10 Biodiversity

Introduction

This chapter examines various initiatives in the area of biodiversity conservation to analyse how the country has performed against the objectives set out in Agenda 21. After a detailed discussion of biodiversity in India, the chapter presents main Agenda 21 concerns with respect to biodiversity conservation. This is followed by highlights of policy and other initiatives in India, which are analyzed to bring out achievements and concerns vis-à-vis Agenda 21 objectives. Finally, directions and strategies are proposed that would contribute to the efficient management and conservation of biodiversity including its rich genetic, species and ecosystem diversity.

Overview of biodiversity in India

India has a rich and varied heritage of biodiversity covering ten biogeographical zones, the trans-Himalayan, the Himalayan, the Indian desert, the semi-arid zone(s), the Western Ghats, the Deccan Peninsula, the Gangetic Plain, North-East India, and the islands and coasts (Rodgers; Panwar and Mathur, 2000). Biodiversity, which is defined as the variety and variability among living organisms and the ecological complexes in which they occur, is measured at three levels — the gene, the species, and the ecosystem. India is rich at all levels of biodiversity and is one of the 12 megadiversity countries in the world.

India's wide range of climatic and topographical features has resulted in a high level of ecosystem diversity encompassing forests, wetlands, grasslands, deserts, coastal and marine ecosystems, each with a unique assemblage of species. The forests cover an actual area of 63.73 million ha (19.39%) and consist of 37.74 million ha of dense forests, 25.51 million ha of open forests and 0.487 million ha of mangroves, apart from 5.19 million ha of scrub, comprise 16 major forest groups. These range from the tropical wet evergreen forests in the northeast to the sub-alpine and alpine forests of the Himalayas through the tropical dry deciduous and tropical thorn forests of Central and Western India. India has five distinct types of grasslands, the *Sehima-Dicanthium, Dicanthium-Cenchrus-Lasiurus*, the *Phragmites-Saccharum-Imperata*, the *Themeda-Arundinella*

and the temperate-alpine types, and account for a species diversity of about 1256 belonging to 245 genera (MoEF, 1999).

Wetlands include a rich diversity of inland and coastal wetland habitats covering 4.1 million ha of the landmass. A number of rare and threatened species of plants and animals including *Aldrovanda vesiculosa, Utricularia minor, Cervus eldii eldii (Manipur brow-antlered deer), Cervus duvaucelli (swamp deer),* and *Lepidochelys olivacea (Olive Ridley turtle)* are associated with wetland habitats. The coastline of India extends over 7,500 km while the marine ecosystems cover 2.1 million sq. km (MoEF, 1999). The under-explored marine world contributes 15% of the total faunal biodiversity of the country. India has some of the most unique mangrove swamps in the world, in the alluvial deltas of the Ganga, Mahanadi, Godavari, Krishna and Cauvery rivers and the Andaman and Nicobar islands, while coral reefs, considered the most productive marine ecosystems, occur in the Andaman and Nicobar islands, Lakshwadeep, and the Gulfs of Kutch and Mannar.

Deserts cover 2% of the Indian landmass and include the sandy Thar desert of Western Rajasthan and adjoining states, the salt desert of Kutch and the high altitude cold deserts of Jammu and Kashmir and Himachal Pradesh.

Surveys conducted so far in India have inventoried over 47,000 species of plants and over 89,000 species of animals over just 70% of the country's total area (MoEF, 1999). India's biogeographical location at the junction of the Agro-tropical, Indo-Malayan and Paleo-Arctic realms has contributed to the biological richness of the country. Amongst plants, significant diversity has been recorded in Pteridophytes with 1022 species, and Orchidaceae with 1082 species. A total of 89,451 animal species has been recorded in India accounting for 7.31% of the faunal species in the world (MoEF, 1999). The endemism of Indian biodiversity is high—about 33% of the country's recorded flora is endemic to the country and is concentrated mainly in the North-East, Western Ghats, North-West Himalaya and the Andaman and Nicobar islands. About 62% of the known amphibian species and 50% of the lizards are endemic to India, the majority occurring in the Western Ghats (MoEF, 1999).

The country is bestowed with immense agro-biodiversity and a rich diversity in landraces / traditional cultivars / farmers' varieties. A number of crop plants (384) are reported to be cultivated in India. This includes 168 species earlier reported under the Hindustani centre, one of the eight Vavilovian centres of origin and diversity. India has 326 species of wild relatives of crop plants. A total of 49 indigenous major and minor crops have been reported in the 'History of Agriculture in India', which include 5 cereals and minor millets, 4 pulses, 1

oilseed crop, 9 vegetables, 5 tuber crops, 11 fruits, 5 spices, 1 sugar yielding plant and 7 fibre crops. India is the centre of origin of 30,000-50,000 varieties of cultivated plants including rice, pigeonpea, mango, okra, bamboo, etc.

The National Bureau of Plant Genetic Resources has over 1,59,080 varieties and 1,07,018 germplasm collections. Much of the country's agrobiodiversity is in the custody of farming communities / tribals who followed age-old farming systems. Genetic diversity comprising native species and landraces is concentrated in the areas of the Western Ghats, northeastern Himalayas, southern plateau, central India and northwestern Himalayas. Wild relatives of wheat and barley are located in the Western and North-eastern Himalaya while a major centre for wild rice is the Eastern-Peninsular India. Domesticated livestock and poultry include 27 breeds of cattle, 8 breeds of buffalo, over 42 breeds of sheep, 20 breeds of goats, 7 breeds of camel, 8 breeds of horses, and a few types of pigs. Of about 20,000 species comprising the fish genetic resources of the world, nearly 11 per cent (or 2118 fish species) have been reported in India, including the finfishes from the Western and Eastern Ghats (MoEF, 2001).

This immense diversity has resulted in the inclusion of two Indian regions in the 25 global biodiversity hotspots. These 2 hotspots, the Western Ghats / Sri Lanka and the Indo-Burma region (covering the Eastern Himalayas) encompassing parts of India and adjoining countries are amongst the top eight most important hotspots (Myers, Mittermeier, Mittermeier et al., 2000). As many as 14 ecoregions lying completely or in part within India figure amongst the Global 200, which are outstanding examples of the world's diverse ecosystems based on criteria such as species richness, species endemism, unique higher taxa, unusual ecological or evolutionary phenomena, and global rarity of major habitat types. The Indian ecoregions are the Chhota-Nagpur Dry Forests, Eastern Deccan Plateau Moist Forests, Eastern Himalayan Alpine Meadows, Eastern Himalayan Broadleaf and Conifer Forests, Indus river delta, Maldives, Chagos, Lakshwadeep Atolls, NagaManipuri-Chin Hills Moist Forests, Rann of Kutch Flooded Grasslands, Southwestern Ghats Moist Forests, Sunderbans Mangroves, Terai-Duar Savannas and Grasslands, Tibetan Plateau Steppe, Western Ghats Rivers and Streams, Western Himalayan Temperate Forests (Olson and Dinerstein 1998). India accounts for 6% of the total number of ecoregions.

This biological diversity is reflected in the cultural diversity of the people whose very existence is tied to the continued maintenance and sustainable use of biological resources. India has a rich ethos of biodiversity conservation and traditional knowledge systems and it is these practices that have given rise to

informal and localized in situ conservation. Traditional farming practices are directly responsible for the country's treasure trove of agro-diversity. This respect for nature continues today, and the government has institutionalized biodiversity conservation by undertaking several activities for its conservation and sustainable use.

Article 48-A and Article 51-A (G) of the Directive Principles of State Policy in the Constitution of India state that 'the State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife in the country', and 'to protect and improve the national environment including forests, lakes, rivers and wildlife, and to have compassion for the living creatures'. A focussed articulation of these concerns in programmes and policies was intensified after the 1992 Rio Summit and India's becoming a party to the Convention on Biological Diversity (CBD). The CBD has three main thrust areas: conservation of biodiversity, sustainable use of biological resources, and equitable sharing of benefits arising from its sustainable use. The CBD offers opportunities to India to realise benefits from its rich biological resources and associated traditional knowledge (MoEF, 2001).

Despite the many measures taken for the protection, conservation and sustainable use of biodiversity, many species and ecosystems are seriously threatened. The 2000 IUCN Red List of Threatened Species (IUCN, 2000) is provided in Tables 10.1 and 10.2.

Table 10.1 Threatened species of India

Taxonomic group	Number of threatened species
Mammals	86
Birds	70
Reptiles	25
Amphibians	3
Fish	3
Molluscs	2
Other Invertebrates	21
Plants	244
Total	459

Source. IUCN (2000). Red list of threatened animals. IUCN. Gland, Switzerland

Table 10.2 Threatened plants and animals of India by status category

	Ex	EW	CR	EN	VU	LR/cd	LR/nt	DD
Plants	7	2	44	113	87	1	72	14
Animals	0	0	18	54	143	10	99	31

Legend. EX-extinct; EW-Extinct in the Wild; CR- Critically Endangered; VU-Vulnerable; LR/cd-Lower risk conservation dependent; LR/NT
Source. IUCN (2000), Red list of threatened animals. IUCN. Gland, Switzerland

Biodiversity and Agenda 21

The broad vision for biodiversity in Agenda 21 is its conservation and sustainable use accompanied by equitable benefit sharing mechanisms. This includes a focus on enhancing national biodiversity protection measures involving the development of national strategies; mainstreaming of biodiversity concerns; ensuring the fair and equitable sharing of the benefits accruing from biodiversity; country-wide studies on biodiversity; fostering traditional methods and indigenous knowledge; encouraging biotechnological innovations along with the equitable sharing of their benefits and promoting regional and international cooperation. It also called for reinforcing at the national and international level, capacities for the assessment, study, and systematic observation and evaluation of biodiversity.

The above objectives of Agenda 21 are to be achieved through 3 broad activity areas:

- Management issues dealing with the development of national level institutions, strategies, legislation, policies, plans and programmes for the conservation and sustainable use of biological diversity; measures to encourage a greater understanding and appreciation of the value of biological diversity; and environmental impact assessments;
- Data and information needs, i.e. research, data collection, inventories and the networking and sharing of information through various means, and;
- International and regional cooperation and coordination for strengthening communication, technical and scientific collaboration and promoting co-operation between parties to relevant conventions.

The means of implementation for the above activities focus on financing mechanisms, scientific and technological means, human resource development, capacity-building and partnerships with the local community.

Review and analysis of initiatives for biodiversity conservation in India

Highlights of major initiatives for biodiversity conservation

Various conservation, wise-use and resource management initiatives have been taken over millenia dating back to people's earliest associations with nature. Since the forests and other natural resources served people in a myriad ways, providing them with medicinal plants, food, fuel and fodder, a body of local taboos, practices and folklore grew up around the forest and wildlife. This led to the creation of sacred forests, trees and tanks as well as the imbuing of several species of wildlife with supernatural powers or the advent of wise-use practices and management mechanisms. The earliest codified law on wildlife protection traces back to the third century BC when King Ashoka made a law in the matter of preservation of wild life and environment where he prohibited the killing of certain species of animals such as the parakeet, rhinoceros etc.

In modern times too, India has been at the forefront of biodiversity conservation and over the years the country has set in place several institutions and measures for the conservation and sustainable use of biodiversity. Numerous actions were taken long before the Earth Summit was even envisaged. These activities are highlighted vis-a-vis the objectives of Agenda 21 in Table 10.3.

Table 10.3 Highlights of major initiatives for biodiversity conservation

Year	Initiative	Scope
1.Legislative and regulatory measures		
1927	Indian Forest Act	Colonial legislation for state ownership of forest resources and to facilitate trade and timber
1972 and amended in 1991	Wildlife (Protection) Act	To protect wild animals, birds and plants including their habitat

1976	42nd amendment of the constitution of India	Article 48a under the Directive Principles of State Policy and Article 51A (g) of the fundamental duties in the Constitution mention that the “State shall endeavour to protect and improve the environment and safeguard forests and wildlife in the country and protect and improve the natural environment including forests, lakes, rivers, wildlife and have compassion for living creatures
1980	Forest (Conservation) Act	Control diversion of forest land for non-forest purposes
1986	Environment (Protection) Act	Legislation for environmental protection

Year	Initiative	Scope
1989	Manufacture, Use, Import, Export and Storage or Hazardous Micro organisms and Genetically Engineered Organism or Cell Rules, 1989	To regulate the storage, use, trade, transport and disposal of hazardous wastes
1991	Coastal Regulation Zones	Notification issued under the Environment (Protection) Act, 1986 for the protection of coastal areas
1994	Environmental Impact Assessment notification	Issued under the Environment (Protection) Act 1986 making EIAs mandatory for 30 sectors

1997	Amendment of the EIA notification	The notification specifies the importance of conserving certain ecologically important and sensitive areas such as National Parks, Sanctuaries, Tiger Reserves and Reserve Forests. it mandates clearance for any project located within the radius of 25 kilometres of the boundary of Reserve Forests, ecologically sensitive areas including National Parks, Sanctuaries and Biosphere Reserves.
Subsequent notifications for fragile areas	Regulatory notifications for fragile areas under the Environment (Protection) Act, e.g. Dahanu taluka, Doon valley Aravalli range, etc.	In addition to the EIA requirements, specific prohibitions and regulations operate in designated ecologically sensitive areas
1996	Panchayats (extension to the Scheduled areas) act, 1996	An Act to provide for the extension of the provisions of Part IX of the Constitution relating to the Panchayats to the Scheduled Areas and which devolved natural resource management with the Panchayats. The Panchayats are empowered to legislate on matters specified in the Eleventh Schedule. The items that relate to biodiversity include land improvement, soil conservation, watershed development, social forestry, farm forestry, minor forest produce, fuel fodder etc. The Panchayat Act regulates the right to minor forest produce, management of water bodies etc.

2000	Biodiversity bill	Proposed legislation to regulate access to biological resources, sustainable use and equitable benefit sharing
2. Policy initiatives		
1983 and updated in 2002 (Operative from 2002-2016)	National Wildlife Action Plan	Wildlife plan for the country leading to creation of protected areas and wildlife management policies
1990	JFM guidelines	Need and procedure for the involvement of village communities and voluntary agencies in the protection and development of degraded forests

Year	Initiative	Scope
1991	Initiation of Ecodevelopment programmes	In situ conservation of biological diversity involving local communities
1992	National Conservation Strategy and Policy Statement on Environment and Development	Lays down guidelines for integrating environmental concerns into developmental planning
1993	Environment Action Programme	Aims at improving environmental services and integrating these concerns in developmental programmes in order to carry forward Agenda 21
1993	National Lake Conservation Plan	Focus is in particular on urban lakes
1998	National Zoo Policy	Roles, responsibilities and strategies for captive breeding and zoo management
1999	National Policy and Macrolevel Action Strategy on Biodiversity	Biodiversity policy for the country
2000	Revised JFM guidelines	Strengthening of JFM in the country

2000	Creation of Forest Development Agencies under the Integrated Afforestation and Eco-development Projects Scheme (IAEPS) of the National Afforestation and Ecodevelopment Board (NAEB)	This is to establish convergence in flow of funds under various schemes for development of rural areas so as to establish interconnectivity between rural development in forest fringe villages, forest conservation and employment generation with smooth and timely flow of funds to the field level.
2002	Wildlife Conservation Strategy	Strategy for conserving wildlife
Development process is underway	National Biodiversity Strategy and Action Plan	To draft a strategy and action plan for the country built on several tiers of strategies, local, state, regional, thematic and cross-cutting
3. Data and Information Needs		
Established in 1890	The Botanical Survey of India (BSI)	Survey and inventorization of flora
Established in 1916	The Zoological Survey of India (ZSI)	Survey and inventorization of fauna
Established in 1981	The Forest Survey of India	To assesses the forest cover, for planning and monitoring purposes
1982	All India Co-ordinated Research Project on Ethnobiology	To identify and document indigenous knowledge of biodiversity
1982	The Environmental Information System (ENVIS) which is the clearing house mechanism for the CBD in India	Collect and disseminate information on the conservation and management of biological resources
1997	All India Co-ordinated Project on Taxonomy	To enhance capacity building on taxonomy in the country
4. Management		
1st park, Hailey National Park (now Corbett NP) set up in 1935	Creation of a network of protected areas-national parks and sanctuaries	Currently (in 2001) there are 88 national parks and 490 sanctuaries

1973	Project Tiger	Currently, 27 project tiger reserves with 6 more proposed reserves
1986	Establishment of biosphere reserves	Identify representative ecosystems for conservation that are inclusive of people's livelihood needs. Currently there are 12 reserves
Year	Initiative	Scope
Task force on elephants in 1990 led to Project Elephant in 1992	Project Elephant	To ensure long term survival of identified viable populations of elephants in their natural habitat
1st private zoo established in 1854 by royalty. First public zoo established in Chennai. Indian Botanic Garden established in 1787 Indian National Gene Bank established in 1996	Creation of various exsitu sites such as botanic gardens (33), zoological gardens (275), gene banks including the National Bureau of Plant Genetic Resources, the National Bureau of Animal Genetic Resources, the National Bureau of Fish Genetic Resources, Tropical Botanical Garden and Research Institute, etc. along with 4 gene banks	Exsitu conservation of biological diversity
5. Institution and capacity building		
1972	Indian Board of Wildlife	Apex wildlife advisory body of the Indian Government
1980	Department of Environment that was later upgraded into the Ministry of Environment and Forests (MoEF) in 1985	Nodal agency for planning, coordination and implementation of environmental and forestry programmes
1982	The Wildlife Institute of India (WII)	Undertakes studies of endangered species of animals and critical ecosystems
1986	National Committee on Coral Reefs,	Implementing programmes for these ecosystems

	Mangroves and Wetlands	
1986	National Committee for Biosphere Reserves	Set up a system and monitor biosphere reserves
1988	G B Pant Institute of Himalayan Environment and Development	Focal agency to advance scientific knowledge, to evolve integrated management strategies, demonstrate their efficacy for conservation of natural resources and to ensure environmentally sound development in the entire Indian Himalayan Region (IHR).
1990	Salim Ali Centre for Ornithology and Natural History (SACON)	Undertakes research and extension activities relating to all aspects of ornithology and natural history of other forms of life
1992	Central Zoo Authority	Guides and monitors functioning of zoos
1992	National Afforestation and Ecodevelopment Board (NAEB)	Promoting afforestation and ecodevelopment
2000	The Indian Institute of Biodiversity is being set up at Itanagar, Arunachal Pradesh	To conduct biodiversity research
6. International and regional cooperation and coordination		
1972	Stockholm Conference on Environment and Development	This conference lead to environmental protection and conservation of natural resources emerging as a key national priority
1972	Convention for the Protection of the World Cultural and Natural Heritage 1972	Appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection,

Year	Initiative	Scope
		conservation, presentation and rehabilitation of the world’s natural heritage.

		Currently, 5 sites in the country.
1976	Ratification of CITES (Convention on the International Trade in Endangered species of wild Flora and Fauna)	International cooperation for the protection of certain species of wild fauna and flora against over-exploitation through international trade
1979 (Appendices as amended in 1985 & 1988)	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	To conserve migratory species paying special attention to 'species the conservation status of which is unfavourable
1981	Ratification of Ramsar Convention	Currently, 6 Ramsar sites in the country
Signed in 1994 into force in 1996	Desertification Convention	To combat desertification
Became a party to the CBD in early 1994	Signatory to the Convention on Biological Diversity	The conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits
Signed by India on 23January, 2001	Cartagena Protocol on Biosafety	Protect biological diversity from the potential risks posed by living modified organisms (LMOs) resulting from modern biotechnology

The country had internalized biodiversity concerns in its policies in the early 1970s, after the Stockholm Conference was held and thus had implemented the greater proportion of Agenda 21's objectives prior to 1992. In subsequent years, more such measures have been taken. The following section discusses the main achievements and concerns vis-à-vis the goals set out in Agenda 21.

Achievements

Management issues related to institutions, legislation, policies, plans and programmes for the conservation and sustainable use of biological diversity

Institutional initiatives (including those related to data and information needs)

The Ministry of Environment and Forests (MoEF) is the nodal agency in the Government of India for planning, promotion, coordination and overseeing the implementation of environmental and forestry programmes. The MoEF is also

the focal point for implementation of the Convention on Biological Diversity. The mandates of the Ministry inter-alia include survey of flora, fauna, forests and wildlife, and conservation of natural resources. These objectives are supported by legislative and regulatory measures. A number of institutions have been set up under the MoEF's umbrella. Surveys of flora and fauna are carried out by the Botanical Survey of India (BSI) established in 1890, and the Zoological Survey of India (ZSI) established in 1916. The Forest Survey of India established in 1981 assesses the forest cover, with a view to develop an accurate database for planning and monitoring purposes. The Wildlife Institute of India undertakes studies of endangered species of animals and critical ecosystems. The Salim Ali Centre for Ornithology and Natural History (SACON) conducts research on ornithology and natural history.

Over 47 000 species of plants and 89 000 animals species have been recorded by the BSI and ZSI respectively. The Surveys have also published Red Data Books on endangered species. The voucher specimens are preserved in Central National Herbarium (CNH) of BSI and National Zoological Collection (NZC) of ZSI. The Ministry has launched the All India Coordinated Project on Capacity Building in Taxonomy in 1999-2000. So far, 11 centres for research and two centres for training have been established. The project envisages establishment of centres for research in identified priority gap areas (e.g., virus, bacteria, microlepidoptera, etc.) in the field of taxonomy, education and training (fellowships, scholarships, chairs, career awards etc.) and strengthening of BSI and ZSI as the coordinating units.

The Forest Survey of India publishes every three years, a State of Forests in India report based on remote sensing and ground truth data. The government is also in the process of setting up an institute specifically for biodiversity research at Itanagar, Arunachal Pradesh (MoEF, 2001).

Many autonomous institutions such as the Bombay Natural History Society (BNHS), French Institute, etc. have also contributed extensively to the identification and documentation of biodiversity.

Programmes for conservation and management

Insitu conservation

India has an extensive system of protected areas (PA) encompassing at present 89 national parks and 496 sanctuaries (MoEF, 2001). These cover an area of 1.83 lakhs sq km in the major biogeographical zones of India. The Tura Range in the Garo Hills of Meghalaya is a gene sanctuary for preserving the rich native

diversity of wild *Citrus* and *Musa* species. Sanctuaries for rhododendrons and orchids have been established in Sikkim.

The Ministry of Environment and Forests constituted the National Afforestation and Eco-development Board (NAEB) in August 1992. NAEB has evolved specific schemes for promoting afforestation and management

Twelve biodiversity rich areas of the country have been designated as Biosphere Reserves applying the UNESCO / MAB criteria. The Nilgiri BR has been recently approved for inclusion within the International Network of Biosphere Reserves recognized by UNESCO (United Nations Educational, Scientific, and Cultural Organization). Under the World Heritage Convention, five natural sites have been declared as World Heritage Sites including Kaziranga NP, Keoladeo Ghana NP, Manas WLS, Nanda Devi NP and Sunderbans NP.

Project Tiger, initiated in 1973 to maintain viable populations of the tiger and its natural habitat, has grown over the years to 27 tiger reserves in 14 states and covers an area of 37 761 km^2. This exemplary conservation initiative has not only benefited the tiger, but acted as an umbrella programme that has benefited a number of other endangered species such as the swamp deer, elephant, rhino and wild buffalo, apart from protecting large swathes of habitat. The second phase of Project Tiger has expanded the programme to include the establishment of guidelines for tourism in tiger reserves, establishment of nature interpretation programmes, integration of local populations through ecodevelopment programmes and management of buffer areas.

Project Elephant is another landmark conservation initiative to protect the Asian elephant that was formally launched in 1992 on the recommendations of a taskforce set up by the MoEF in 1990 to look into the conservation of the Asian elephant. The objective of Project Elephant is to assist states having ranging populations of wild elephants to ensure the long-term survival of identified viable population of elephants in their natural habitats by providing the range states with financial as well as technical and scientific assistance. Project Elephant is aimed at the ecological restoration of existing natural habitats and migratory routes of elephants, development of scientific and planned management for conservation of elephant habitats and viable populations, measures aimed at mitigating human-elephant conflicts, anti-poaching measures as well as enhanced research and training. Other special programmes have been launched for the insitu conservation of mammals including the Indian rhino, lion, certain primates (such as the Indo-US Primate Project in Northeast India) and aquatic mammals including river dolphins.

The Indian Council of Forestry Research and Education (ICFRE) has identified 309 forest preservation plots of representative forest types for conservation of viable and representative areas of biodiversity. 187 of these plots are in natural forests and 112 in plantations, covering a total area of 8 500 hectares. Eco development programmes for the in situ conservation of biodiversity involving local communities has been initiated in recent years. The concept of eco development integrates ecological and economic parameters for sustained conservation of ecosystems by involving the local communities near protected areas.

Besides forest biodiversity, wetland conservation has been a priority for to the government since the late 1980s. In 1986/87, the Indian government initiated a programme on the conservation and management of mangroves and coral reefs and a national committee was constituted to advise the government on policy and management aspects of mangrove ecosystems. Fifteen mangroves and four coral reefs were identified for conservation and management, and state-level steering committees have been formed to coordinate the implementation of Management Action Plans for these areas. This year, another 15 mangrove areas have been added to the list. The major reef formations in India are found in the Gulf of Mannar, Palk Bay, Gulf of Kutch, Andaman and Nicobar islands, and Lakshadweep islands. Primary, fragile coral reefs that are a conservation priority include Lakshadweep, Andaman and Nicobar islands, Gulf of Mannar, Gulf of Kutch. The Indian Coral Reef Monitoring Network was set up to cover activities relating to coral reefs including research and monitoring, training and capacity-building, establishment of a database, etc.

Insitu conservation of medicinal plants is a priority issue. With the collaboration of the State Forest Departments of Kerala, Karnataka and Tamil Nadu, the Foundation for Revitalisation of Local Health Traditions has established 30 Medicinal Plant Conservation Areas as well as 15 parks to store the germplasm of threatened, rare and endemic, medicinal plants. Insitu conservation of agro-biodiversity has been strengthened through steps taken by the government and NGOs to protect the conservation traditions of farming communities.

Exsitu conservation

Exsitu conservation in the country has been institutionalized by setting up botanic and zoological gardens as well as a number of gene banks including the National Bureau of Plant Genetic Resources (NBPGR), the National Bureau of Fish Genetic Resources (Indian Council of Agricultural Research) and the

Tropical Botanic Garden and Research Institute. The Indian National Gene Bank was set up by the NBPGR to house collections of indigenous germplasm, seeds, propagules, safe-keep duplicate germplasm of other organizations and carry out the distribution and exchange of material.

The Central Zoo Authority has been set up to oversee the functioning of zoos, carry out planned breeding programmes and has provided detailed guidelines to zoos to monitor their activities. The National Zoo Policy, 1998, clearly identifies roles, responsibilities, objectives and strategies for ex situ conservation centres which may be broadly classified into:

- Supporting the conservation of endangered species
- Providing opportunities for scientific studies useful for conservation in general and creation of database for sharing between agencies involved in insitu and exsitu conservation
- To inspire amongst zoo visitors empathy for wild animals, an understanding and awareness of the need for conservation of natural resources and for maintaining the ecological balance

The total number of zoos, animal parks and aquaria is about 300, while there are 34 botanic gardens in the country including the National Botanical Garden in NOIDA, Uttar Pradesh (MoEF, 1998). A scheme entitled 'Assistance to Botanic Gardens' provides one-time assistance to botanic gardens to strengthen and institute measures for the exsitu conservation of threatened and endangered species in their respective regions. NGOs are also active in exsitu conservation of reptiles including for example, the Chennai Snake park, Madras Crocodile Bank, Pune Serpentarium and Calcutta Snake Park.

In situ conservation of selected species of birds and reptiles has been fortified through captive breeding programmes. The Government of India started a crocodile breeding and management project in 1976 to save the three endangered crocodilian species, the fresh water crocodile, salt water crocodile and the *gharia*l. Thousands of crocodiles of these three species have been reared at 16 centres and several of these have been released into the wild. Eleven sanctuaries have been declared specially for crocodile protection including the National Chambal Sanctuary in Madhya Pradesh. The endangered white-winged wood duck was also bred in captivity and released into Protected Areas of the Northeast, in an Indo-British collaborative programme.

Policy and regulatory initiatives

The National Wildlife Action Plan, 1983 was a landmark document that laid the foundation for the establishment of a network of protected areas to cover representative samples of all major wildlife ecosystems. It also provided for a wide spectrum of wildlife activities including the setting up of botanical and zoological gardens, research and monitoring facilities and the control of wildlife trade and poaching. An updated version of the plan operative from 2002-2016 is now in place. The National Conservation Strategy and Policy Statement on Environment and Development in 1992, along with the National Forest Policy, is a major policy instrument of the government for integrating conservation considerations in the policies and programmes of other governmental sectors such as agriculture, irrigation, animal husbandry, industry, mining, tourism, etc. India now also has a Wildlife Conservation Strategy, 2002 in which wildlife and forests have been designated as priority sectors at the national level.

The Forest (Conservation) Act, 1980 controls diversion of forest land for non-forest purposes. Details of this act are given in Chapter 9. The Wildlife (Protection) Act is the single most significant statute on wildlife conservation in India. Under it, the protected areas have been created or given legal protection. Though there were several laws relating to wildlife prior to 1972, the WLPA was India's first comprehensive legislation, covering the whole country. The WLPA provides for three categories i.e. national parks, sanctuaries and closed areas. The areas that comprise national parks and sanctuaries include a broad range of biodiverse regions and can include reserve forests, protected forests, revenue land including lands that were once used as common property resources by villagers, and private (mostly agricultural and plantation) land. The WLPA prescribes both prohibitive and permissive provisions for the use of the categories of protected areas within its legal mandate (Upadhyay and Upadhyay, 2000). The highest degree of protection is accorded to national parks where no human interference is permitted except that are beneficial to conservation. In case of sanctuaries certain rights may be permitted by the Collector in consultation with the Chief Wildlife Warden (Section 24 (2) (c)) (Upadhyay and Upadhyay, 2000).

Biodiversity concerns as being integral to forest management and the advent of conservation forestry was emphasized as early as 1988, in the National Forest Policy. The Forest Policy of 1988 (NFP) spelt a complete paradigm shift from the earlier policies. Unlike the use-oriented forest policy of 1952, the present policy emphasizes the ecological role of forests, and the meeting of rights and concessions from them to be primarily for the bonafide use of communities living within and around the forest areas, especially tribals. No other policy has

made such a radical pro-people approach and this can be used as a benchmark of the basic values that any development policy must embody. The policy clearly states ‘the principal aim of forest policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms, human, animal and plant. The derivation of direct economic benefit must be subordinated to this principal aim.’

The 1988 Forest Policy was articulated through the Joint Forest Management (JFM) guidelines issued in 1990 and revised in 2000, that provided for village communities involvement in the protection and regeneration of forests. Details are provided in Chapter 9. This mandate has been further strengthened in the National Forestry Action Programme, 2000.

The Eco-development programme is another initiative for local communities and aims at economic development for the people near protected areas in order to reduce their dependence on the forest resources of the protected areas. This programme includes a range of interventions aimed at rural development, enhancing agriculture, minor irrigation, raising fuel and fodder plantations, etc.

The Environment Protection Act, 1986 was the response to a widely-felt need for a general legislation for environment protection (refer to Chapter 2 for details). The EPA has been used in the past to protect fragile or biodiverse regions such as the Dahanu taluka. Under the EPA as well, in 1991, the MoEF issued a notification for the protection of coastal areas known as Coastal Regulation Zones (CRZ) that led to the formulation of State-level Coastal Zone Management Plans.

The Biodiversity Bill is an important mechanism for regulating access to biological resources and in establishing benefit-sharing arrangements. It was referred to the Department Related Parliamentary Standing Committee on Science, Technology, Environment and Forests, for further examination which has approved it, making a few principal changes in the original draft. With the new set of recommendations, the Bill has been laid in both the Houses of Parliament.

The legislation primarily addresses the issue concerning access to genetic resources and associated knowledge by individuals, institutions or companies, and equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people. The legislation provides for setting up of a three-tiered structure at national, state and local level. Section 8 (i) provides for the establishment of the National Biodiversity Authority which deals with matters relating to requests for access by foreign individuals,

institutions or companies, and all matters relating to transfer of results of research to any foreigner; imposition of terms and conditions to secure equitable sharing of benefits and approval for seeking any form of Intellectual Property Rights (IPRs) in or outside India for an invention based on research or information pertaining to a biological resource obtained from India. The State Biodiversity Boards deal with matters relating to access by Indians for commercial purposes and restricts any activity that violates the objectives of conservation, sustainable use and equitable sharing of benefits. The Biodiversity Management Committees are to be set up by institutions of self-government in their respective areas for conservation, sustainable use, documentation of biodiversity and chronicling of knowledge relating to biodiversity. Biodiversity Management Committees are to be consulted by the National Biodiversity Authority and State Biodiversity Boards on matters related to use of biological resources and associated knowledge within their jurisdiction.

All foreign national / organizations require prior approval of the NBA for obtaining biological resources and / or associated knowledge for any use. Indian individuals / entities require approval of the NBA for transferring results of research with respect to any biological resources to foreign nationals / organizations. Indian citizens and organizations are required to give prior intimation to the concerned SBB about obtaining any biological resource for commercial use, and the SBB may prohibit or restrict the activity if found to violate the objectives of conservation, sustainable use and benefit-sharing.

Section 18(iv) stipulates that one of the functions of NBA is to take measures to oppose the grant of IPRs in any country outside India on any biological resource obtained from India or knowledge associated with such a biological resource. For ensuring equitable sharing of benefits arising from the use of biological resources and associated knowledge, Sections 19 and 21 of the Biodiversity Bill 2000, stipulate prior approval of the National Biodiversity Authority (NBA) before their access. While granting approval, NBA will impose terms and conditions that secure equitable sharing of benefits.

Local people and communities of the area will have free access to use biological resources within the country. Issues relating to protecting, recognizing and rewarding traditional knowledge (TK) associated with biological resources are very complex. The modalities of protecting TK are still emerging and evolving. The nature of entitlements and share in benefits is also a grey area.

Realizing the need to ensure that the holders of TK which is not still in the public domain should be able to get the benefits arising from the use of such

knowledge, an enabling provision has been made for protecting the TK in the Biodiversity Bill 2000. Section 36(iv) provides for protection of knowledge of local people relating to biodiversity through measures such as registration of such knowledge, and development of a *sui generis* system. While granting approvals for access, NBA will impose terms and conditions so as to secure equitable sharing of benefits. These benefits inter alia include:

- Grant of joint ownership of intellectual property rights to the National Biodiversity Authority, or where benefit claimers are identified, to such benefit claimers;
- Transfer of technology;
- Location of production, units in such areas;
- Association of Indian scientists, benefit claimers and the local people with research and development in biological resources and bio-survey and bio-utilization;
- Setting up of a venture capital fund;
- Payment of monetary compensation and other non-monetary benefits to the benefit claimers as the National Biodiversity Authority may deem fit; and
- The legislation provides for setting up of biodiversity funds at central, state and local levels. Benefits will be given directly to individuals or group of individuals only in cases where biological resources or knowledge are accessed directly from them. In all other cases, monetary benefits will be deposited in the Biodversity Fund which in turn is used for the conservation and development of biological resources and socio-economic development of areas from where resources have been accessed.

Section 36(i) requires the Central Government to develop national strategies, plans, programmes for the objectives of the Act including measures for the identification and monitoring of areas rich in biodiversity, promotion of insitu and exsitu conservation, incentives for research, training, etc. Section 36(ii) calls for integration of biodiversity concerns into relevant sectoral or cross-sectoral activities. Sections 37 (I) and 38 requires the state government to notify biodiversity heritage sites and the central government to notify threatened species respectively.

In India, a well-documented example of benefit sharing with local communities already exists (Anuradha, 2000). This is the Kani-TBGRI model in Kerala State that is included in Box 10.1.

Box 10.1 Kani-TBGRI model in Kerala State

Kani is a tribal community inhabiting the Southern Western Ghat region of Kerala. In 1957, a team of scientists from the Tropical Botanic Garden and Research Institute (TBGRI) undertook an ethnobotanical field study in the tribal-inhabited Western Ghat region of Kerala. During this expedition, they came across interesting ethnomedical information on a wild plant *Trichophus zeylanicus*, locally called as 'Arogyapacha' by the Kani tribe. The scientists noticed that the Kani tribals accompanying the team frequently ate some fruits that kept them energetic and agile. When asked about the source of the fruit, the Kani men were initially reluctant to reveal the information. The team convinced the Kani men that information would not be misused and that if any marketable drugs / products got developed, the benefits accrued would be shared with the tribe. Pharmacological investigations of the fruit confirmed its anti-fatigue properties. Detailed chemical and pharmacological investigations showed that the leaves contained various glycolipids and some other non-steroidal compounds with anti-stress and anti-hepatoxic properties. The team developed a polyherbal formulation that was named 'Jeevni'. After satisfactory clinical evaluation this herbal drug was released for commercial production. After negotiations with various interested parties, the manufacturing licence of 'Jeevni' was transferred to the Aryavaidya Pharmacy Coimbatore Ltd. for a licence fee of Rs 10 lakhs for a period of 7 years. The TBGRI in consultation with the tribal community has worked out an arrangement for benefit-sharing. According to this arrangement, the TBGRI has agreed to share 50% of the licence fee and royalty with the tribal community. In November 1997, a number of Kanis got together, and with assistance from the TBGRI, registered a trust call the Kerala Kani Samudaya Kshema Trust, comprising nine members, all of them tribals. The decision to form the trust was taken at a local meeting of around 40 Kanis. The trust deed states as its objectives; welfare and development activities for the Kanis of Kerala; preparation of a biodiversity register to document the Kanis' knowledge base; and evolving and supporting methods to promote the sustainable use and conservation of biological resources.

India has prepared a National Policy and Macrolevel Action Strategy on Biodiversity through an extensive consultative process. This document is a macro level statement of policies, gaps and further actions needed for conservation and sustainable use of biological diversity.

In a major advancement for the cause of biodiversity conservation in the country and in compliance with requirements of the Convention on Biological Diversity, the drafting of the country's National Biodiversity Strategy and Action Plan (NBSAP) with funding support from GEF, the Global Environmental Facility, is now underway. The strategy and action plan are very broad in scope and comprehensive in coverage and propose to prepare detailed action plans at sub-state, state, regional and national levels based on the framework Policy and Action Strategy on Biodiversity. NBSAP is India's biggest planning and development process aiming at conservation and sustainable use of biological diversity. A decentralized approach has been adopted for developing the NBSAP. Under the NBSAP, about 20 local micro-planning process at village to district levels, 33 state and union territory level processes, 10 planning exercises at ecological regions cutting across states, are engaged in

collecting a variety of area specific information and perspectives. In addition, national working groups are preparing action plans on 14 themes. About 75 executing agencies at various levels across the length and breadth of the country are involved in the preparation.

The process is participatory, tapping into the knowledge of diverse stakeholders and incorporating a variety of strategies for its development such as workshops and public meetings, consultations, expert inputs, etc. For implementation of the NBSAP project, an arrangement between a private company, Biotech Consortium India Ltd. (BCIL) and an NGO, Kalpavriksh has been worked out. While BCIL acts as the coordinating agency to deal with administrative financial and logistic arrangements, Kalpavriksh is the coordinator of a Technical and Policy Core Group (TPCG) which is responsible for technical execution of the project. The institutional structure for development of the Strategy and Action Plan is detailed in Table 10.4.

Table 10.4 Institutional structure of the NSBAP process

Level	Functions	Composition
National		
Steering Committee (SC)	Overall guidance and monitoring	Relevant GOI ministries/agencies, independent experts, NGO representatives
National Project Director and Team (NPD)	Overall execution and direction	MoEF Joint Secretary and team
Technical and Policy Core Group (TPCG)	Conceptualization, execution, monitoring, and finalization of process; integration of all SAPs	Thematic and geographically representative experts
Administrative Coordination Agency (ACA)	Administrative and financial execution of process	Biodiversity Consortium India Limited
Thematic Working Groups (TWGs)	Preparation of thematic SAPs	Relevant governmental and non-governmental experts, geographically representative (including from local communities)
Inter-state, Ecoregional Working Groups (BWGs)	Preparation of ecoregional SAPs	Relevant governmental and non-governmental experts, geographically representative (including from local communities)
State		
State Steering Committee (SSC)	Conceptualization, guidance and monitoring	Relevant state government agencies, NGO representatives, community/grassroots representatives
State Nodal Agency/agencies	Overall execution, substantive and administrative	Relevant state agency and/or NGOs
Thematic Working Groups (TWGs)	Preparation of thematic SAPs at state level	Relevant governmental and non-governmental experts (including from local communities)
Local/sub-state		
District/Local Advisory Committee (D/LAC)	Conceptualization, guidance, and monitoring	Relevant governmental and non-governmental experts, in particular local community and grassroots organization members
District/Local Nodal Agency	Execution, substantive and	Relevant district-level or local agency, in

Level	Functions	Composition
	administrative	particular people's representative agencies, grassroots organizations

The expected outcome of the NBSAP project is an implementable and realistic action plan, which can be easily translated into a number of projects at the ground level in areas of priority that would contribute significantly towards conservation and sustainable use of biodiversity in the country.

The government has also recently issued policy and guidelines for ecotourism in India (Box 10.2).

Box 10.2 Ecotourism in India

Ecotourism may be defined as nature based tourism that is educative and ensures the sustainable use of environmental resources, while producing viable economic opportunities for the host communities.

India's geographic diversity provides a wealth of ecosystems that currently or potentially could support ecotourism activities. These include biosphere reserves, wildlife sanctuaries, mangroves, coral reefs, deserts, mountains and forests, flora and fauna, seas, lakes and rivers and caves. While specific statistics on ecotourism growth in India are not available, statistics on visitation to selected parks and sanctuaries provide some indicators showing growing trends in visitor interest in nature-based activities in park settings. Recognizing the enormous potential of ecotourism in India, the government issued a policy on ecotourism in 1998 along with operational guidelines for the key players in ecotourism business-government, local authorities, developers and operators, visitors and local community while recognizing the role of NGOs and the scientific community.

International and regional cooperation and coordination

India is a party to CITES, the Convention on International Trade in Endangered Species of wild flora and fauna (CITES) which entered into force in India on18/10/1976. The Convention explicitly recognises that 'international cooperation is essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade'.

India is also a party to the Convention on Wetlands of International Importance, Ramsar 1971, that seeks to preserve the fundamental ecological functions of wetlands as regulators of water regimes and as habitats supporting a characteristic flora and fauna. Each contracting party is required to designate suitable wetlands within its territory for inclusion in a list of wetlands of international importance. Besides, information regarding pollution or other human interference-related developments in designated wetlands have to be

given to the Ramsar Convention Bureau. Further, the parties are also required to formulate and implement domestic laws to promote conservation of wetlands in consonance with obligations under this convention. Conservation initiatives included identifying wetlands of conservation value and framing policy guidelines.

India has 6 Ramsar wetlands—Keoladeo National Park, Bharatpur; Sambar, (Rajasthan); Chilka, (Orissa); Loktak, (Manipur); Wullar, (Jammu and Kashmir); and Harike (Punjab). A National Committee on Wetlands, Mangroves and Coral Reefs was created which identified 19 wetlands. The central government funded numerous conservation activities such as data collection and surveys, wetland mapping, landscape planning, wildlife development, and fisheries control. This led in 1993 to the formation of a National Lake Conservation Plan focussing in particular on urban lakes. To date, 11 lakes have been identified for conservation and management. India, however, is yet to develop a wetland policy or provide specific legal protection to wetland areas.

The Convention on Biological Diversity has been instrumental in putting the concerns for conservation of biodiversity on the international agenda. Implementation of the Convention is at the national level. For this the Convention requires that each contracting party develop (or adopt) national strategies, plans or programmes for conservation and sustainable use of biological diversity and integrate these into sectoral / cross-sectoral plans. The country has carried out national reporting including, 'Implementation of Article 6 of the CBD in India: National Report' in 1998 (MoEF, 1998) as well as submission of the second national report in 2001 (MoEF, 2001).

The COP to the Convention on Biological Diversity adopted a supplementary agreement to the Convention known as the Cartagena Protocol on Biosafety on 29 January 2000. The Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms (LMOs) resulting from modern biotechnology. It establishes an advanced informed agreement procedure for ensuring that countries are provided with the information necessary to make decisions before agreeing to the import of such organisms into their territory.

Concerns and strategies for sustainable development

Despite the great strides made, there is a need for greater community awareness on issues concerning biodiversity and its permeation into all sectors of developmental planning.

As discussed in Chapter 9 on forestry, financial resources pose a severe constraint on efficient conservation of forests and biodiversity. The potential of the private sector has also not been tapped effectively. Detailed policies and strategies are required for fragile and important ecosystems such as wetlands, grasslands, seas and oceans as well as corridor and buffer areas, since the emphasis is often overly on forests. Implementation and enforcement of the excellent legislation in existence is often poor. Poaching continues to be a very major threat, even though a very detailed action plan for combating it is already in place (MoEF, 1994). Another major lacuna in our current policy environment is the lack of coordination and communication between various departments and agencies whose activities impinge on natural resources. There is a need therefore, to infuse biodiversity / forestry and land considerations in the process of development planning itself.

The NBSAP process mentioned above will provide detailed strategies for ensuring conservation, protection and management of biological resources in conjunction with their sustainable use in a fair and equitable manner. Some indicative measures for mainstreaming biodiversity vis-à-vis Agenda 21 concerns, in accordance with the a National Policy and Macrolevel Action Strategy on Biodiversity have been presented below until such time as detailed recommendations emerge from the NBSAP process.

Data and information needs

A Biodiversity Information Facility—a comprehensive database for dissemination of research data that ensures networking amongst institutions across the country needs to be established. Surveys and inventories need to be intensified with the involvement of a broader range of organizations in the process. This must include surveys of islands, marine and coastal areas, the Himalayas, listing of endangered species and their population abundance, inventories of protected areas, studies on agro-biodiversity, traditional knowledge systems, etc. There is a need to strengthen the BSI, ZSI and the three bureaus of the ICAR (NBPGR, NBAGR AND NBFGR). These institutions must play a guiding role by preparing a list of priority research issues and areas for circulation to relevant institutions, based on countrywide consultation of experts. Funding for these prioritized projects could be stepped up to ensure that research focuses on them.

Management

There is a need to expand the protected area network to the 160 National Parks and 698 sanctuaries accounting for 18.7 mha as suggested by Rodgers, Panwar and Mathur (2000). This coverage will provide a 'better distribution of protected areas with less gaps in the protection of biogeographic zones, biomes and species and fewer spatial or geographic gaps in the pattern of PA coverage' (Rodgers; Panwar and Mathur, 2000). This must be accompanied by strengthening management of PAs based on the provision of adequate humanpower, equipment, infrastructural facilities, etc. Further, management planning for protected areas must be strengthened on par with Working Plan formulation and the local communities need to be involved in conservation and management efforts. A landscape / waterscape approach for conserving ecosystems and habitats both within and outside the PA network may to be adopted. This will ensure that biodiversity concerns filter into the non-protected areas. Measures for enhancing inter-sectoral cooperation are of the essence to design strategies for preventing habitat destruction and over-exploitation. There is a need to minimize activities that are detrimental to biodiversity such as habitat destruction, over-exploitation, pollution and introduction of exotics. A wetland policy and strategy for their management must be developed.

Priority must be given to the conservation of traditional varieties of crop and to strengthen measures for conservation of crop and livestock diversity as well as on-farm and on-orchard conservation programmes. The establishment of a Central Botanic Garden Authority along the lines of the Central Zoo Authority is also required.

Policy environment and capacity-building

Biodiversity concerns need to permeate all spheres of developmental planning, since most activities have direct or indirect impacts on biodiversity. There is a need to incorporate biodiversity, forestry, and land-use considerations in development planning itself. Coordination and capacity must also be strengthened so as to ensure cross-sectoral linkages. Various economic tools also support intersectoral integration by ensuring that activities incorporate the costs to biodiversity such as taxes and cesses. Two important mechanisms for this are certification schemes and developing methods for valuing biodiversity in national accounting systems.

Another important area is genetic engineering and the related issue of genetically modified organisms. These new developments can play a positive role in increasing agricultural productivity. Given the revolutionary nature of the technology there are associated risks and uncertainties. Therefore to fully

realize the potential of this new technology proper regulatory mechanisms have to be put in place, backed by scientific inputs and testing facilities.

The capacity and involvement of local communities in biodiversity conservation, monitoring and most importantly in the decision-making process needs to be enhanced. Eco-tourism and recreation forestry for instance are income-earning options for local communities and need to be encouraged along with activities such as farming of medicinal plants and the initiation of non-wood forest produce-based enterprises. This must also include the ability to meet the subsistence needs of local people through the promotion of fodder, fuelwood plantations, non-conventional energy sources, irrigation programmes, etc. There is a need for greater documentation of traditional knowledge as well as the revival of sustainable traditional resource use practices and the application of local knowledge, scientific and medicinal systems. This must be accompanied by equitable benefit-sharing arrangements. Encouraging sustainable resource use at all levels of society is of the essence for the country.

Finally, innovative mechanisms for financing biodiversity conservation need to be devised, including tapping the potential of the private sector and earmarking at least 1% of state and central government resources for biodiversity (MoEF, 1999). Such initiatives will reinforce the initiatives taken by the government towards conserving the rich and unique biodiversity of the country.

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