potato alone providing 60%). Also, about 30 mammalian and bird species are used extensively, but just 15 of them account for over 90 per cent of global livestock production. The Indian scenario is not very different. Choice of crops and farm livestock in agricultural production systems is now getting largely influenced by market trends and changing lifestyles, affecting the variety, taste and nutrition value of our food basket.

Landraces, developed and grown traditionally by farming communities through generations, locally adapted obsolete cultivars and their wild relatives comprise crop genetic resources. These provide the building blocks used by farmers and scientists as the raw material for breeding new plant varieties and also act as a reservoir of genes sought after for manipulation using new tools of biotechnology. Indigenous cultivars, adapted to local situations are, however, mostly low yielding (largely because of not receiving due breeding effort) and are, hence, getting fast replaced by just a few high-yielding and pest-resistant superior varieties/hybrids under each crop. Alarm bells are ringing because narrow genetic base means more vulnerability to widespread epidemics. A large number of over 300,000 samples of these cultivars kept under long term storage in the National Gene Bank, has gone out of cultivation. Many among the well-known nearly 140 native breeds of farm livestock and poultry are also facing similar threat to their survival. This is happening even when local breeds are genetically better adapted to their environment and are more cost-effective being productive even whilst consuming lower quality feedstuffs. The local breeds are also more resilient to climatic stress, are more resistant to local parasites and diseases, and serve as a unique reservoir of genes for improving health and performance of 'industrial' breeds. Conservation and greater use of local breeds will be most effective in achieving food and nutrition security objectives at the local level.

Wild species, related closely to their cultivated forms, are valued by plant breeders for obtaining genes for resistance to virulent diseases and tolerance to stresses like drought, salinity and temperature. Continuing evolutionary development of these valuable species depends on adequate genetic diversity in their natural populations. Increasing fragmentation, degradation and loss of their habitats over the years have seriously limited their availability and threatened their survival.

Efforts to conserve plants and animals in gene banks are vital but an even more important task is to maintain biodiversity on farms and in natural habitats where it can continue to evolve and adapt to changing conditions. As custodians of agricultural biodiversity, farmers are better suited to conserving and developing these genetic resources, ensuring their survival and availability to serve present and future needs. Developing fruitful national partnership for this purpose, while working towards sustainable agriculture, presents a challenge to all the concerned government agencies, scientific institutions and rural communities.

3.2 Declining natural resource base and over-exploitation of resources

India is endowed with diverse forest types ranging from the tropical wet evergreen forests in North-East to the tropical thorn forests in the Central and Western India. The forests of the country can be classified into five major groups based on climatic factors. These major groups have been divided into 16 forest types based on temperature. They are further divided into 202 sub-groups and type groups based on location specific climatic factors and plant species constitution. Forests face threats on account of diversion of forest land for agriculture, industry, human settlements, and other developmental projects. Construction of roads and canals, quarrying, shifting cultivation and encroachments are other threats. Degradation of forests results from illicit felling, excess removal of forest products, fodder, fuel wood, forest floor litter, overgrazing and forest fires. As a result, some of the floristic and faunal components, including many keystone and endemic forest species are now left with narrow eroding populations which need to be urgently conserved.

Even though forestry is the second largest land use in India after agriculture, covering approximately 23.57 percent (recorded forest area) of the total geographical area, the contribution to the Gross Domestic Product from forestry is minimal (it was barely 1.1 percent in 2001). An estimated 41 percent of the country's forest cover has been degraded to some degree. As much as 78 percent of forest area is subject to heavy grazing and about 50 percent of the forest area is prone to forest fires. Domestic demand for timber and fuelwood is well above the sustainable level.

The rich diversity of medicinal plants (over 6,500 species) in the country needs conservation and sustainable utilization, as their habitats are either degraded or the species are being over-exploited. In fact, nearly 90% of the medicinal plants in trade are harvested from the wild. The medicinal plants constitute critical resource for health care of rural communities and for the growth of Indian herbal industry. Currently, India's share in the complementary medicine related global market is only 0.3% and there exists immense scope for expanding its share in the 62 billion US$ world market from the present level of Rs. 5,000 crores (approximately 1.2 billion US$). But, it is a sad reflection that while it has the knowledge, skills and resources, India has not yet seized opportunities in the global market. Even its 0.3% share is largely (70%) through export of raw materials and only in a limited way (30%) through value addition and sale of finished products. Indian exports are thus guided by what may be termed as a trader's vision rather than by a knowledge-products vision.

The MoEF has mooted a Multi-Stakeholder Partnership (MSP) framework involving the three partners, namely, the land owning agency/ forest department, the local village community and the sponsor, for afforestation on degraded forest lands and other lands, as one of the measures to achieve the National Forest Policy goal of one-third forest and tree cover in the country.

Unsustainable exploitation of biodiversity resources, particularly by developed countries, have serious adverse impacts, both local and global. The global impacts are largely manifest in developing countries, and may further accentuate poverty in these countries. Failure on the part of developed countries to provide incentives for conservation in the form of financial resources, technology transfer and scientific cooperation, as envisaged under the CBD, further dampen the conservation efforts in the developing countries.

The increasing population of the country has led to diversion of natural forest for agricultural use, fuelwood, timber and human settlements. The five grassland types in India (namely, Sehima-Dicanthium type, Dicanthium-Cenchrus-Lasiurus type, Phragmites-Saccharum-Imperata type Themada-Arundinella type and Temperate-Alpine type) too are under severe threat. There is dearth of both trained manpower and targeted research on grasslands and their carrying capacities. Similarly, the wetlands and coastal and marine ecosystems such as mangroves and coral reefs are also facing threats from increased resource use, pollution, reclamation and illegal poaching.

Although population growth and resource consumption are the proximate threats to biodiversity today, in the long run their impact on biodiversity will be determined by more than one variable, including social and economic progress of the country. The steps that are taken to improve literacy, empower women, invest in health and child welfare, and stimulate sustainable economic development, will in the end also determine the level where human population, and the demands it places on natural resources, stabilize.

3.3 Invasive alien species

Among the major threats faced by native plant and animal species (and their habitats), the one posed by the invasive alien species is considered second only to habitat loss. The major plant invasive species include *Lantana camara, Eupatorium odoratum, E.adenophorum, Parthenium hysterophorus*, *Ageratum conyzoides, Mikania micrantha, Prosopis juliflora, Cytisus scoparius,* etc. Alien aquatic weeds like water hyacinth are increasingly choking waterways and degrading freshwater ecosystems. *Lantana* and carrot grass cause major economic losses in many parts of India. Highly invasive climbers like *Chromolaena* and *Mikania* species have over-run the native vegetation in North-East Himalayan region and Western Ghats. Numerous pests and pathogens such as coffee berry borer, turnip stripe virus, banana bunchy top virus, potato wart and golden nematode have invaded agro-ecosystems becoming serious menace.

In addition, illegally introduced catfishes (like the African magur) and also the big head carp are known to have adversely affected native fish diversity. Accidental entry of silver carp in Govindsagar lake and its subsequent dominance over the native catla and mahseer fish is a shocking experience. Tilapia has similarly been reported to have adverse effects on indigenous species in Vaigai reservoir in Tamil Nadu. A recent intruder, the African catfish (also called Thai magur) seem to have posed even far greater threats to native fish fauna.

In view of the severe damage that has been done to major ecosystems and taking note of the alarming environmental degradation caused by the invasive alien species, some states have adopted legislative and administrative measures for eradicating/preventing their further spread. These welcome initiatives notwithstanding, the threat posed by the exotic invasive species is not yet contained and awaits more effective steps to be taken at the ground level.

3.4 Climate change and desertification

Climate change, on account of build-up of greenhouse gases in the atmosphere leading to global warming, poses another significant threat to biodiversity, ecosystems, and the goods and services they provide. There are indications that the projected changes in temperature and CO_2 concentration may alter growth, reproduction and host-pathogen relationships in both plants and animals. It is believed that the ecosystems with undiminished species

diversity, and species with their genetic diversity intact, are likely to be in a much better position to face the impact of climate change. The Intergovernmental Panel on Climate Change in its summary report released in February, 2007, has estimated huge loss of biodiversity for biodiversity-rich megadiverse countries such as India because of higher greenhouse gas emissions. Targeted research on impacts of climate change on forest types, eco-sensitive zones, crop yields and biodiversity is required under the changing climatic regime.

Similarly, scientific studies have brought out that strong interlinkages exist between desertification and biodiversity loss. This calls for undertaking focused research on the impact of desertification as also synergizing efforts to combat desertification and promote biodiversity conservation.

3.5 Impact of development projects

India, with its large population, is poised for rapid economic growth. Large infrastructural and industrial projects, including highways, rural road network, and the special economic zones, are coming up. With cities and townships expanding, often at the cost of agriculture, and agriculture expanding at the cost of tree cover, fresh threats to biodiversity are emerging. In addition, changing lifestyles of the people, with rising incomes, in both rural and urban areas, are placing increasing demands on biodiversity.

In order to harmonise developmental efforts with protection of environment, Environmental Impact Assessment (EIA) was made mandatory through a notification issued in 1994 for notified categories of developmental projects in different sectors of the industry, thermal and nuclear power, mining, river valley and infrastructure projects. To make the EIA process more efficient, decentralized and transparent, a revised notification was issued on September 14, 2006.

Biodiversity in India is facing threats from various sources of pollution, both point and non-point. The major threats are from improper disposal of municipal solid waste, inadequate sewerage, excessive use of chemical pesticides and continuous use of hazardous chemicals even where non-hazardous alternatives are available. New industrial processes are generating a variety of toxic wastes, which cannot be dealt with by currently available technology in the country. Besides, economic constraints and problems related to the indigenization makes the substitution of these technologies difficult.

Although India's per hectare use of pesticide is very low as compared with many other countries, pesticide residues in land, water and food have been detected over the last three decades. Varying amounts of DDT and BHC residues have been found in agricultural produce including milk, meat and fodder. Levels found have been mostly below stipulated norms but their presence is a matter of concern.

There is a need for significant body of research and development seeking new biologically based methods for abatement of pollution.

3.6 Biodiversity information base

So far, almost 70% of the country's land area has been surveyed and around 45,500 species of plants and 91,000 species of animals have been described. It is estimated that about 4,00,000 more species may exist in India which need to be recorded and described. The baseline data on species and genetic diversity, and their macro-and micro-habitats, is inadequate. Further, although a number of organizations/agencies are working on various aspects of biodiversity, the information on the subject is scattered and not yet integrated into a national database. Some of the databases being developed are not upto the standard, primarily because of lack of infrastructure, skilled manpower and coordination among experts in different fields. The different sectoral networks therefore need to establish a nationwide information system with a uniform format for collection, retrieval and dissemination of data.

The underground biodiversity, particularly soil microbes, are poorly understood. The degradation of land has led to the loss of underground biodiversity. Similarly, the microbial diversity of fresh water and marine ecosystems is less known and may yield novel compounds of therapeutic and industrial value. For sustainable agriculture, microorganisms play a decisive role. They have very wide potential for stimulating plant growth, increasing nutrient availability and accelerating decomposition of organic materials, and are anticipated to increase crop production as well as maintain sound environment for sustainable harvests.

Hence, it is necessary to explore, preserve, conserve and utilize the unique microbial flora of our country for fulfilling the emerging food, fodder and fibre needs, clean environment and improved soil health. There is a need to conserve microbial diversity from various niches for varied applications.

The information on biodiversity of freshwater, coastal and marine areas of the country is highly fragmentary, although it has vast economic potential. Nearly 50% of the aquatic plants of the world are recorded from the Indian sub-continent but only a few have been studied in detail. In order to address some of these concerns, a National Institute on Mangroves and Coastal Bioresources is being set up by the MoEF in Sunderbans. Human induced changes in terrestrial ecosystems have been adversely impacting the marine biodiversity too. Efficient management system for marine protected areas is lacking. Documentation, conservation and sustainable utilization of marine biodiversity are urgently needed. In India, conservation biology studies have been carried out only on a few marine organisms (viz. estuarine crocodiles, olive ridley, leather back and hawkbill turtles). Other important life forms such as coral reefs, sea horses, sea cucumbers, dolphins, dugongs, whales, sharks, mollusks and crustaceans have not been properly studied so far. Information on several taxa is insufficient to categorise them as extinct, endangered, vulnerable or rare. This is mainly

because of the lack of expertise on specific groups, lack of resources to work on groups having only scientific importance, lack of coordination in exchanging data, and lack of proper technology in culturing/growing the organisms.

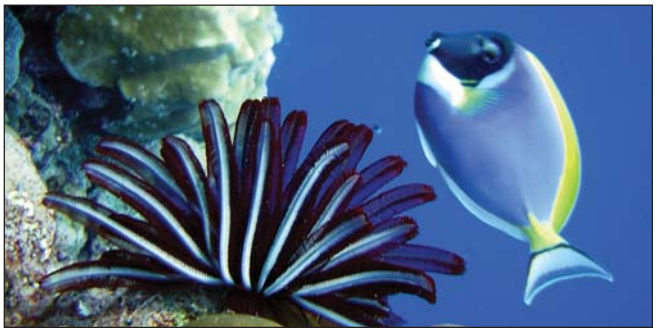
It is evident that the taxonomists are ageing and declining in number and there is insufficient expertise in identification of several groups of organisms mainly because of failure in transferring the capacity in taxonomic identification to the next generation. Similarly, the frontline forestry staff requires training for equipping them for undertaking research and monitoring activities.

India has a strong base of indigenous knowledge on various aspects of biodiversity including that of coastal and marine biodiversity. This traditional knowledge has to be scientifically validated through screening of biological diversity for commercially valuable products, so as to make bio-prospecting useful and effective. Department of AYUSH through its research councils is undertaking validation of traditional systems of medicines.

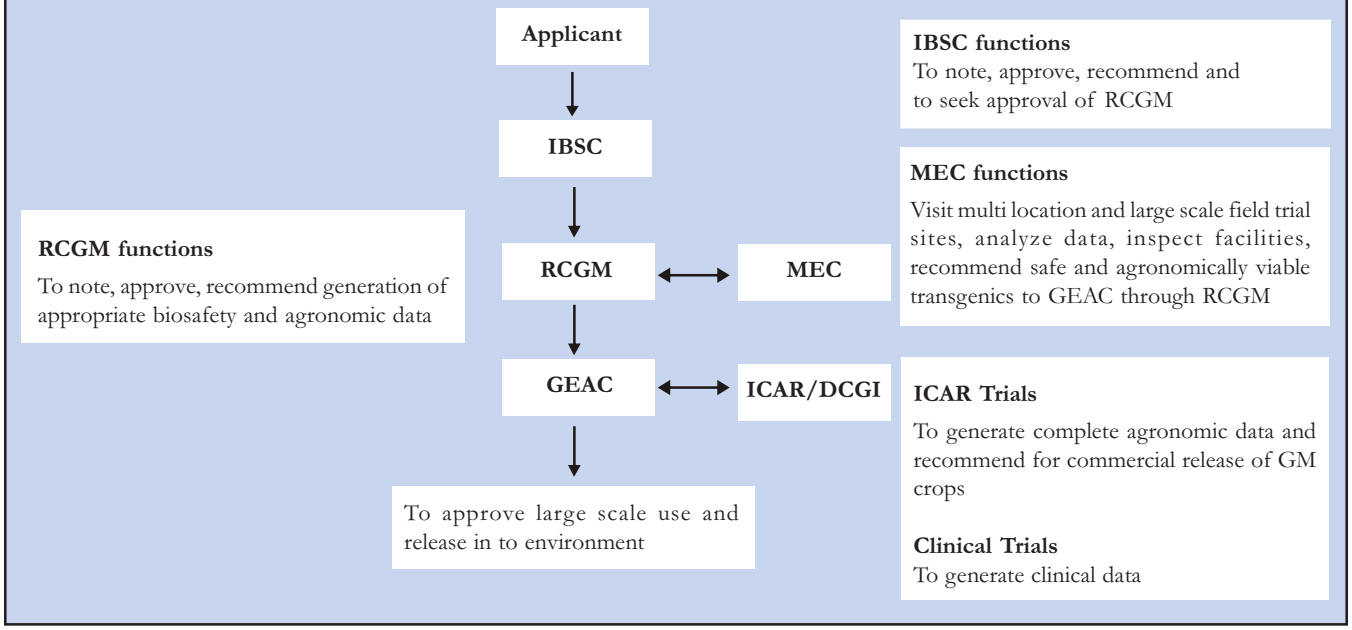
Our understanding of the underlying causes of the loss of biodiversity is incomplete as is the assessment of the consequences of such a loss for the functioning of ecosystems. Available data does not help in unequivocally establishing cause-effect relationships. There is also a lack of any widely accepted indicator(s) of biodiversity. We need to strengthen institutional framework and human capacity to generate new knowledge, create greater awareness on the linkages of biodiversity with other components of our life-support system, and apply scientific solutions to the problem of erosion of species and genetic diversity. The loss is allied with increasing human demands and decreasing productivity in ecosystems.

3.7 New and emerging biotechnologies

Development and introduction of transgenic or genetically modified organisms (GMOs), developed through the use of r-DNA technology , are already in the process of revolutionising all facets of human life, be it agriculture, industry or health care. Significant investments in biotechnology research have been made in India and many research projects are at advanced stages of development. About 20 recombinant therapeutics and a transgenic crop, Bt cotton, have already been approved for commercial use in the country. The area under Bt cotton cultivation has increased substantially in the last six years. Further,



Box 2: Procedures Involved in the Approval of GMOs in India



11 transgenic crops are under various stages of field trials. Among various biosafety issues, there are concerns with respect to impact on biodiversity.

A multi-tiered mechanism is already in place in India to evaluate and regulate such organisms and their products **(Box 2)**. However, the long-term impact of introduction of transgenics on biodiversity, particularly on genetic diversity of domesticated animals and crops, is far from clear. The sheer magnitude of potential benefits of transgenics, and the perceived fears of their possible harmful consequences, call for urgent steps to review the existing mechanisms and protocols for biosafety assessment of transgenic organisms on a continuous basis.

The application of Genetic Use Restriction Technologies (GURTs) or terminator technologies is prohibited and import of GURTs based products is also banned in the country **(Box 3)**. Hence, there is a need to further develop state-of-the-art containment facilities and diagnostic tools for GURTs in the country.

Policies and programmes, aimed at securing biotechnological capacity building of the country for realizing the actual and potential value of biodiversity, along with its conservation, also need to be strengthened.

3.8 Economic valuation and natural resource accounting

Sensitivity to conservation issues and decision making has been 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 long run. Despoilers of environment will not find it economically viable if an economic value is put on the goods and services provided by the ecosystem. In India, natural resource accounting systems are likely to play an important role in decision-making and resource allocation in the future. However, such systems are still evolving and easily usable methods are not yet available. Cess, user charges and other fiscal instruments are to be used to confer value on biological resources. Among other things, an overt objective of such suggestions is to generate revenue,

Box 3 : Genetic Use Restriction Technologies

GURT, also called terminator technology, is a biotech-based strategy that prevents seeds from germinating in the next growing season unless treated chemically by the seed company prior to planting. When seeds of crop varieties (containing this kind of genetic manipulation) are purchased from the company and planted, they germinate and grow normally but produce seeds that do not germinate when saved by the farmers for sowing during the following season. Thus, healthy and high yielding plants are genetically commanded to produce 'sterile' seeds preventing the farmers to use them for the next season's planting. The technology was first developed by the Delta & Pine Land, a multinational seed company, and the US Department of Agriculture. If commercialized, 'terminator' would compel farmers to purchase fresh seeds from the company every year. It is bad for agricultural biodiversity and worse for the small and marginal farmers.

Farmers have to purchase seeds of high yielding hybrid varieties because seeds produced by the hybrid plants are not uniform and their production capacity decreases in successive seasons. Hybrid varieties are not yet popular in self-fertilised crop plants like wheat and rice whose seeds are normally replaced after five years or so and that too on exchange among the farmers. Multinational seed companies intend to prevent this traditional practice through GURTs.

It is noteworthy that India opted to enact its sui generis system (PPVFR Act 2001) for protection of crop varieties as required under the WTO-TRIPS provisions. The Indian system is largely compliant to an accepted international system for variety protection, called UPOV 1978, that permits farmers to use saved-seeds and also exempts researchers in using seeds of protected varieties. These two exemptions distinguish this system from its more recent version called UPOV 1991 which does not permit them and operates more like the patenting system. GURTs can be employed to achieve this objective without the need to seek protection or patenting of new seed varieties.

The International Agricultural Research Centre, operating under CGIAR, decided in 2000 against the use of this technology and India was the first country to block its entry. The Government of India has further strengthened this action through Protection of Plant Varieties and Farmers' Rights Act, 2001. Its section 29 (3) states that "Notwithstanding anything contained in sub-section (2) and sub-sections (1) and (3) of section 15, no variety of any genus or species which involves 'any technology' injurious to the life or health of human beings, animals or plants shall be registered under this Act. For the purposes of this sub-section, the expression "any technology" includes genetic use restriction technology and terminator technology."

which could provide much needed financial support for biodiversity conservation programmes. However, feasibility and the eventual usefulness of these controls and fiscal instruments deserve evaluation.

3.9 Policy, legal and administrative measures

Although a number of policy, legal and administrative measures are in place to address various aspects of biodiversity conservation [including Wildlife (Protection) Act, 1972, Forest (Conservation) Act, 1980, Biological Diversity Act, 2002, etc.], there is need to promote greater harmony and synergy in these measures. Another major identified gap is lack of effective enforcement of existing laws. For tribal dominated areas, the implementation of existing laws is to be gauged in the light of sixth schedule of the Constitution.

Further, role of macro-economic policies and measures on biodiversity is least understood. Policies, which directly or indirectly work as incentives for indiscriminate use of biodiversity, are insensitive to biodiversity concerns. On the other hand, biodiversity

and wildlife conservation policies that rely on denying people access to their natural resource base can inflict hardships on the poor, as there is no accounting of the costs of conservation thrust on them for the benefit of distant interest groups. There is a need to promote people's participation and, solicit their cooperation, particularly of those living inside the Protected Areas (PAs) and fringe areas.

Some of the good practice initiatives taken by the Ministry of Environment and Forests include

rationalizing and streamlining the processes for environmental and forestry clearances for achieving greater transparency and inducting expertise in decision-making, and for ensuring that decisions are taken within a fixed time frame on each proposal. In addition, some developmental schemes of the Ministry have provision for entry point activities which include providing supplementary and alternative livelihood support, and creation of minor infrastructure facilities such as construction of paths and roads, jetties, drinking water, medical and health, irrigation facilities, etc., with the objective of improving the quality of life of people living in and around forests.

Even though the Biological Diversity Act was enacted in 2002, and the Rules notified in 2004, its provisions are yet to be fully and effectively implemented. This progressive legislation has the potential to address the lacunae in several aspects relating to conservation and management of biodiversity and associated traditional knowledge. However, its implementation is proving to be quite challenging.

The Act provides for setting up of a National Biodiversity Authority (NBA) at national, State Biodiversity Boards (SBBs) at state and Biodiversity Management Committees (BMCs) at local levels. The Act also stipulates preparation of People's Biodiversity Registers (PBRs) by the BMCs involving local people and with guidance from SBBs and NBA, for documenting traditional knowledge relating to biodiversity. The preparation of PBRs across the country is an enormous task. Further, it has many limitations. The programme is being implemented in a phased manner after addressing the limitations. The institutes/agencies which have already initiated such programmes should be strengthened to complete the task in States where the programme has made some progress. SBBs and BMCs should be set up in all the States and local bodies, respectively.

The documentation of traditional knowledge available in our ancient texts is being undertaken by Council of Scientific and Industrial Research (CSIR), in the form of a computerized database called Traditional Knowledge Digital Library (TKDL). Preparation of PBRs is expected to document the un-coded oral traditional knowledge of local people. Considering that this would be a stupendous and time-consuming exercise, there is a need for an All India Coordinated Project on Traditional Knowledge for documenting the un-coded, oral traditional knowledge of local people, especially of little-known bioresources of potential economic value.

3.10 Institutional framework and capacity building

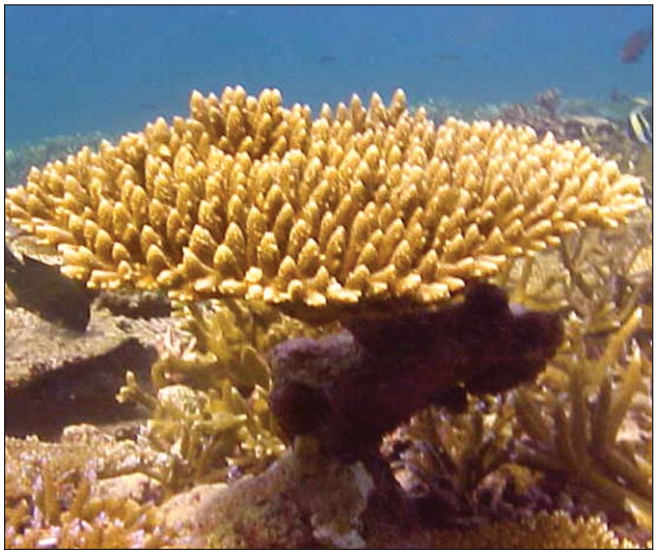
A reasonably sound institutional infrastructure is in place for adequate coverage of biodiversity concerns with specific mandates and activity profiles of existing institutes. However, there is a need for improving intersectoral coordination inter alia through continuous review and revision of their mandates, and networking of these institutions to ensure adequate coverage of biodiversity concerns and issues and also to avoid duplication/overlapping of efforts.

There is a need for human resource development and capacity building for scientific management of biodiversity. Capacity building in taxonomy requires particular attention since taxonomists are rapidly declining in number when the need for taxonomic stocktaking of earth's biodiversity is becoming increasingly important and urgent. Many groups of biota are yet to be catalogued, while biodiversity losses are rampant. The implementation of Biological Diversity Act and National Environmental Policy 2006 would be difficult without having adequate number of trained taxonomists.

CHAPTER 4

OBJECTIVES

The objectives of the NBAP, enumerated in the paragraphs that follow, are founded in the backdrop of the cardinal principles already set out in the NEP 2006. The most important of these principles is that human beings are at the centre of sustainable development concerns. The other relevant principles on which the objectives are premised include: right to development; precautionary approach; economic efficiency; entities with 'incomparable' value **(Box 4)**; equity; public trust doctrine; decentralisation; integration; preventive actions; and environmental offsetting. These principles, which have an established genecology, provide the necessary overall guidance for the implementation of the objectives. The objectives are broad-based and relate to current perceptions of key threats and constraints to biodiversity conservation. These may accordingly evolve over time. The objectives are to be realized through various strategic interventions by different public authorities at central, state and local government levels. They are also to form the basis of diverse partnerships.



4.1 Strengthening and integration of *in situ*, on-farm and *ex situ* conservation

- To protect and conserve through *in situ*, on-farm and *ex situ* conservation, major national bio-geographic zones, critical ecological systems and genetic resources, which are essential for life support, livelihoods, food and nutritional security; and are in consonance with the national economic growth and broad conception of human well-being.

4.2 Augmentation of natural resource base and its sustainable utilization: Ensuring inter and intra-generational equity

- To promote holistic approach to conservation, enhancement and sustainable utilization of biodiversity, providing access to bioresources for all sections of society, in particular the economically poor, who are directly dependent on them, thereby ensuring inter- and intra-generational equity.

4.3 Regulation of introduction of invasive alien species and their management

- To develop unified national system for regulation of all introductions including their quarantine check, assessment and release.
- To improve management of invasive alien species and restore the adversely affected ecosystems.

4.4 Assessment of vulnerability, and adaptation to climate change and desertification

- To develop appropriate tools, methodologies and indicators of impact of climate change, and desertification at the national level.

- To assess vulnerability of various important national economic sectors to global threats such as climate change and desertification.
- To devise appropriate strategies for mitigating the impact of and adaptation to climate change, and desertification.

4.5 Integration of biodiversity concerns in economic and social development

- To integrate biodiversity concerns into policies, plans, programmes and projects for economic and social development.
- To achieve sustainable development based on protection, enhancement and management of biological resources.

4.6 Pollution impacts

- To prevent, minimize and abate impacts of pollution from point and non-point sources on various components of biological diversity, keeping in view cost minimization, polluter-pays principle, and imperatives of international trade and investment.

Box 4: Entities of Incomparable Values

The National Environmental Policy (NEP) 2006 while defining the basic principles of environmental conservation and management, emphasizes need for priority allocation of societal resources for conservation of Entities of Incomparable Value (EIV), both natural and man-made, which may impact the well-being, broadly conceived, of a large number of persons. The country has already taken several measures to protect and conserve environmental life-support systems, besides certain other natural and human-made entities, and cultural heritages, which impact present and the future well-being and happiness of individuals and communities.

Some of the ecologically rich and sensitive areas are currently covered through the protected areas (PA) network and eco-sensitive zones, deriving power under diverse legal instruments and/or regulatory frameworks but the provisions of extant legal instruments have not been translated into regulatory frameworks and guidelines, and they do not fully cover certain EIVs such as biosphere reserves, natural heritage sites and man-made monuments, wetlands, mangroves, and sacred groves. It has therefore become necessary to set up a harmonized system for identification, constitution, rationalization and management of the diverse EIVs under a unified regulatory framework within the ambit of Environment (Protection) Act, 1986.

Taking into account the concerns expressed in the NEP and requirements for a specific regulatory framework, an EIV is defined as follows:

'Entities of Incomparable Values are sites containing unique natural or man-made entities, (living and/or non-living), that provide critical life support environmental services and/or are essential for the well-being, broadly conceived, of a large number of people of present and future generations.'

Criteria for Identification of EIV are:

a. Unique biodiversity (genetic, species and ecosystem). It includes species and ecosystems characterized by endemicity, rarity and representativeness (such as relevant components of biosphere reserves, natural heritage sites and other fragile ecosystems).
b. Life support systems (water, soil, geology, glaciers) impacting the well-being and health of large number of people, i.e. at least 100,000 population.
c. Entities of cultural, aesthetic and religious significance to a large number of people, i.e. at least 1,00,000 people.
d. Large economic potential in the context of specific unique natural resources to be conserved i.e. at least 25 crores potential annual income at 2007 prices and/or major livelihood support to 1,00,000 population.
e. Natural entities providing eco-system resilience.

4.7 Development and integration of biodiversity databases

- To collect, collate and integrate biodiversity information from diverse sources into a national database on different components of biodiversity with distributed networking systems and linkages.
- To intensify the survey, identification and inventorization of country's floristic, faunal and microbial resources with special attention to hitherto unexplored areas, and keystone, umbrella, endangered and endemic species which need to be conserved on priority basis.

4.8 Strengthening implementation of policy, legislative and administrative measures for biodiversity conservation and management

- To review and update the extant policy, legislative and administrative measures for conservation and management of biological diversity.
- To promote greater harmony, synergy and linkages among extant policy, legal and administrative measures for conservation and management of biological diversity and associated traditional knowledge.
- To accelerate effective implementation of provisions of Biological Diversity Act and Rules with special attention to protecting the traditional knowledge (both codified and un-codified), innovations and practices, and encouraging their use, while ensuring equitable sharing of benefits arising out of their use as stipulated under the CBD.

4.9 Building of national capacities for biodiversity conservation and appropriate use of new technologies

- To promote human resource development, institutional strengthening and capacity-building for biodiversity conservation and management with special attention to taxonomy and conservation biology.
- To build institutional and human capacity for biosafety, inter alia for undertaking risk assessment and management of genetically modified organisms.

- To increase public education, awareness and participation in decision making, management and sustainable use of biological resources.
- To promote targeted research in critical gap areas pertaining to biodiversity conservation and management.
- To ensure higher resource flows, comprising finance, technology management skills, traditional knowledge, and social capital, for biodiversity conservation through mutually beneficial mutlistakeholder partnerships between local communities, public agencies, the academic and research community, investors, and multilateral and bilateral development partners.
- To review and strengthen ongoing training, extension and on-site demonstration programmes at requisite levels to incorporate directed focus to conservation.

4.10 Valuation of goods and services provided by biodiversity and use of economic instruments in decision making processes

- To assign appropriate market value to the goods and services provided by various ecosystems and strive to incorporate these costs into decision making, management and sustainable utilization of biological diversity resources.

- To factor in natural resource accounting (NRA) in the national economic planning processes and encourage financial institutions to adopt appropriate NRA appraisal practices so that risks to biological diversity are adequately considered in the financing of projects.
- To facilitate integration of biodiversity concerns into cost-benefit analysis with a view to encouraging more efficient allocation of resources while making public investment decisions.

4.11 International cooperation

- To consolidate and strengthen bilateral, regional and multilateral cooperation on issues related to biodiversity

CHAPTER 5

ACTION PLAN

In the sections that follow, broad action points have been listed corresponding to the areas identified in Chapter 3. These are envisioned to be achieved in the backdrop of extant national policy framework and a large number of programmes and activities, currently underway in different Departments and Ministries of the central and state governments, complemented by NGOs and civil society organizations working in the field of biological diversity. In the long-term perspective, the state governments and Panchayati Raj Institutions would be encouraged to undertake their own action programmes consistent with the present NBAP under the overall ambit of the NEP. In the short-term perspective (eleventh plan period), the actions required, the functionaries, and corresponding capacities for attending to the major, imminent gap areas have been described. These action points are certainly not exhaustive and are intended to facilitate the process of conservation of biodiversity in the country. This is an iterative and dynamic process, which will continue to evolve on its own with experience.

5.1 Strengthening and integration of *in situ*, on-farm and *ex situ* conservation

A total of 605 Protected Areas covering approximately 4.74% of the total geographical area of the country are under *in situ* conservation through a PA network of National Parks (96), Wildlife Sanctuaries (509), and Conservation Reserves (3), established under the Wildlife (Protection) Act. A state-wise list of National Parks and Wildlife Sanctuaries in the country is given in **Table 6**. As may be seen in this table, the top five states in terms of PA coverage are Gujarat, Maharashtra, Jammu & Kashmir, Andhra Pradesh and Madhya Pradesh. The PA network covers about 24.2% of the forest area of the country, mainly with relatively larger populations of target species and associated ecological components. Many important habitats exist in the rest of the forests, which require special attention for conservation for ensuring sustainability of the populations. Habitats of sandalwood, red sanders, shola forests of southern tropical montane forests, alpine meadows in the Himalayan region, elephant habitats including corridors connecting PAs, southern tropical rain habitats, tropical swamps, mangroves outside forests in Sunderbans, etc., are some of such habitats existing in the forests outside the PAs. Hence, in the eleventh five year plan, it is envisaged to take up a new component for protection of wildlife outside PAs under the centrally sponsored scheme on 'Integrated development of wildlife habitats'.

Substantial chunk of India's biodiversity exists outside the precincts of 'formally declared conservation zones', which are owned and managed by the local communities. The livelihood security of these communities is delicately and intricately interwoven with the prudent resource management and conservation status of these areas. Further, any future plans to expand the Protected Area network in India,

would depend significantly in recognizing such Community Conserved Areas. Recent amendments to the Wildlife (Protection) Act provide for setting up of Community and Conservation Reserves. Voluntary relocation of villagers from critical habitats of PAs contributes to enhancing the quality of habitat for wildlife and also the quality of living for villagers by facilitating better access to mainstream development.

To conserve the representative ecosystems, a Biosphere Reserve (BR) programme is being implemented. Fifteen BRs have been notified, of which four have been recognized by the UNESCO under the World Network of BRs **(Table 7)**. Fourteen more potential sites have also been identified for this purpose.

Table 6: State-wise Details of the Protected Area Network of the Country

S.No.	States/UTs	No. of National Parks	No. of Wildlife Sanctuaries
1.	Andhra Pradesh	4	22
2.	Arunachal Pradesh	2	11
3.	Assam	5	20
4.	Bihar	1	11
5.	Chhattisgarh	3	10
6.	Goa	1	07
7.	Gujarat	4	21
8.	Haryana	2	10
9.	Himachal Pradesh	2	32
10.	Jammu & Kashmir	4	16
11.	Jharkhand	1	10
12.	Karnataka	5	21
13.	Kerala	6	13
14.	Madhya Pradesh	9	25
15.	Maharashtra	6	35
16.	Manipur	2	05
17.	Meghalaya	2	03
18.	Mizoram	2	07
19.	Nagaland	1	03
20.	Orissa	2	18
21.	Punjab	Nil	10
22.	Rajasthan	5	23
23.	Sikkim	1	06
24.	Tamil Nadu	5	20
25.	Tripura	Nil	04
26.	Uttar Pradesh	1	23
27.	Uttaranchal	5	06
28.	West Bengal	6	15
29.	Andaman & Nicobar	9	96
30.	Chandigarh	Nil	02
31.	Dadar & Nager Haveli	Nil	01
32.	Lakshadweep	Nil	01
33.	Daman & Diu	Nil	01
34.	Delhi	Nil	01
	Total	**96**	**509**
	GRAND TOTAL	**605**	

Table 7: Biosphere Reserves in India

S. No.	Name of the Biosphere Reserve & total Geographical Area (km^2)	Date of Notification	Location (State)
1.	**Nilgiri (5520)**	01.08.86	Parts of Wynad, Nagarhole, Bandipur and Madumalai, Nilambur, Silent Valley & Siruvani hills (Tamil Nadu, Kerala & Karnataka)
2.	**Nanda Devi (6497.03)**	18.01.88	Parts of Chamoli, Pithoragarh & Almora Districts and Valley of Flowers (Uttarakhand)
3.	Nokrek (820)	01.09.88	Parts of Garo Hills (Meghalaya)
4.	Manas (2837)	14.03.89	Parts of Kokrajhar, Bongaigaon, Barpeta, Nalbari, Kamprup and Darang Districts (Assam)
5.	**Sunderbans (9630)**	29.03.89	Parts of delta of Ganges & Brahamaputra river system (West Bengal)
6.	**Gulf of Mannar (10500)**	18.02.89	Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu)
7.	Great Nicobar (885)	06.01.89	Southern most islands of Andaman and Nicobar (A&N Islands)
8.	Similipal (4374)	21.06.94	Parts of Mayurbhanj district (Orissa)
9.	Dibru-Saikhowa (765)	28.07.97	Parts of Dibrugarh and Tinsukia districts (Assam)
10	Dehang Debang (5111.5)	02.09.98	Parts of Siang and Debang valley in Arunachal Pradesh
11	Kanchanjunga (2619.92)	07.02.2000	Parts of North and West Sikkim.
12.	Pachmari (4926.28)	03.03.99	Parts of Betur, Hoshangabad and Chindwara districts of Madhya Pradesh.
13.	Agasthyamalai (3500.36)	12.11.2001 (area expanded on 30.03.2005)	Parts of Thirunelveli and Kanyakumari Districts in Tamil Nadu and Thiruvanathapuram, Kollam and Pathanamthitta.
14.	Achanakmar-Amarkantak (3835.51)	30.03.2005	Parts of Anuppur and Dindori districts of Madhya Pradesh and Parts of Bilaspur district of Chhattisgarh State
15.	Kachch (12454)	29.01.2008	Parts of Kachch, Rajkot, Surendranagar and Patan district of Gujarat

**Sites with bold letters have been recognized by UNESCO on World Network of Biosphere Reserves.*

Specific programmes for scientific management and wise use of fragile ecosystems such as wetlands, mangroves and coral reef are under implementation **(Table 8)**. Internationally significant wetlands are declared as Ramsar sites under the Ramsar Convention **(Figure 1)**. Under the World Heritage Convention, natural sites are declared as world heritage sites.

Table 8: Statewise Distribution of Wetlands under National Wetland Conservation Programme

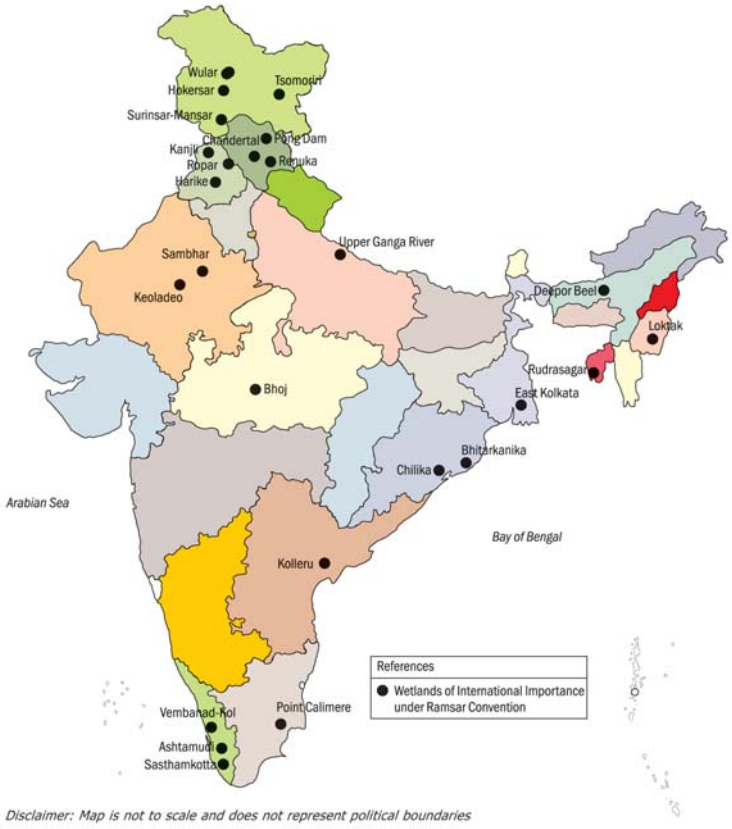
State	Number of Wetlands	Area (ha)
Andhra Pradesh	1	90100
Assam	2	4504
Bihar	3	11490
Chandigarh	1	148
Gujarat	8	1270875
Himachal Pradesh	5	15739
Haryana	2	288
Jammu and Kashmir	10	120450
Jharkhand	2	98965
Karnataka	7	4297
Kerala	5	213229
Madhya Pradesh	12	359814
Maharashtra	3	40298
Manipur	1	26600
Meghalaya	1	22150
Mizoram	2	185
Orissa	4	120407
Punjab	4	5965
Rajasthan	1	24000
Sikkim	6	164
Tamil Nadu	3	46283
Tripura	1	240
Uttar Pradesh	12	14080
Uttarakhand	2	1244
West Bengal	6	553099

A National Lake Conservation Plan (NLCP) is being implemented for conservation of polluted and degraded urban/semi-urban lakes, leading to lake rejuvenation in terms of improvement in water quality and biodiversity. As on March 2007, 31 projects for conservation of 46 lakes have been taken up **(Table 9)**. A National River Conservation Plan (NRCP) is also under implementation in 160 towns along polluted stretches of 34 rivers spread over 20 states, the major rivers being Ganga, Yamuna, Gomti, Damodar, Satluj, Krishna, Cauveri and Godavari. The objective of NRCP is to check pollution in rivers through implementation of various pollution abatement schemes.

Table 9: List of 31 Projects for Conservation of 46 Lakes as on March 2007

S.No.	Lake	State
1.	Banjara	Andhra Pradesh
2.	Dal Lake, Srinagar	Jammu & Kashmir
3.	3 lakes of Bangalore namely Vengaiahnkere, Nagavara and Jarganahalli	Karnataka
4.	Bellandur lake, Bangalore	Karnataka
5.	Kotekere, Belgaum	Karnataka
6.	Bhishma, Gadag	Karnataka
7.	Lal Bagh, Bangalore	Karnataka
8.	Sharanabasveshwara	Karnataka
9.	Akkamahadevi, Haveri	Karnataka
10.	Chanapatna, Hasan	Karnataka
11.	Veli Akkulum, Thiruvananthapuram	Kerala
12.	Powai	Maharashtra
13.	9 lakes in Thane	Maharashtra
14.	Mahalaxmi lake, Vadagaon	Maharashtra
15.	Mansagar, Jaipur	Rajasthan
16.	Ooty	Tamil Nadu
17.	Kodaikanal	Tamil Nadu
18.	3 lakes of Agartala	Tripura
19.	4 lakes of Nainital District	Uttarakhand
20.	Nainital lake	Uttarakhand
21.	Rabindra Sarovar, Kolkata	West Bengal
22.	Mirik	West Bengal
23.	Bindusagar, Bhubaneswar	Orissa
24.	Kundwad lake, Davengere	Karnataka
25.	Rani Talab, Riva	Madhya Pradesh
26.	Kotetavarekere, Chickmaglore	Karnataka
27.	Tripuranthekeshwar, Bidar	Karnataka
28.	Rankala, Kolhapur	Maharashtra
29.	Varhala Devi, Bhiwandi	Maharashtra
30.	Sagar, Sagar	Madhya Pradesh
31.	Mansi Ganga	Uttar Pradesh

Figure 1: Identified Ramsar Sites in India



Source: Conservation of Wetlands in India: A Profile, Ministry of Environment & Forests, Government of India, 2007

Box 5: Great Indian Bustard *(Ardeotis nigriceps)*

Indian Bustard *(Ardeotis nigriceps)*, alternate scientific name *Choriotis nigriceps,* is found in the short grass plains and desert plains of west Rajasthan and Gujarat. This bird is on the endangered red list of IUCN due to its small and declining population. Indian bustard is the most endangered member of the bustard family in the world and the total population in wild may not exceed 700.

Threats to the Great Indian Bustard (GIB) include degradation of grasslands due to development works, habitat fragmentation, expansion of agriculture, conversion of grasslands into other forms of land cover and change of floral composition of grasslands including conservation of grasslands and woodlands, habitat degradation due to invasive species and general increase in anthropogenic pressures.

Various conservation measures being undertaken include population and habitat monitoring exercises and awareness raising among people, policy makers, managers and other stakeholders. The MoEF has sanctioned a project to GEER Foundation, Gujarat for monitoring GIB population in Gujarat. BNHS is also engaged in research and population monitoring of GIB. With the above conservation measures, it is hoped that the conservation of Great Indian Bustard would be ensured in the long run.

Intensive conservation measures for other flagship species such as snow leopard, musk deer and Kashmir stag will be taken up during the eleventh five year plan. Gene sanctuaries for preserving the rich native diversity of citrus, banana, rhododendron and orchids have also been established. Measures undertaken for conservation of Great Indian Bustard and vultures are presented in **Box 5** and **Box 6,** respectively

Subsequent to amendments to the Wildlife (Protection) Act in the year 2006, National Tiger Conservation Authority and Wildlife Crime Control Bureau have been constituted.

Box 6: Vulture Crisis in India and Steps Taken for its Conservation

The following nine species of vultures are found in India:

1. White-rumped Vulture
2. Long-billed Vulture
3. Slender-billed Vulture
4. Red-headed (king) Vulture
5. Egyptian Vulture
6. Himalayan Griffon
7. Eurasian Griffon
8. Cinereous Vulture
9. Lammergier Vulture

It is believed that the population of three Gyps vultures (white-rumped vulture, long-billed vulture, and slender-billed vulture) has declined by about 95% since early 1990s in the Indian sub-continent. India too is witnessing this catastrophic vulture crisis, which is largely due to:

- Food scarcity caused by changes in disposal practice of dead cattle in developed areas, cities, etc., coupled with competition with other scavengers such as stray dogs, etc., whose populations have increased.
- Decline in the number of tall trees preferred by vultures for nesting and roosting.
- Anthropogenic pressures, industrialization, urbanization, etc.

Various measures initiated for conservation of vultures in India include awareness raising among people, policymakers, veterinarians and other stakeholders, establishment of two Vulture Breeding Centres in Haryana and West Bengal (a new Vulture Breeding Centre has been approved for Gujarat) and initiation of population monitoring of vultures. During 2005, state wide Gyps vulture population survey was carried out in Gujarat by GEER Foundation and 2,647 Gyps vultures were found in the state. The Ministry had also formulated an "Action Plan for Vulture Conservation in India" in April 2006. The population survey was repeated in 2007 under a project sanctioned by the MoEF. These measures would help in the revival of vulture population in the country.

In situ conservation of medicinal plants is being undertaken by various government and non-government organizations. A National Medicinal Plants Board was set up under a government resolution notified on 24th November 2000 under the Ministry of Health and Family Welfare to promote coordination and implementation of policies relating to medicinal plants both at the Central and State levels. There is a need to study the agronomy of medicinal plants to develop agro-techniques for their cultivation. Cultivation of medicinal and other economically important plants can also be promoted through home herbal and kitchen gardens, resident welfare associations in urban and semi-urban areas, village commons, etc.

This research component can be taken up by national institutions, universities, including state agricultural universities. The cultivation of medicinal plants can be taken by the State Forest Departments within the forests where they occur naturally or on lands situated close to their native habitat ranges.

Forest Departments should be strengthened by the MoEF to implement these programmes. Planting of trees of medicinal value on waste lands should be encouraged. This can be implemented through National Afforestation and Eco-Development Board. Bio-prospecting of native medicinal plants (nearly 6,500 species) needs to be undertaken on a priority basis. It can be done through institutions like National Institute of Pharmaceuticals Education and Research (NIPER), Chandigarh, CSIR labs, such as Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow, National Botanical Research Institute (NBRI), Lucknow and India Institute of Integrative Medicine [(IIIM) (formerly known as RRL, Jammu)] which are at present concentrating only on 40-45 species. Their mandate should be enlarged to embrace all highly traded endemic medicinal plants. Simultaneously, the ICAR system should work on developing agro-technologies for bringing the endemic medicinal plants into the fold of cultivation. Growing medicinal plants should also receive priority in urban plantation programmes. This would reduce pressure