that techniques of valuing biodiversity, however imperfect, need to be applied while preappraising project ideas. At present, medicinal plants and marine organisms are largely extracted from natural habitats for preparation of drugs and pharmaceutical products. There is an urgent need to develop packages of practices for cultivating farming the widely used medicinal plants and marine organisms, sponges, soft corals, horse shoe crabs etc. This would prevent rapid depletion of natural species and subsequent extinction from wild habitats.

India is rich in both coded and uncoded systems of practices and use of biological resources which mostly have scientific foundations. Often in a bid to have quick results and also satisfy the bulk

demand, scientific methods related to extraction and utilisation of resources are either deliberately ignored or neglected on account of ignorance. Ministries and Departments in-charge of scientific validation and popularisation of such knowledge systems have at best functioned somewhat patchily till now. Coordinated approach appears to be an immediate need.

4.5.3 Action points

- Secure integration of biodiversity concerns wherever needed into intersectoral policies and programmes to identify elements having adverse impact on biodiversity and design policy guidelines to address such issues and make valuation of biodiversity an integral part of preappraisal of projects and programmes to minimise adverse impacts on biodiversity.
- Promote sustainable use of biodiversity in sectors such as agriculture, animal husbandry, fisheries, forestry, industry etc.
- Initiate capacity building at grassroot level for participatory decision making to ensure eco-friendly and sustainable use of natural resources.
- Encourage/revise traditional sustainable uses of biodiversity and devise mechanisms for providing tangible benefits to local communities for their efforts.
- Study issues relating to utilisation of natural resources in representative areas to identify incentives and disincentives in conservation and sustainable use to promote strategies favourable to conservation and sustainable use of biodiversity.
- Encourage farming of medicinal plants and culture of marine organisms exploited for drugs to prevent their unsustainable extraction from the wild.
- Develop suitable mechanisms for protection of knowledge, and related rights including Intellectual Property Rights.

Initiate capacity - building for enhancing bio-relevance and biodiversity significance of resources management interventions in private and common property resources endowed with biodiversity potential.

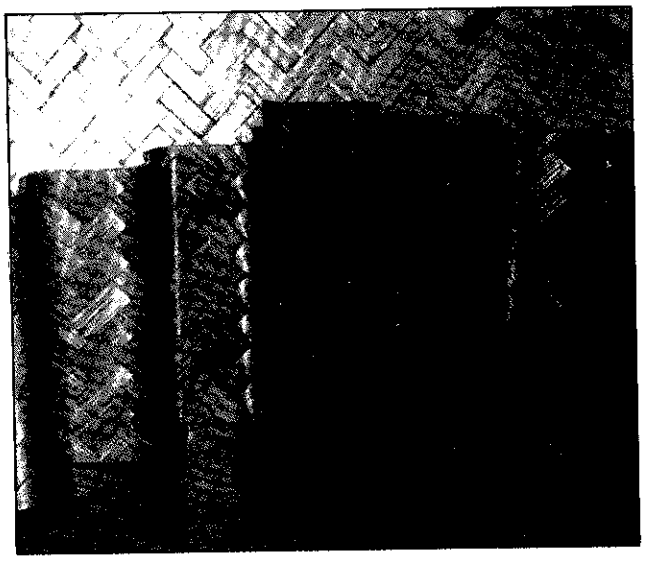
Facilitate revival of indigenous traditions of organic farming for various crops without endangering food production and productivity.

4.6 INDIGENOUS KNOWLEDGE SYSTEMS, PRACTICES, INNOVATIONS AND BENEFIT SHARING

4.6.1 Current Status

Indigenous knowledge systems are both coded and non-coded and are formal and informal. Coded systems include treaties on Ayurveda, Unani and Sidha systems of medicine and health care. There may be some lesser known descriptions of other uses in ancient texts. A wealth of information is non-coded which is in the form of local knowledge

systems and practices. That the potential of such local applications and practices both for the local people and for society in general, is substantial has been proved time and again by widely used products developed on their basis. These products may sometimes be limited to a region while others may cross regional boundaries and find usage all over the country. Development of products and processes beyond national boundaries has also been traced to the leads provided by these in quite a few cases already. The actual number of such products is difficult to guess at present for want of a system which obliges such users to disclose origin of resource information on usage etc. An integrated multidisciplinary and multi-institutional All India Coordinated Research Project on Ethnobiology initiated in 1982 by the Ministry of Environment and Forests, has documented uses of biological resources by ethnic communities in India. The documentation, as the name suggests, is only limited to ethnic or to use a more popular term, tribal communities. It does not include a vast wealth of other local uses and practices. The Wealth of India Series, a dictionary of Indian raw materials and industrial products covering plant species, animals and animal products and minerals brought out by the Council of Scientific and Industrial Research (CSIR), has included description of prevalent usage of various plants and other elements of bioresources amongst the local people. This series has a substantial documentation of local indigenous knowledge systems, innovations and practices. However, it does not identify the area or the people who are the creators and holders of such knowledge systems. Taxonomic descriptions and Flora and Fauna series published by Botanical Survey of India and Zoological Survey of India, respectively, also include information about locally prevalent uses, practices, etc. of the described species. These series also do not identify the holders and creators of such practices and knowledge systems. Dispersed efforts are currently afoot in various parts of the country to document such non-coded knowledge systems. Government agencies, non-government organisations and universities are currently doing such documentation.



4.6.2 Gaps

As already noted, local communities in general possess a wealth of information on the traditional uses of biological resources, much is still undocumented and hence, there is a threat of extinction through non-use on account of substitution effect of modern products or non-transfer of information to successive generations particularly if the information is held by an individual or a family. This traditional knoweldge has the potential of being translated into commercial benefits. This should however be accompanied with sharing of the benefit accruing from commercial utilisation of the local knowledge with the communities/people/individuals responsible for creating, refining and using this knowledge. What should be the nature of entitlements, and share in benefits to compensate these people for the use of their knowledge systems, innovations and practices is still a subject under review. Documentation of knowledge systems and practices and innovations has to be sensitive to the needs of protecting intellectual property rights (IPRs) of these people, even though the subject of such IRPs is not yet fully resolved.

4.6.3 Action Points

- Document traditional knowledge on conservation and upgrade sustainable use of biodiversity available with local communities keeping the sensitivity of intellectual property rights protection in mind. In this regard, examine the utility of community biodiversity registers.
- Engage and revive sustainable traditional and other folk uses of components of biodiversity and promote tangible benefits to local communities for conserving traditional knowledge and practices.
- Examine feasibility of a system which could provide protection to these knowledge systems so as to ensure benefits to the community.
- Create a documentation system of benefit sharing and practices for wider use.
- Create people's awareness about the need to conserve, protect and gainfully use these knowledge systems securing benefits, wherever due.
- Institute suitable mechanisms and systems to negotiate benefits on behalf of local people, communities, and/or create capability amongst local people to negotiate benefits for themselves.

4.7 PEOPLES PARTICIPATION

All the ecosystems described in Chapter 1 are subject to conjunctive use by the people. Hence, it is axiomatic that participation of people in issue related to these ecosystems is essential to ensure their conservation and sustainable utilisation. Practically, all the Ministries and Departments of the Government having programmes relating to use of air, land and water, have components of people's participation. Programmes aiming at rural development, infrastructure development in rural areas, drought prone area development, desert area development, hill areas development, flood prone area development etc., emphasise involvement of people in implementation to secure long term stake building of the people in such programmes. The National Forest Policy (1988) formally initiated a new approach in the management of forests by involving people in planning afforestation and management of degraded forest areas. The policy has subsequently been implemented through Joint Forest Management (JFM) concept. States of the country have evolved their respective parameters for securing Joint Forest Management through joint committees of Government officials and local people. The 73rd and 74th Amendments to the Constitution of India have legally broadened the pace for people's participation decentralising management and control for various programmes pertaining to management and use of local resources to the local bodies.

Informed decisions on the part of the people in the use of various elements which directly impinge upon biodiversity *per se* is an essential ingredient of a meaningful participation of people in conservation and sustainable utilisation of biodiversity. Such informed decisions would include considerations such as long term impacts of such

uses on soil microbial biodiversity and soil nutrients, harvesting of components of coastal and marine biodiversity, fish and other marine resources, forest

resources with sensitivity to long term sustainability of such utilisation, as well as other biodiversity. People use components of biodiversity and the elements of the environment, namely, air, land and water for earning livelihoods and for various other purposes. Aquaculture, agriculture, animal husbandry, forestry operations, some of the major areas of economic activities for people at large, directly depend on use of biodiversity. A large number of people act as individual decision makers in these sectors. Often their decisions lack sensitivity towards short-term and long-term impacts of their decisions on ecological parameters and components of biodiversity. For example, impacts of agricultural and other land use decisions on soil microbial biodiversity and soil nutrients hardly ever form part of the consideration. Consequently, damage to biodiversity at all the three levels, namely, genetic level, species level and ecosystem level takes place.

People's participation profile under the biodiversity action plan, therefore, needs to include participation of people in decision making, management and utilisation at both the levels — at the level of private individual oriented activities and at the level of public or government promoted activities.

Not many documented examples of benefit sharing with the communities are as yet available. One recent example has been that of the Tropical Botanical Garden and Research Institute (TBGRI). The Institute has developed a model for sharing of benefits accruing from use of indigenous knowledge with the holders of this knowledge. Seeds of a herb *Trichhopus zeylanicus* growing in Agastyamalai region were found to be used by Kani tribe living in and around the region as an antifatigue and restorative agent. Based upon this information, TBGRI developed a drug 'Jeevni' from this plant and 2-3 other plants in combination. This steroid-free drug has been tested and found to be comparable to Korean ginseng. The technique for drug manufacture was transferred to a private firm.

Coimbatore Ayurveda Pharmacy, following CSIR norms of technology transfer. 50% of the license fee received and 2% of the royalties on sale will go to the Kani tribal community through Tribal Welfare Department of the State Government.

4.7.1 Action Points

- Strengthen participatory appraisal techniques to promote biomass production by urban local bodies, to reduce biomass pressures on rural common property resources, within the framework of Panchayati Raj Institutions.

- Strengthen participatory rural appraisal techniques and encourage formation of local institutional structures for planning and management of natural resources ensuring participation of women.

- Strengthen community land management system and institute systems for ensuring suitable access to community property resources.

- Recognise and integrate traditional knowledge and practices into biodiversity conservation and management of common property resources.

- Devise methods (e.g., the agricultural extension network) for the speedy effective transmission of relevant technical knowledge and information.

- Devise ways and means to meet the subsistence needs of local people by activities such as :

- promoting fodder production on village wastelands and developing fuelwood plantations

- Introducing fuelwood saving devices (e.g. for economic fuel consumption & smokeless stoves)

- promoting use of non-convention sources of energy (e.g., biogas, solar, wind)

- increasing sustainable access to fuelwood through joint forest activities

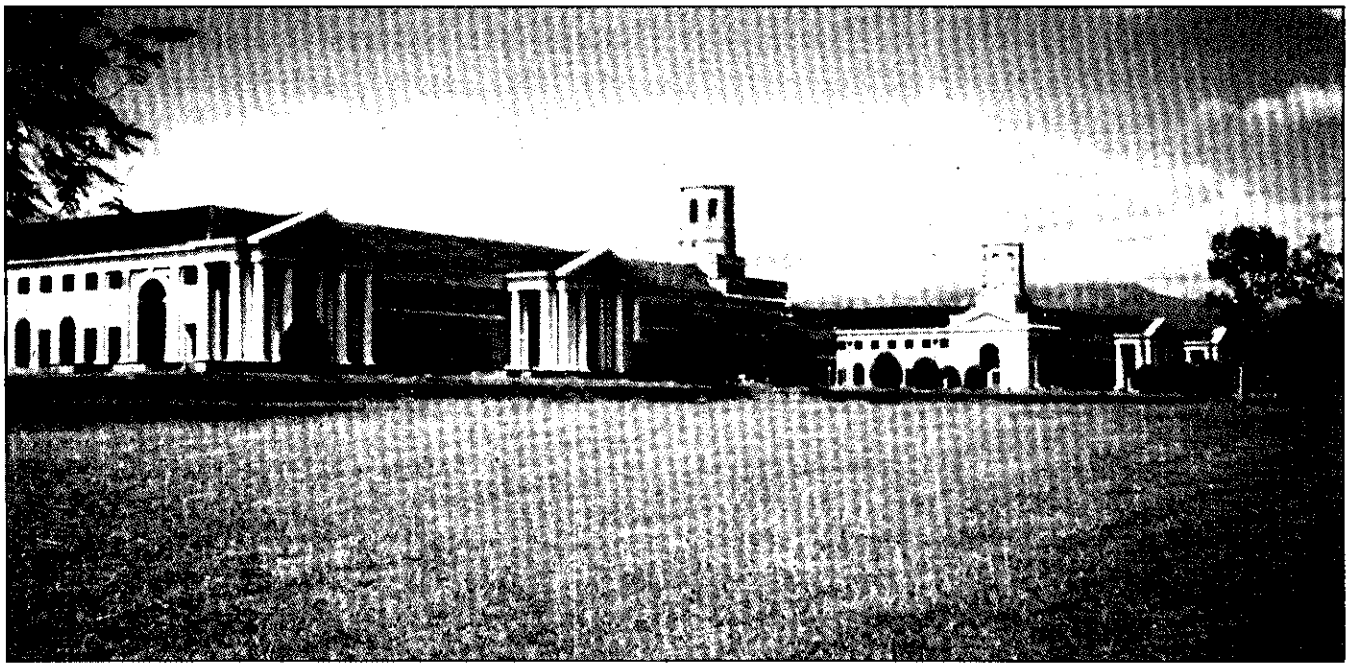
- providing small scale irrigation schemes

- encouraging use of biofertilisers and biopesticides etc. for increasing agricultural productivity

- introducing crop protection measures (e.g., electric fencing)

- Preserve and strengthen traditional, religious, ethical and cultural methods of conservation (e.g., sacred groves, worshipping plants and animals).

- Create and involve communities in field lab situations to upgrade and value add to their knowledge and technologies.



4.8 INSTITUTIONAL FRAMEWORK

4.8.1 Current status

At the Central Government level, Ministry of Environment & Forests is the focal point for implementation of the Convention on Biological Diversity as well as the nodal Ministry for all environment and forest related matters.

The main activities of the Ministry include conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas and protection of environment.

The Ministry of Agriculture is responsible for conservation of domesticated biodiversity, fishery resources, protection of forests through control of shifting cultivation, soil conservation and watershed management. The Department of Science and Technology is concerned with the technology for environment protection. The responsibility of regeneration of biomass outside recorded forest areas lies with the Ministry of Rural Development. The matters related to energy conservation and development of alternative sources are dealt with by the Ministry of Power, Ministry of Industry and Ministry of Non-Conventional Energy Sources. The monitoring of water quality and the environmental impact assessment for water resource projects is the responsibility of Ministry of Water Resources. The Ministry of Urban Development is concerned with solid waste collection and disposal in urban areas. While the trade related aspects of biological resources (e.g. TRIPS in the WTO) are being dealt with by the Ministry of Commerce, the patent act and other IPRs are the concern of the Department of Industrial Development and Policy.

A large number of institutions, which are affiliated with some of these Ministries/ Departments, are involved in the work related to various aspects of biological diversity.

At the provincial level, all the States and the Union Territories have departments looking after environment and forests, collectively or singly. In

addition, most of the States have State Pollution Control Board, State Wildlife Advisory Board, State Committee on Biosphere Reserves etc. Some of the States also have specialised institutes, e.g., the Kerala Forest Research Institute and the Tropical Botanic Garden and Research Institute in Kerala; the Environmental Protection and Coordination Agency in Madhya Pradesh, and Gujarat Ecology Commission in Gujarat.

A number of professional academic bodies in the country have been contributing actively through research and training on biodiversity related aspects.

Many non-government organisations (NGOs) and voluntary agencies in India play an active role mainly for raising public awareness of the importance and threats to the biological wealth of the country. Some of the NGOs, however, are also active in research, monitoring and public information.

4.8.2 Gaps

Institutional structures include administrative, legal and financial mechanisms and systems. While some of these have been discussed elsewhere under respective subject heads, it is necessary to take note of these systems here to have a total picture of the institutional system. Mandates and activity profiles of existing institutes such as Indian Council of Forestry Research and Education, Wildlife Institute of India, National Bureau of Plant Genetic Resources, National Bureau of Animal Genetic Resources, National Bureau of Fish Genetic Resources, Botanical Survey of India and Zoological Survey of India need to be continuously reviewed and revised to include adequate coverage of biodiversity concerns and issues.

A study of ecosystems such as grasslands and deserts, with a view to find suitable administrative, legislative and policy instruments in accordance with need requirements, need to be undertaken, as these ecosystems have as yet not received adequate attention and coverage.

Sensitivity to conservation issues and decision making has been absent or insufficient as a result of non-accounting of intrinsic value of biodiversity and non-visibility of serious damage caused to ecosystems and ecological balance in the immediate and the long run.

Human resource development for scientific management of biodiversity has suffered because

of inadequate infrastructure for research and development, the shortage of organisations capable of imparting technical skills at the local and regional levels, the limitations of education and public awareness through formal and non-formal means, and insufficient training for policy makers, administrators, trainers, educators, students, local self-government authorities and grassroot level workers. Some of these issues have been discussed under respective captions of Research and Development, Survey etc.

On the fiscal front, the task of incorporating biodiversity concerns in development projects requires much larger levels of financial investments. Considering the limited public investments currently made available for biodiversity, there is a need to attract private and external sources of financing. The inadequacy of funding and the lack of a variety of fiscal instruments further compound the problems arising from deficiencies of skilled human resources and organisations and inadequacy of environmental education network.

4.8.3 Action points

- Strengthen BSI and ZSI to augment their capabilities, including manpower and support training of personnel in identified areas where (a) no expertise is available (b) inadequate expertise is available so as to intensify surveys, inventorisation and monitoring.

- Strengthen the three Bureaus of ICAR (NBPGR, NBAGR and NBFGR) in respect of infrastructure and manpower so as to enlarge and expand their domain of activities covering other domesticated plants and animals as well and augment research to bring additional species for potential culture. Strengthen the existing Centres of Excellence in environment for undertaking biodiversity related work, e.g., documentation of traditional knowledge, traditional conservation and use practices etc.

- Expand the network of botanical gardens and zoological parks, to represent all the biogeographic regions, and to improve the facilities of the existing gardens and parks to undertake research with adequate manpower, library and laboratory facilities.

- Encourage decentralised micro-level planning under "Panchayat Raj" system for conservation of natural resources including biodiversity as envisaged in 73rd and 74th amendments of the Constitution.

- Initiate actions to reorient all natural resources use and development policies, including agriculture, industry, forestry, fisheries, mining etc. to integrate biodiversity concerns.

- Promote intersectoral and interdepartmental coordination and cooperation to ensure that activities undertaken by different sectors and departments are mutually supportive to the cause of biodiversity conservation and sustainable use.
- Evolve suitable mechanisms to coordinate activities related to conservation, agriculture, animal husbandry, forestry, fisheries, wildlife etc.
- Capacity-building programmes for local communities be initiated in the areas of natural resources mapping to facilitate formulation of locally designed biodiversity conservation plan.
- Ensure active support of public and private sectors for conservation and sustainable use of biodiversity.
- Develop a system of natural resource accounting reflecting the ecological as well as economic values of biodiversity.
- Devise measures for generating resources, such as a cess on industrial uses of biodiversity, collection of fees, royalties etc. for conservation and sustainable use of biodiversity based on critical analysis of the issues involved, and explore the possibility of creating a Biodiversity Fund for this purpose.
- Develop in-house monitoring for biodiversity programmes starting from village/block level local bodies, District level, State and Central Governments. In addition, encourage ex-house monitoring through independent agencies.
- Assess the utility of traditional fiscal instruments like seigniorage rates, grazing fees from the view point of sustainable utilisation of biodiversity.
- Depending upon the feasibility of study, develop systems to return a part of the revenues generated in protected areas, zoological parks, botanical gardens, aquaria etc. for improving their management to conserve biodiversity.
- Earmark at least 1% of State and Central Government resources for biodiversity and to enhance these allocations from time to time.
- Factoring the element of biodiversity conservation while considering extending fiscal concessions including taxes, cesses and charges to natural resources using sectors on the economy.
- Review and revise regulations that govern the ownership, access and management of natural resources.

4.9 EDUCATION, TRAINING AND EXTENSION

4.9.1 Current status

Education training and extension has so far received attention on general environmental issues including conservation issues. Conservation and sustainable utilisation of biodiversity has an integrated comprehensive theme for these three activities, though related issues have been covered in the past. Hence, the need to look at the on-going education, training and extension programmes profile to incorporate assigned directed focus to conservation of biodiversity and sustainable utilisation of its components.

The Ministry of Environment & Forests interacts actively with the University Grants Commission (UGC), National Council of Education, Research & Training (NCERT) and the Ministry of Human Resources Development (MHRD) for introducing and expanding environmental concepts, themes, issues etc. in the curricula of schools and colleges.

In order to generate awareness regarding the need to conserve and sustainably utilise biological

resources, the communication media such as TV, Radio and Press are being utilised. The education system, both formal and non-formal, is also mobilised to this end.

For education, awareness, research and extension development on forestry issues, the Indian Council of Forestry Research and Education (ICFRE), which is an autonomous institution of the Ministry, is the focal point. The major areas of ICFRE's forestry extension programmes includes transfer of technology, creation of public awareness, extension of technical support to State Forest Departments, NGOs etc. These activities are undertaken through organisation of short term courses and seminars, publication of brochures, books and pamphlets, production of films and other audio-visual programmes, adoption of villages for developing social forestry and agro-forestry models and transfer of technology from the laboratory to field.

The Forest Research Institute (FRI) is a deemed University for imparting education and creating awareness on various aspects of environment and forestry. The Indian Institute of Forest Management (IIFM) is another autonomous body of the Ministry for imparting education and training in forest management. The Wildlife Institute of India (WII) imparts training on wildlife management through organisation of short term courses, seminars and workshops.

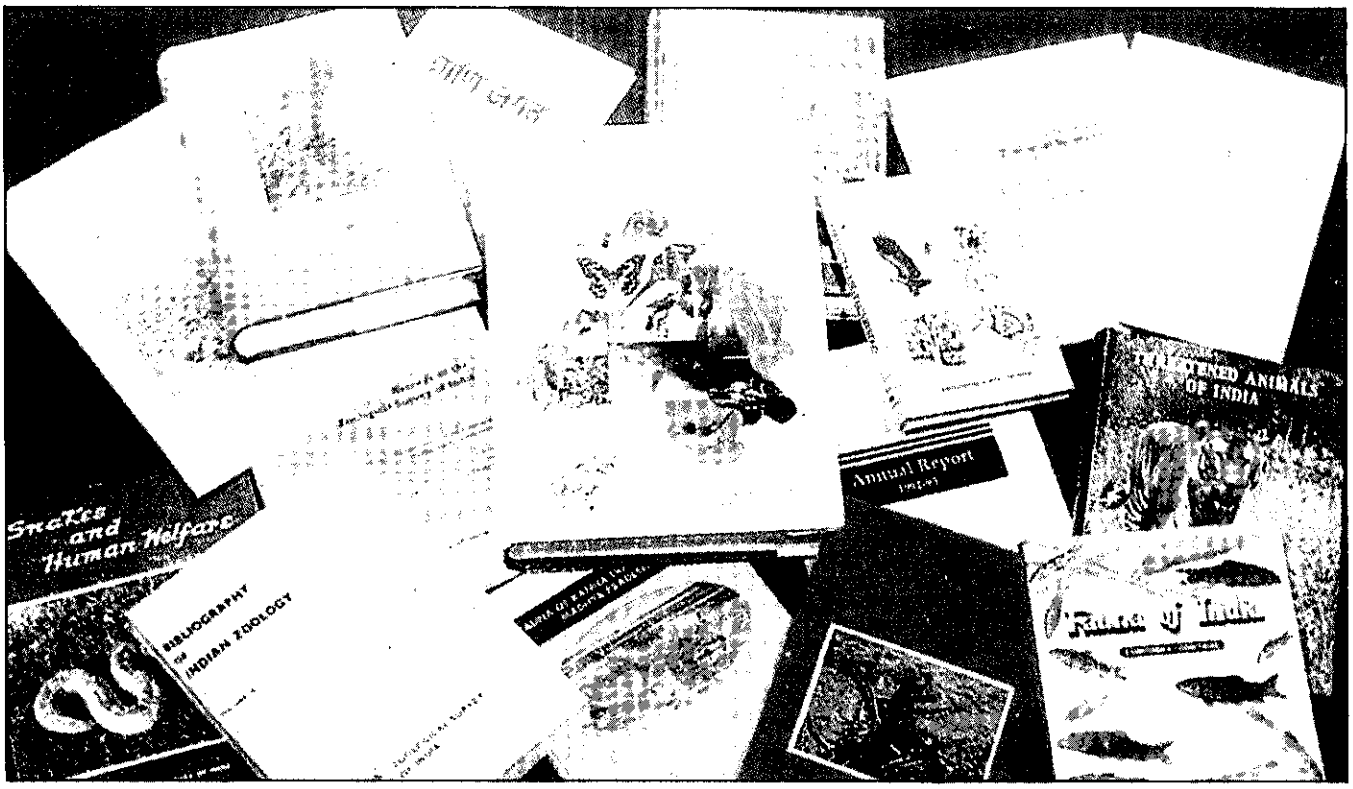
The Botanical Survey of India conducts short term courses on field survey, herbarium methodology and Flora writing at its Southern Circle office in Coimbatore. The Survey also provides resource persons for training teachers and other members of Eco-clubs and participants in ecodevelopment programme.

The Zoological Survey of India conducts training programme in the areas of (i) Environmental Education and Wildlife Conservation (ii) Ornithology (iii) Parataxonomy (iv) Identification

of Insects and Mites (v) Community Biodiversity — all contributing to the conservation of biodiversity and largely catering to the needs of NGOs. It has also biannual programme for training on EIA specially for ecological impacts. ZSI actively collaborates with WWF-India and CEE in teachers' training programme and provides resource persons for training programmes organised by NGOs. ZSI has also signed a MOU with SACEP to assist seven South Asian countries in assessing faunal diversity in each country.

The Centre for Environment Education, Ahmedabad and CPR Environment Education Centre, Chennai, the Centres of Excellence supported by the Ministry, organise activities aimed at creating environmental awareness among all sections of the society, especially the students and the teachers. These Centres are also fully involved in the activities of the UGC, MHRD and NCERT related to formal environmental education.

The National Museum of Natural History (NMNH) is devoted to environmental education and creation of conservation awareness among the public through exhibit galleries, mobile museum, discovery room, and various other activities. CEE is working as a nodal point for Environmental Education for South Asia as a partner with SACEP.



On non-formal education and awareness, the National Environment Awareness Campaigns are organised annually, under which NGOs, schools, colleges, research institutions, women and youth organisations are supported to organise a variety of activites aimed at creating awareness on environmental issues among different target groups.

Target groups for education, training and extension include students, public at large, teachers, functionaries of the Government in various sectoral departments, and funtionaries of the Government directly involved in programmes of conservation, management and utilisation of biodiversity. Students and teachers are two of the important target groups.

4.9.2 Gaps

Since a number of organisations/agencies are working on various aspects of biodiversity, the information on the subject is scattered. The different sectoral networks could therefore be linked to establish a nationwide information system with a uniform format for collection, retrieval and dissemination of data. The current efforts for environmental education and awareness should be strengthened to highlight the importance of conservation and sustainable use of biodiversity. Keeping in view the need for more specialists on specific aspects of biodiversity, the university and professional curricula have to be suitably reoriented, and the university departments have to be accordingly strengthened. School teachers and students could be effectively involved for documenting local biodiversity and traditional conservation practices. For generating public awareness, the audio, visual and the print media could be more effectively used. The use of other means such as posters, playcards etc. in public places, special publicity boards at main roads leading to Sanctuaries, National Parks, Botanical Gardens, Zoological Parks, Natural Landscapes, World Heritage Sites etc. can also be explored. There is a

need not only to strength the inservice training and orientation courses for personnel engaged in conservation programmes, but also develop special orientation programmes for politicians, lawyers, judges, economists, custom officials etc.

4.9.3 Action points

- Promote through both formal and non-formal means of environment education, the importance of conservation and sustainable use of biodiversity.
- Develop and include in the primary and secondary school curricula and undergraduate college curricula the importance of and the need for conserving biodiversity.
- Produce field guides and identification keys in Hindi, English as well as in regional languages to facilitate identification and conservation of key groups of plants and animals.
- Design and implement awareness programmes particularly for rural women, and also absorb their wisdom; women's organisations such as Women's Council and Mahila Mandals could be used for this purpose.
- Biodiversity conservation theme be suitably incorporated in school and college curricula and in relevant disciplines at higher levels.
- Incorporate a module on conservation and sustainable utilisation of biodiversity in foundational and professional training in All India Services, State Services and other services.
- Design mechanism of transferring technological packages developed by institutions such as Indian Council of Forestry Research and Education, Wildlife Institute of India, National Bureau of Plant Genetic Resources etc. to people at large.
- Commission an All India Coordinated Project on Taxonomy to fill up the gap areas.

- Develop training programmes for sustainable use of bioresources at village level.
- Carry out awareness programmes amongst Panchayati Raj Institution functionaries on the objectives, scope and obligations arising from the Convention on Biological Diversity.
- Develop mechanisms for training in parataxonomy involving local communities and NGOs.
- Create Chairs in Taxonomy in universities, institutions etc.
- Develop special orientation programmes for