



Sectoral Integration of Biodiversity in India

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1. Introduction

India reported¹ that India, over the past 60 years, is witnessing transition from predominantly rural based agrarian society into a diversified economy. India's planned approach to socio-economic development and poverty eradication has underlined sustainability of natural resources. Conservation and resource management is integral to India's development plans. A sound environmental policy and legal framework is in place in the country. Recent economic liberalization policies have seen new strides in technology upgradation, cleaner fuels, efficiencies in production and environmentally sound practices. The planning process also seeks to diversify the economy further into industrial and service sectors, while accelerating the growth rate. Development has to be long-standing and inclusive, involving both the private and public sectors as partners. The national planning process emphasizes promotion of people's participatory institutions and social mobilization, particularly through empowerment of women and other disadvantaged sections of the society, for ensuring environmental sustainability of the development process. Socio-economic development consists of increase in the production, distribution, sale and consumption of food, goods and services. The planning process in India seeks to increase wealth, and thereby, human welfare, and provide a safety net for the environment.

In this background, India is continuing its efforts and taking effective and appropriate measures to integrate biodiversity concerns into relevant sectoral and cross-sectoral plans, programmes and policies in conformity with the provisions of the CBD.

The objective of mainstreaming biodiversity is "to internalize the goals of biodiversity conservation and the sustainable use of biological resources into economic sectors and development models, policies and programmes, and therefore into all human behaviours" (GEF, 2004). The significant elements of mainstreaming biodiversity in overall developmental sectors are as follows:

- ☐ In production landscapes/seascapes and within economic sectors related to natural resource use, such as agriculture, forestry, fisheries, IAS control, wildlife conservation, ecotourism, etc.
- ☐ Integration of biodiversity values into enabling environment (policy, legislation, programmes, activities that inter alia include land use planning, economic incentives, international trade, capacity building, research and technology).
- ☐ Involvement of diverse stakeholders through partnerships of NGOs, community groups, government, entrepreneurs and industry.
- ☐ Sustainability of PA network through rationalization, consolidation and expansion.

¹ India (2009). India's Fourth National Report to the Convention on Biological Diversity, Ministry of Environment and Forests, New Delhi, 2009, 144 pp.

- ☐ Regional and international cooperation for conservation and management of biodiversity through various extant and evolving bilateral agreements and MEAs.

2 mainstreaming biodiversity in production landscapes/seascapes and sectors

2.1 Agriculture

Some illustrative examples undertaken for mainstreaming agro-biodiversity are as under:

- ☐ The National Policy for Farmers 2007 (Box.1) underpins the importance India accords to the integration and mainstreaming of agro-biodiversity considerations.

Box 1: Objectives of National Policy for Farmers (2007)

- ☐ Protect and improve land, water, biodiversity and genetic resources essential for sustained increase in productivity, profitability and stability of major farming systems by creating an economic stake in conservation.
- ☐ Strengthen the bio-security of crops, farm animals, fish and forest trees, etc.
- ☐ Address major constraints experienced by farmers related to breed, feed and fodder, healthcare and remunerative prices for that produce.
- ☐ Management and economic use of the EEZ for a variety of economic activities, including fisheries.

☐ The PPV&FR Act, 2001 recognizes and protects the rights of farmers for their contributions in conserving, improving and making available plant genetic resources for the development of new plant varieties and has created a corpus fund called national gene fund, for the conservation and development of plant genetic resources and benefit sharing.

☐ The MoA established PPV&FR Authority to deal with issues of recognizing and protecting the rights of farmers. PPV&FR has awarded five farming communities/farm families with the certificate of “Plant Genome Savior Community Recognition” in February 2007.

☐ India ratified the ITPGRFA in June 2004. Its coverage includes 35 crop genera and 29 forage crops and establishes the multilateral system for the facilitated access to plant genetic resources for food and agriculture, including fair and equitable benefit sharing arrangements.

☐ India is one amongst the seven Asian countries to have signed an agreement with Food and Agricultural Organization (FAO) to participate in the regional cooperative project “Establishment of the National Information Sharing Mechanism on the Implementation of the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (PGRFA) in Asia and the Pacific Region”. The project aims at promoting the implementation of Global Plan of Action

(GPA) at national and regional levels and mechanism for gathering and sharing information, as well as priority setting for GPA implementation.

☒ India has acceded to the agreement for the establishment of GCDT in October 2006 (www.croptrust.org).

☒ Various centres of ICAR and ICFRE are actively involved in Integrated Pest Management (IPM) programmes, which include, IPM of mandated species in nurseries and plantations with special reference to bio-pesticides and microbial pesticides; upgradation and computerization of National Insect Reference Collection (NIRC); management of potential insect pests and diseases of important medicinal plants grown in arid and semi-arid regions, ecological studies of seed insect pests; relative resistance of neem provenances to insect pests and mites, and their bio-management in arid areas.

☒ The MoA is promoting organic farming which supports greater biodiversity than comparable systems. An example of the State of Sikkim illustrates the point (Box 2).

Box 2: Sikkim – One of the organic states

- ☒ Substantially reduced subsidy on chemical fertilizers
- ☒ Two Government farms converted to Centres of Excellence for organic farming - Nazitam (East District) and Melli Dara (South District); selected 100 bio-villages with EM technology in 2006-07 increasing the acreage from 3000 acres to 6500 acres which means 26,000 tonnes of EM compost and 65 tonnes of bokashi used in the field; Additional 100 numbers of villages have also been included for conversion into bio-village through EM technology.
- ☒ Encouraging farmers for the production of rural compost on massive scale by providing necessary assistance; assistance is being provided to about 5,500 farmers to develop the compost units in their fields.
- ☒ The use of bio-fertilizers is being propagated through demonstration on the farmers' fields. A biofertilizer production unit is already constructed at Mazitar using the funds provided by NEC; undertaking capacity building of the officers and field functionaries in organic farming and seed production.

In response to India's National Policy on Agriculture, two projects that follow ecosystem approach have been implemented (Box 3).

Box 3.3: Projects that follow ecosystem approach – two examples

National Agriculture Innovation Project (NAIP)

The NAIP responds to the GOI's objectives as expressed in India's National Policy on Agriculture, and its

R&D priorities match national and sectoral priorities, encourage creative local level systematic needs assessment and envisage integrating sub-projects in a systems mode to meet local level requirements. It focuses on:

- Agricultural diversification to cover precision farming, small farm mechanization, resource conservation technologies and protective cultivation.
- Livestock and fisheries production as 'sunrise sectors' to involve genetic up gradation, nutrition, management, disease surveillance and control, etc.
- Genetic resources and bio-prospecting to cover continued improvements in germplasm (plants, animals including fish and microbes) and improved nutritional value of staple foods.
- Enhance farmers' capacities to use and conserve natural resources and indigenous knowledge in an efficient and sustainable manner.
- Pesticide misuse and development of IPM best practices for all types of crops including new races, pathotypes, strains and biotypes.
- Value addition and post-harvest processing to enhance the global competitiveness of Indian agriculture.

Conservation and Management of Pollinators for Sustainable Agriculture Development

The components and activities of this project are:

- Development of knowledge base.
- Extension and promotion of pollinator friendly management practices.
- Capacity building.
- Public awareness, mainstreaming and information sharing.

2.2 Major institutions, missions and projects

National Bureau of Plant Genetic Resources

NBPGR is mandated to plan, conduct, promote, co-ordinate and take lead in activities concerning collection, characterization, evaluation, conservation, exchange, documentation and sustainable management of diverse germplasm of crop plants and their wild relatives. The major contributions of NBPGR include: i) maintenance of 37,94,000 accessions of germplasm belonging to 2045 species; ii) DNA fingerprinting for 33 crops comprising 2,215 varieties of national importance undertaken and fingerprint database developed; iii) establishment of 10 regional stations/base centres/quarantine centres spread over different phytogeographic zones of the country; iv) active collaboration and linkages with over 57

national active germplasm sites situated at different crop based ICAR centres and SAU; v) developed four online databases viz., “NORV” (notified and released varieties of India - “IINDUS” (Indian Information System), Information Sharing Mechanism for the PGR-“GPVR” (Germplasm and Plant Varieties Registration); and vi) capacity building on biosafety and biosecurity issues.

National Bureau of Agriculturally Important Microorganisms

NBAIM promotes mainstreaming microbial biodiversity by undertaking projects on i) molecular and functional diversity of microorganisms isolated from extreme environments; ii) assessment of genotypic diversity of *Bacillus* and *Bacillus*- derived genera in Indo-Gangetic plains; iii) germplasm collection and characterization of antagonistic microorganisms of soil borne fungal pathogens; and iv) microbial diversity analysis of soils contaminated with industrial effluents, etc.

National Bureau of Animal Genetic Resources

The major achievements of NBAGR, among others, include, i) development of conservation models and performance and economics of AnGR; ii) molecular characterization of genes responsible for immune response and milk performance of indigenous AnGR; iii) evaluation of genetic diversity and characterization of candidate genes involved in heat tolerance; and iv) building DNA fingerprinting profiles.

National Bureau of Fish Genetic Resources

Besides establishing live gene banks of fish genetic resources, NBFGR has developed sperm cryopreservation protocols of prioritized fish species, prepared national fish seed certification document, established IPR and Patents Cell and is set to further strengthen standardization of fish database, characterize and sequence prioritized species and develop diagnostic kits for exotic pathogens.

National Bamboo Mission

The main objectives of NBM are: i) to promote the growth of bamboo sector; ii) increase the coverage of area; iii) promote marketing of bamboo and bamboo based handicrafts; iv) establish synergies among stakeholders; v) develop and disseminate technologies through a seamless blend of traditional wisdom and modern scientific knowledge; and vi) generate employment opportunities for skilled and unskilled people, especially unemployed youth.

2.3 Livestock genetic resources and animal husbandry

India lays major thrust on cattle and buffalo breeding, and livestock production including fish and fish products. The major initiatives and achievements include:

- Substantial increase in fish production as a result of setting up of NFDB.
- Implementation of a national project for improvement of poultry and small animals, among others, envisages conserving threatened breeds of livestock.
- A central sector scheme on fodder development provides assistance in grassland development.

- Central Fodder Development Organization is involved in propagation and production of certified seeds, production of pasture species, seed storage and processing, improved agronomic package of practices, etc.
- Establishment of central poultry development organizations which are meant to provide quality chicks, diversify poultry development, monitor feed quality and impart training.

2.4 Forestry and wildlife

With 2.4% of world's geographical area, India at present is supporting 16% of global human population and 18% of cattle population. Forests meet nearly 40% of the energy needs of the country, of which more than 80% is utilized in rural areas. It is estimated that about 270 million tonnes of fuelwood, 280 million tonnes of fodder, over 12 million cubic meter of timber and countless non-timber forest products are harvested from forests annually. India duly recognizes that augmentation of forest resources provides an opportunity to optimise broad-based development and poverty reduction of the forest-dependent communities. Important initiatives in this regard are as follows:

☐ The NAP has shown good results in extending forest and tree cover with people's participation with the twin objectives of decentralising forest management and extending the forest and tree cover. The Twelfth Finance Commission recognised that the entire nation has the responsibility to maintain forests as a national wealth, and recommended a grant of Rs.10,000 million spread over the period of 2005-2010, over and above regular allocations for maintenance of forests.

☐ The forestry sector is also being strengthened through various schemes, institutional mechanisms, legislations and policies.

☐ The Constituion (73rd Amendment) Act, 1992 provides for the management of certain types of forests through PRIs.

☐ Mandatory clearances are required for undertaking any non forestry activity involving the diversion of forestland under the Forest (Conservation) Act. Such diversions are subject to strictest scrutiny which, among other things include, provisions for compensatory afforestation and payment of net present value of the land being diverted.

☐ The GOI has enacted the Forest Rights Act for empowering the tribal communities and other forest dwellers, and for protecting their access and use of forest resources.

☐ EPA, 1986 provides for the declaration of certain important ecologically fragile areas abutting forests/PAs as eco-sensitive zones.

India's rich wildlife resources offer numerous opportunities for ensuring livelihood security and development of wildlife based small enterprises to grow and flourish following the twin objectives of conservation and sustainable development. Some such examples that help to promote mainstreaming

of biodiversity considerations especially through active involvement of local communities are detailed as under.

Promotion of wildlife based eco-tourism

NWAP clearly recognizes the importance of people's support for wildlife conservation, livelihood security and establishing new PA categories, etc. It further emphasizes that eco-tourism must primarily involve and benefit local communities. In this context, some of the important initiatives include: formulation of a 'Wilderness Tourism Policy' for PAs and other forests (Karnataka); advances in wildlife based eco-tourism (Madhya Pradesh, Kerala, Himachal Pradesh, Sikkim, Uttarakhand, etc.); transforming poachers into protectors and involving them in ecotourism programmes (Periyar Tiger Reserve, Kerala and Manas BR, Assam); promotion of home stays to encourage community based tourism (Hemis National Park and other areas of Trans-Himalayan zone in Jammu and Kashmir).

Livelihoods from non timber forest products

NTFPs play a pivotal role in the lives of large number of forest dependent communities. The central and state governments provide a strong backup to strengthen institutions like Tribal Co-operative Marketing Development Federation of India Limited; the Girijan Co-operative Corporation, Andhra Pradesh; formation of the large Adivasi Multipurpose Societies, JFMCs and EDCs so as to improve the economic status of the poor NTFP collectors.

Medicinal flora and fauna

The collection and trade in medicinal plants constitute a major share of livelihood means of the forest dwellers in India. Over one and a half million practitioners of the ISM&H in the oral and codified streams use medicinal plants, animal and mineral products in preventive, promotive and curative applications. A large number of medicinal plants (> 6500 species) are collected and used by local health healers and households and used as a livelihood strategy. Foundation of Revitalization of Local Health Traditions (FRLHT) has established 13 community owned enterprises for value addition and marketing of collected and cultivated medicinal plants in seven states.

Besides, traditional Indian Ayurvedic medicines account for 70% share of the formal medicine market in India. The domestic trade in Ayurvedic and herbal products in the country is about Rs 23 billion and is expected to substantially increase by 2010.

Realizing the potential of mainstreaming medicinal plant use, India has established NMPB, with an aim to bring in the much-needed coordination among different players for development of medicinal plant sector. Further, at the state level, SMPBs have been or are being set up. Considering that the sector is still new, the Governments at national and state levels are taking effective measures to create market opportunities with appropriate fiscal and policy support.

2.5 Inland waters and marine fisheries

Realizing that development of fisheries sector is entirely dependant on the conservation and management of water bodies such as lakes, rivers, coastal and marine scapes, the MoEF is making

concerted efforts to mainstream efficient conservation measures for their sustainable utilization. The major programmes for the restoration of ecological health are summarized as follows:

- National River Conservation Programme
- National Lake Conservation Plan
- National Wetland Conservation Programme
- Water Quality in River and Lakes (Monitored by Central Pollution Control Board in four major river basins and lake waters).
- Development of Marines Fisheries Infrastructure and Post Harvest Operations

3. Enabling environment

Policies and legislations

The important national policies for environmental management include the NFP, 1988; the National Conservation Strategy and Policy Statement on Environment and Development, 1992; the Policy Statement on Abatement of Pollution, 1992; and the NFP, 2006. Some important sectoral policies such as the National Agricultural Policy, 2000; National Population Policy, 2000; and National Water Policy, 2002; are also relevant for environmental management. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effects to such recognition. The NEP seeks to extend the coverage, and fill in the gaps that exist, in the light of present knowledge and accumulated experience. It does not displace, but builds on the earlier policies.

NAPCC identifies measures that promote development objectives while also yielding cobenefits for addressing climate change effectively. It outlines a number of steps to simultaneously advance India's development and climate change-related objectives of adaptation and mitigation.

The EIA Notification, 2006 and CRZ Notification, 1991, attempt to ensure that environmental concerns are integrated in developmental activities in order to achieve sustainable development, and exemplify India's progressive approach to factor in biodiversity concerns into developmental process.

The EIA notification, 2006 has adopted some progressive measures to make the environmental clearance a democratic and more transparent process. The developmental projects have been classified into two categories – one to be dealt with at the Centre and the other by the State level expert appraisal committees. Live recording of proceedings of public hearings has been made mandatory to ensure transparency.

Some other important policy and legal initiatives relating to biodiversity are as below:

- Enactment of the BDA, 2002 and Biological Diversity Rules, 2004 to give effect to the provisions of the CBD, including those relating to ABS.

Box: National Biodiversity Authority (NBA)

- The NBA established in October 2003 pursuant to Section 8 of the BDA
- Focuses and advises GOI on conservation of biodiversity, sustainable use of its components and securing equitable sharing of benefits arising out of the utilization of biological resources.
- Regulates access to biological resources and associated traditional knowledge for research and/or commercial purposes, bio-survey and bio-utilization as well as transfer of research results, seeking IPR and third party transfer of bio-resources.
- Advises the State Governments in the selection of areas of importance as biodiversity heritage sites and measures for the management of such sites.
- Has constituted expert committees to perform functions such as laying down the procedure and guidelines to govern the activities such as Access and Benefit Sharing (ABS), Prior Informed Consent (PIC), Mutually Agreed Terms (MAT), Intellectual Property Rights (IPR), list of normally traded commodities, establishment of heritage sites and their management, national designated repositories and safeguarding of traditional knowledge respecting the Article 8 (j) of the CBD.
- May take measures necessary on behalf of GOI to oppose the grant of IPR which do not adhere to the PIC and MAT.
- Coordinates the activities of the State Biodiversity Boards and large number of local level Biodiversity Management Committees by providing them with technical guidance and financial assistance.
- Commissions studies and sponsor investigations and research on preparation of PBRs to document the rich valuable knowledge of local people on biodiversity and conducts capacity building programmes.

Source: www.nbaindia.org

- A separate regulations for BRs is being prepared under the provisions of EPA, 1986.
- A draft Notification on EIVs has been issued under EPA, 1986.
- The CRZ Notification, 1991 recognizing the mangrove and coral reef areas as ecologically sensitive providing them protection of the highest order. Under the promotional measures, the GOI has identified 38 mangrove and four coral reef areas/ sites for providing financial assistance to the States/UTs for intensive conservation and management.

- “Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Microorganisms/Genetically Engineered Organisms or Cells” have been notified in 1989 under EPA, 1986.
- Guidelines for sustainable development and management of brackish water aquaculture have been drawn up. State Governments like Andhra Pradesh and Tamil Nadu have aquaculture guidelines at the local level also.
- Continued implementation of NAP - the flagship afforestation scheme of the MoEF.
- Reconstitution of National Board of Wildlife 2007 to make it broad based.
- Establishment of the National Forest Commission in 2003 for the overall improvement of forestry sector. The Commission submitted its Report in 2006.
- Creation of a NTCA, 2006, to strengthen efforts in management of Tiger Reserves.
- Creation of a WCCB, 2006, to strengthen institutional mechanisms to control wildlife crimes.
- The Science and Technology Policy Statement, 2003 has been announced following in the footsteps of the Scientific Policy Resolution (1958) and Science and Technology Policy Statement (1983).

Institutional mechanisms

Towards achieving the long term goals of various programmes and policies for mainstreaming of biodiversity, India has recognized the need of a strong multi-disciplinary, holistic and integrated approach, and has responded positively by providing a broad based sectoral or cross-sectoral institutional structure ranging from national, state, district to village level. While execution at state level is ensured by relevant departments such as SFDs, agriculture and horticulture departments, irrigation departments, science & technology departments, etc., various specialized national/state level institutions ensure R&D backup on the relevant subjects.

Another example of cross-sectoral coordination is the implementation of the wetland programme which follows multiple models based on the specific needs.

- In some states, it is being executed by the SFDs and/or Environment or Urban Development; in some others, by the Department of Irrigation or Science and Technology or Fisheries.
- Considering the complexities of the implementation issue, state level steering committees have been constituted with a broad base representation including communities, NGOs and academics.
- Several States have already constituted authorities for execution of the programme in their respective states. Notable among these are, Chilka Development Authority in Orissa (mandated to manage all identified lakes in the State); Loktak Development Authority, Manipur; Shore Area

Development Authority, Andhra Pradesh; Lakes and Waterways Development Authority, Jammu and Kashmir; Lake Development Authority, Karnataka; and Lake Conservation Authority, Madhya Pradesh.

Allocation of financial resources

Realizing that adequate financial resources are essential to achieve the targets of sectoral and cross sectoral integration of biodiversity, India has made specific provisions for its Plan activities. MoEF, being the major player covering the sector, provision of Rs 100 billion (approximately US\$ 2 billion) has been made in the XI Plan (2007-08 to 2012-13), as against Rs 595 billion (approximately US\$ 1.2 billion) made under 10th plan (2002-03 to 2006-07) allocations. Sector wise provisioning of available funds under 10th Plan is shown (Figure 1).

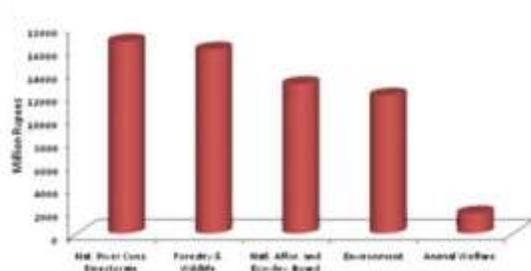


Figure 1. 10th Plan Outlay for different sectors of the MoEF

In order to promote excellence and outstanding contributions in environmental conservation, the MoEF provides for incentives in the form of various awards (Box 3).

Box 3: Incentives: fellowships and awards

- Indira Gandhi Prayvaran Puraskar: to organizations/individuals in recognition of significant contribution in the protection of environment.
- Pitamber Pant National Environment Fellowship: to encourage excellence in any branch of environmental sciences.
- Amrita Devi Bishnoi Wildlife Protection Award: to individuals/institutions pertaining to rural communities for significant contribution in wildlife protection.
- Rajiv Gandhi Wildlife Conservation Award: for significant contribution in protection and conservation of wildlife.
- The Janaki Ammal National Award on Plant/Animal Taxonomy: for outstanding contribution in the field of plant/animal taxonomy.
- Indira Priyadarshini Vriksha Mitra Award: for outstanding contributions in afforestation and wasteland development in eight categories.

Considering another important sector agriculture, the eleventh plan strategy of inclusive growth rests upon substantial increase in public sector outlay. The XI plan allocation is projected at Rs 5,48,010 million (approximately US\$ 1.1 billion) as against Rs 2.05 billion (approx. US\$ 4.1 billion) for Xth plan.

The MoEF provides financial assistance to State/UT Governments for the implementation of the various central programmes relating to biodiversity conservation including several cross-cutting priority programmes. An overview of one such sector is given in Box 4.

Box 3: NRCP, NLCP and NWCP- An overview

NRCP: A sewage treatment capacity of 869 million litres per day (mld.) and 753 mld has been undertaken under Ganga Action Plan and Yamuna Action Plan, respectively. Likewise, under various river action plans, pollution abatement works have been undertaken in 14 states covering 30 rivers and 68 towns.

NLCP: Over 33 projects for conservation of 49 lakes have been approved in 13 states and conservation works for 11 lakes have been completed.

NWCP: Number of wetlands under the programme increased from 27 in 2004 to 115 in January 2009. A number of regional workshops are held to sensitize people about values and functions of wetlands.

Recognizing that the entire nation has the responsibility to maintain forests as a national wealth, the recommendations of the 12th Finance Commission providing a grant of Rs 10 billion (approx. US\$ 0.2 billion) spread over a period of 2005 – 2010, are being implemented. This is in addition to the regular Plan allocations.

Capacity building

As capacity building is an important tool for achieving the goals of conservation and sustainable use of biodiversity, India has taken several initiatives in this regard. Notable initiatives of capacity building in different sectors are given below:

- In-house training courses of varying duration on remote sensing, GIS and application of global positional system in forest survey; specialized training to officers on spatial referencing of Monitoring of Illegal Killing of Elephant (MIKE) data; enhance and improve the technical capacity required at the national level to monitor SFM and biological diversity.
- Development of National Forestry Database Management System.
- Extensive capacity building activities for efficient management of field trials of GM crops covering 16 states where field trials are being undertaken.

- Study on applied rates and import duties of forestry products for multilateral and bilateral trade agreements.
- Training programmes in collaboration with different academic institutions/research organizations/ State Governments/NGOs on various components of wetland conservation.
- 12th World Lake Conference (Taal 2007) under the aegis of International Lake Environment Committee (ILEC) Foundation organized by the MoEF, where Jaipur Declaration, stressing on wise use of lakes and wetlands was adopted.
- Implementation of AICOPTAX.
- Organizing district level inter-departmental linkage workshops for promoting linkage of NAP with other developmental programmes to ensure sustainability of JFM.
- Under NGC programme, about 84,000 eco-clubs (school/colleges) supported by the MoEF and implemented through state nodal agencies.
- During 2007-2008, over 10,000 organizations associated with the NEAC.
- The MoEF has formulated Media Action Plan, producing television programmes 'Bhoomi' and 'Sarokar' covering community effort in environmental protection, water conservation, water pollution, afforestation, herbal pesticides, bio-medical waste, bio-diesel, air pollution, etc.
- Staging shows of street play by Centre for Education and Voluntary Action (CEVA) spreading awareness on environmental degradation in various states. Since 2007, 'Vatavaran', a competitive environment film festival is being held.
- Environmental appreciation courses developed by Indira Gandhi National Open University (IGNOU) are being used as distance education material.
- Under Global Learning and Observation to Benefit the Environment (GLOBE), 1,800 trained teachers in the country covering 16 states were given hands-on training on various environmental parameters.
- Other awareness programmes include: i) Observance of Earth Day to increase public awareness on environment, ii) Inter eco-club school competition, iii) Students environmental congress, etc.
- Nation-wide programs are organized during Wildlife Week, Earth Day, World Forestry Day & World Environment Day.
- TRAFFIC India has conducted a training needs assessment for wildlife enforcement officers on wildlife crime in 2007.

Further, various organizations in the country offer specialized courses for capacity building, some of which are given below:

Indira Gandhi National Forest Academy (IGNFA)

Induction training in the form of two years diploma and certificate courses for the newly recruited state forest services officers into the Indian Forest Service; IFS officers and Foreign Trainees undergo training in advanced forest management and policy and legal issues.

Indian Plywood Industries Research and Training Institute (IPIRTI)

IPIRTI conducted various diploma courses and vocational courses to meet the human resources development needs of mechanic wood industries, postgraduate programmes in forest management and natural resource management are also offered.

Wildlife Institute of India (WII)

Through the postgraduate diploma course in wildlife management, training is imparted in biological and ecological management, eco-development and human dimension aspects of wildlife conservation, taking into consideration the skills required for dealing with the present conservation situation and needs.

Indian Institute of Forest Management (IIFM)

The Institute offers management development programmes to practicing managers, foresters and policy makers in India and other Asian countries, on concepts and techniques relevant for the forestry, development and environmental sectors.

G.B. Pant Institute of Himalayan Environment and Development (GBPIHED)

The Institute undertakes capacity building programmes for rural masses and other stakeholder groups on mountain-specific environment friendly technologies for improvement of livelihood options and conducts orientation courses and training workshops for teachers and students on conservation education.

Botanical Survey of India (BSI) and Zoological Survey of India (ZSI)

The two organizations have regular capacity building programme in the taxonomy of plants and animals, respectively, leading to the award of degree of Doctor of Philosophy. In addition, they also organize in-service training programmes for academicians and foresters from time to time.

Centre for Environmental Education (CEE)

CEE hosted 4th International Conference on Environmental Education (organized by GOI and cosponsored by UNESCO and UNEP in November 2007), in which 97 countries participated.

Collaborative programme of UNICEF, Nehru Yuva Kendra (NYK), and National Service Scheme engages college youth in environmental education and awareness campaigns.

CPR Environmental Education Centre (CPREEC)

CPREEC brings out four issues of the quarterly newsletter ECONews, and has published abstract volumes on Sacred Animals of India, Sacred Water Bodies of India along with a number of video films for use in training programmes. The Centre has also undertaken a Green School Initiative on environmental education and training programmes on biodiversity conservation focusing on teachers, students, NGOs and animators.

Environmental Information System (ENVIS)

ENVIS is a comprehensive network in environmental information collection, collation, storage, retrieval and dissemination to varying users which include decision-makers, researchers, academicians, policy planners, research scientists, etc. At present, it consists of a chain of 76 network partners out of which 46 are on subject-specific and 30 are on State related issues.

Information Facilitation Counter (IFC)

The MoEF has been set up an IFC to disseminate information on its activities.

Despite such a diversified base for capacity building to promote sectoral and cross-sectoral mainstreaming of biodiversity, there is a felt need to upscale the feedback mechanism/ process and make it as an integral component of all capacity building initiatives.

Land use planning

All the Five Year Plans have emphasized the need for efficient use of land, water and other natural resources for accelerated as well as sustainable economic development in the country.

Considering that India possesses 16% human and 18% livestock population of the world on only 2.4% of the land, a long-term perspective plan on land use is important. Further, the existing database on land use needs to be upgraded periodically. Therefore, strengthening of the database, using traditional cadastral surveys, modern remote sensing techniques, GPS, GIS and computerization of land records is being given priority. Similarly, it is necessary to strengthen the monitoring mechanism to document the on-going land use changes. Towards fulfilling these requirements, several Ministries are undertaking various measures.

As an example, some of the cross-cutting initiatives of MoA which provide appropriate enabling environment for sectoral and cross-sectoral integration for land use are given below:

- Scheme on Macro Management of Agriculture is being implemented in states through State Land Use Board.

- GOI provides 100% assistance for another centrally sponsored scheme of MoA on All India Soil and Land Use Survey.
- Central sector scheme of National Land Use & Conservation Board provides for the formulation of national land use policies, perspective plan for optimum utilization of land resources and undertakes overall review of the progress of implementation of ongoing schemes and programmes.
- Various other programmes, such as soil conservation for enhancing productivity of degraded lands in the catchments of flood prone rivers, reclamation of alkali soils; soil conservation for enhancing productivity of degraded lands in the catchments of flood prone rivers, and other projects like Uttar Pradesh sodic land reclamation project with World Bank assistance, watershed development project in shifting cultivation areas of north eastern states, etc., are being implemented.

Research and technology

Among various initiatives to support sectoral and cross sectoral research and technology backup for mainstreaming biodiversity, following are some of the major initiatives:

- Establishment of BGIR at Noida, to cater to the need for conservation of endangered species and build public awareness. This was identified as a “Green Channel” project under National Jai Vigyan Mission of the Ministry of Science and Technology, GOI.
- The programme on assistance to botanic gardens focuses on ex-situ conservation of rare endemic plants. It has also promoted the establishment of lead gardens in different phytogeographic zones of the country.
- A scientific methodology for estimating tiger population (including co-predators, prey animals and assessment of habitat status) has been evolved and mainstreamed.
- Environmental research programme of the MoEF covers prevention, abatement and control of pollution. It also reviews and initiates new projects on ecosystem research, Eastern and Western Ghats research and economic and social issues.
- Several interdisciplinary projects have been taken up under the NNRMS such as: i) national projects on snow and glaciers; ii) mapping of WLSs/NPs; iii) forest type mapping; and iv) coastal/mangrove/coral reef studies.
- Nineteen research projects on various aspects of wetland conservation under implementation.
- National Institute of Research in Mangroves and Coastal Bio-resources proposed to be established near Sunderbans in West Bengal.
- Ten SFRs published so far based on the interpretation of remote sensing satellite data.
- Forest cover maps on different scales kept in public domain and used by SFD officials.

- A new National Forest Inventory designed and adopted since 2002.
- A number of innovative afforestation programmes of NAEB are being implemented by government departments, urban local bodies, PRIs, public sector undertakings, autonomous bodies, NGOs, etc.
- ETF battalions have been raised by deploying ex-servicemen for ecological restoration of terrains rendered difficult due to severe degradation and inaccessibility.
- Seven regional centres of NAEB located in various universities and national level institutions promote sustainability of JFM.
- Physical and mechanical properties of more than 500 species of Indian timbers have been evaluated.
- Protocols developed for propagation of important medicinal plants.
- Design of solar heated kiln developed and standardized for accelerated seasoning of timber compared to air drying; about 200 commercial units have so far been installed.
- Rajpath and Central Vista Tree Conservation Project in New Delhi and development and maintenance of tree avenues in Commonwealth Games village.
- Studies on molecular ecology of Indian fauna indicated that large mammal population in the Western Ghats show genetic differentiation across the Palghat gap that has acted as a bio-geographic barrier.
- Populations of leatherback turtles are being monitored using conventional tagging, satellite telemetry and genetic analysis.
- Monitoring population structure of elephants of Mudumalai WLS.
- Participatory natural resource monitoring in selected villages in Uttara Kannada district has helped in understanding changes and taking corrective action.
- The monitoring of climate change and forests in India projects a shift towards wetter forest types in northeastern region and drier forest types in northwestern region in the absence of human influence.
- Evaluation of butterfly communities as bio-indicators in Western Ghats.
- CEMDE has developed strategies to restore mined-out areas, eradicate lantana and restore landscapes.

- A Centre of Excellence has been established in Madras School of Economics to build capacities in environmental economics and undertake studies in natural resource accounting.
- Research activities have been initiated by the FRLHT on medicinal plants which include: i) creation of bio-cultural repository; ii) establishment of ethno-medicinal plant demo garden; iii) pharmacognostic studies on prioritized medicinal plants; iv) distribution mapping using GIS and identification of issues concerning traded medicinal plants; and v) outreach training and educational material on plants of Indian Systems of Medicine.
- CZA has identified 61 different critically endangered wild animal species for coordinated conservation breeding programmes in Indian zoos.
- A National Referral Centre has been established at Indian Veterinary Research Institute (IVRI) for providing super speciality services and diagnostic facilities for better health care of wild animals in Indian zoos.
- National Bioresource Development Board (NBDB) under DBT prepares digitized inventories of plant, animal, microbial, and marine resources, supports establishment of Centres of Excellence, training activities and demonstrations, for the development of bioresources for special areas such as north-eastern region, Himalayan region, coastal & island ecosystems, desert region, Indo- Gangetic plain and Peninsular India and promotes knowledge empowerment and human resource training.
- The NBRI through the use of bioinformatics has initiated development of plant diversity databases under collaborative research programme to: facilitate the study on conservation of Indian biodiversity through comprehensive database of all Indian plants on web (www.plants-of-india.org); update and upgrade the legume database of South Asia; establish a herbarium database and network the herbaria of India; undertake computational analysis of genomics and proteomics databases; and act as plant diversity information centre for India and undertake diploma courses in bioinformatics; and strengthen the linkages with national (DBT's Biotechnology Information System network) and international (International Legume Database & Information Service (ILDIS), UK) programmes, thus facilitating biotechnology research in India.
- CCMB is pursuing a major and unique research programme La CONES with the help of DBT, CZA, CSIR and Government of Andhra Pradesh as its partners. The project known as La CONES is aimed at the conservation of endangered animals through the use of biotechnological intervention. Under LaCONES, monitoring of genetic variation using techniques such as DNA fingerprinting, establishment of cell banks and gene banks through cryo-preservation of semen, eggs and embryos of endangered species, and the development of assisted reproductive technologies are being undertaken. The LaCONES has been honoured as a member of the International Consortium of the Frozen Arc, an international depository of DNA representing the Indian subcontinent.
- CSIR has initiated one of the largest coordinated programmes on drugs, which is based on India's rich bio-resources and its traditional knowledge. This initiative involves 20 CSIR laboratories, 13

universities and also institutes of traditional medicinal systems. This path-breaking programme has so far screened 23,000 samples and identified 44 potential bio-active molecules.

- TKDL is a collaborative project between CSIR, Ministry of Science & Technology, and Department of AYUSH, MOHFW and National Informatics Centre (NIC) for developing computerized database of documented traditional knowledge available in ancient texts.

4. Participation of NGOs

A large number of NGOs are actively involved in integration and mainstreaming of biodiversity considerations.

Box: Community led Whale Shark conservation along the Gujarat Coast

Whale Sharks travel thousands of kilometres every year from far-off shores to visit the coast of Gujarat. In the past, local fishermen have traditionally hunted them for oil to waterproof their boats and for their meat for export. Whale Shark comes under the Schedule 1 of the WPA, 1972, wherein hunting of Whale Shark leads to an imprisonment of 3-7 years and a fine of not less than Rs. 10,000/-. To address the issue of conservation of Whale Shark, a multi-pronged campaign has been launched since 2004 by Government, NGOs and private sector.

Box: Community sets aside land for protecting elephant corridors in Garo Hills

Meghalaya supports the second largest elephant population in northeast India and majority of them are concentrated in Garo Hills which has been declared as Garo Hills Elephant Reserve by the SFD. However, jhum cultivation and other developmental activities have led to fragmentation and degradation of elephant habitats leading to increase conflict with humans. Being a Sixth Schedule area, the State has a typical system of forest management, wherein local communities and private persons own majority of the land. Less than 10% area comprising reserve forests, national parks, wildlife sanctuaries and protected areas is controlled by the State and remaining land is under the jurisdiction of the district council. To negate the adverse effect of fragmentation, six elephant corridors in the State have been identified. NGOs such as WTI working with Garo Hills Autonomous District Council and forest department, have actively worked with local community to join the fragmented patches for developing the corridors by donating their land for reforestation. Reforestation activities in this area have resulted in better water retention improving their water reserves as also better fish yields thereby involving other village heads (nokmas) to join efforts for the conservation of wildlife and augmentation of natural resources. As a result, several chunks of forest ranging from 200 hectares (Selbalgre village reserve forest) to 700 hectares (Mandalgre village reserve forest) have been declared as reserves. Two major landscapes, the Balphakram National Park and the Nokrek National Park are therefore in the process of being connected for both terrestrial and arboreal movement of animals with full participation of the local community and sharing of benefits accruing to the community.

5 partnership and cooperation in different sectors

- Plant, animal, human and microbial genomics: Some of the multilateral/bilateral institutions/programmes under consideration in association with Ministry of External Affairs are: Joint Centers in biotechnology specially, with Germany and France; Indo-ASEAN Institute of Biotechnology in Jakarta; Indo-ASEAN Biotechnology Network; India-Singapore Joint Biotechnology Park, etc.
- ICGEB, New Delhi: This is an autonomous international organisation. India, the host country is a contributor along with Italy. The statute came into force on February 3, 1994. There are 65 member countries.
- Cooperation with CGIAR Centers: CGIAR centres have been providing support to ICAR's research activities. India has entered into MoU with 13 CG Centres including International Maize and Wheat Improvement Center (CIMMYT), International Rice Research Institute (IRRI), International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), IGPRI, World Fish Centre and International Water Management Institute (IWMI).
- Partnership Building through FDAs & JFMC: Execution of NAP provides support, both in physical and capacity building terms, to the FDAs and JFMCs. Decentralized two-tier institutional structure (FDA and JFMC) allows greater participation of the community, both in planning and participation on afforestation programmes. Seven pilot projects for establishing forest-based microenterprises and promoting greater organic linkages of JFMCs with Gram Panchayats.
- Partnership with Industries: The Central Institute of Medicinal and Aromatic Plants, Lucknow, and Shriram Institute for Industrial Research, New Delhi, have signed an MoU on collaborative research in biological and herbal products quality standards.
- CSIR Strategic Alliances: CSIR has forged a collaborative programme with EU in key areas of global relevance and import such as health, biotechnology, energy, environment and nanotechnology.
- New initiatives in agriculture sector:
 - India signed MoUs for developing, promoting and accelerating closer collaborative efforts for development of agricultural research and education with a large number of countries, namely, ASEAN countries, Australia, Bangladesh, Belarus, Bhutan, Brazil, China, Chile, Cuba, Cyprus, Egypt, France, Iran, Iraq, Italy, Japan, Kazakhstan, Mauritius, Mozambique, Myanmar, Namibia, Nepal, New Zealand, Oman, Panama, Peru, Philippines, Qatar, Rwanda, Russia, Serbia, Sri Lanka, Surinam, Tanzania, South Africa, Uganda, Uzbekistan, UK, Ukraine, Vietnam and Zambia.
 - Genomic resources collection centre has been envisaged to collect validate and facilitate the use of useful genes and gene constructs generated in the country.

- The huge collections in the genebank would be utilized for identifying genes and alleles conferring special traits which would be further utilized in future crop improvement programme.

- Mangroves for the Future: India is participating in the IUCN MFF initiative, under which it has prepared a national strategy and action plan. Six small grants and four large grants programmes have been envisaged. A national coordination body is also in place. India hosted the 4th Regional Steering Committee meeting in 2008.

- An International Dryland Ecosystem Workshop was jointly organized by UNESCO and GOI in 2007 to exchange techniques and globally available appropriate technologies for tackling problems associated with dryland ecosystem.

- Wildlife protection and care

1. The GOI has formulated an action plan for vulture conservation which is being implemented in collaboration with the State/Union Territory and civil society organizations.

Under Coalition Against Wildlife Trafficking Initiative, India has joined hands with USA and other partners against wildlife crime/trafficking. This coalition is working together to combat illegal trade in wildlife and its derivatives.

- Partnership and collaboration through GEF

Most of the GEF projects being undertaken in India have a strong component of mainstreaming biodiversity into production sectors and landscapes for sustainable development.

6. International cooperation

With a deep commitment for environmental conservation and sustainable development, India has responded positively to relevant international treaties and conventions. The MoEF is the nodal Ministry for UNEP, UNDP, World Bank, United Nations Industrial Development Organization (UNIDO), UNCSD, GEF and regional bodies like ESCAP, SAARC, South Asian Cooperative Environmental Programme (SACEP), Asian Development Bank (ADB), ITPGR and EU. India has participated actively in all the major international events related biodiversity conservation over the past decades and has ratified all the major biodiversity and environment related global conventions.

7. Other cross-sectoral initiatives

India has taken up several other initiatives to further augment and synergize the efforts of various ministries, departments and institutions to address issues related to poverty alleviation, education, technology innovation, etc. Such efforts facilitate sustainable development and mainstreaming biodiversity conservations. A few select examples are tabulated below:

Rural Development (MoRD, MoEF, MoA, MoHFW, MoWR, MoPR)

NREGS (2005) – augmenting wage employment through various activities including NRM, afforestation, plantation, water harvesting, flood protection, insulating local communities on adverse effects of climate change, mandates 33% participation for women

Education (Central/State Education Boards, Students)

Inclusion of environmental education in schools and college curriculum (includes modules on biodiversity conservation)

Innovation (DST, NGOs, Innovators)

National Innovation Foundation – Documenting grassroots green innovation through “Honey Bee Network”, Value addition, and dissemination

Technology transfer (DST, State and local institutions)

Technology Information Forecasting and Assessment Council (TIFAC)- development of bioprocesses and bio products, patent facilitating centre, technology up gradation and transfer

8. Facilitative role of judiciary of India

While considering efforts for mainstreaming of biodiversity conservation, the role played by the Indian judiciary needs special mention. The facilitative role of the Indian Supreme Court in the realization of the objective of proper implementation of the conservation of the biodiversity owes its origin to the advent of public interest litigations in India. Towards this end, the judiciary interpreted provisions of domestic legislations on biodiversity subject through the instrumentalities of both the Indian Constitution and the MEAs.

In quite a few environment related cases, the court emphasized the need for balance between development and conservation. For example, in Godavarman case, the Supreme Court took note of the importance of maintaining forest cover and underscored the need for scientific management of forests.