politicians, lawyers, judges, economists, custom officials, police and other relevant groups.

- Strengthen extension programmes on biodiversity issues for conservation professionals, NGOs and for those in public and private sectors.

- Promote networking of biodiversity extension/training programmes with ongoing programmes in participatory forest management and tribal development.

- Develop a structured publicity programme for enhancing the awareness for biodiversity conservation through audio, visual and print media.

4.10 RESEARCH AND DEVELOPMENT ACTIVITIES

4.10.1 Current status

The Ministry of Environment and Forests, Department of Agricultural Research and Education, Department of Agricultural Cooperation, Department of Animal Husbandry and Dairying, Department of Science & Technology (DST), Department of Biotechnology (DBT), Department of Ocean Development, Department of Space, Department of Scientific and Industrial Research and Ministry of Health are the principal Departments/Ministries which have R&D initiatives and support research activities related to biodiversity. Many of these Departments and Ministries have a host of subject-specific or goal-specific organisations. The organisations under Indian Council of Agricultural Research (ICAR), Council of Scientific & Industrial Research (CSIR) and Ministry of Environment and Forest are listed in Boxes 8, 9 and 10, respectively.

In semi-government sector, universities and deemed universities such as Indian Institutes of Technology, Indian Institutes of Management, Indian Institute of Science etc. are doing pioneering research work. Some of such research programmes are funded by the UGC, CSIR, DST, DBT, MOEF etc.

Some organisations under the State Governments, such as Kerala Forest Research Institute, and Tropical Botanic Garden and Research Institute, are undertaking R&D on biodiversity.

Some important NGOs engaged in research related to biodiversity are given in Box 11.
| Box 8: R&D organisations under Indian Council of Agricultural Research (ICAR) |
|---|---|
| 1. Central Agricultural Research Institute, Port Blair |
| 2. Central Arid Zone Research Institute, Jodhpur |
| 3. Central Avian Research Institute, Izzatnagar |
| 4. Central Inland Capture Fisheries Research Institute, Barrackpore |
| 5. Central Institute for Cotton Research, Nagpur |
| 6. Central Institute of Research on Buffaloes, Hisar |
| 7. Central Institute for Research on Goats, Makhdoom |
| 8. Central Institute of Agricultural Engineering, Bhopal |
| 9. Central Institute of Brackishwater Aquaculture, Madras |
| 10. Central Institute of Fisheries Education, Mumbai |
| 11. Central Institute of Fisheries Technology, Kochi |
| 12. Central Institute of Freshwater Aquaculture, Bhubaneswar |
| 13. Central Institute of Horticulture for Northern Plains, Lucknow |
| 14. Central Marine Fisheries Research Institute, Kochi |
| 15. Central Plantation Crops Research Institute, Kasaragod |
| 16. Central Potato Research Institute, Shimla |
| 17. Central Research Institute for Dryland Agriculture, Hyderabad |
| 18. Central Research Institute for Jute & Allied Fibres, Barrackpore |
| 19. Central Rice Research Institute, Cuttack |
| 20. Central Sheep & Wool Research Institute, Avikanagar |
| 21. Central Tobacco Research Institute, Rajamundry |
| 22. Central Tuber Crops Research Institute, Thiruvananthapuram |
| 23. Cotton Technological Research Laboratory, Mumbai |
| 24. Directorate of Oilseeds Research (ICAR), Hyderabad |
| 25. Directorate of Pulses Research (ICAR), Kanpur |
| 26. Directorate of Rice Research (ICAR), Hyderabad |
| 27. ICAR Research Complex for North Eastern Hill Region, Shillong |
| 28. Indian Agricultural Research Institute, New Delhi |
| 29. Indian Grassland and Fodder Research Institute, Jhansi |
| 30. Indian Institute of Horticultural Research, Sadashivnagar |
| 31. Indian Institute of Sugarcane Research, Lucknow |
| 32. Indian Lac Research Institute, Ranchi |
| 33. Indian Veterinary Research Institute, Izzatnagar |
| 34. National Academy of Agricultural Research Management, Hyderabad |
| 35. National Bureau of Animal Genetic Resources, Karnal |
| 36. National Bureau of Fish Genetic Resources, Lucknow |
| 37. National Bureau of Plant Genetic Resources, New Delhi |
| 38. National Centre for Mushroom Research and Training, Solan |
| 39. National Dairy Research Institute, Karnal |
| 40. National Research Centre for Citrus, Nagpur |
| 41. National Research Centre for Groundnut, Junagadh |
| 42. National Research Centre for Integrated Pest Management, Faridabad |
| 43. National Research Centre for Mithun, Shillong |
| 44. National Research Centre for Sorghum, Hyderabad |
| 45. National Research Centre for Soyabean, Indore |
| 46. National Research Centre for Spices, Calicut |
| 47. National Research Centre on Camel, Bikaner |
| 48. National Research Centre on Coldwater Fisheries, Haldwani |
| 49. National Research Centre on Equines, Hisar |
| 50. National Research Centre on Yak, Dirang |
| 51. Sugarcane Breeding Institute, Coimbatore |
| 52. Vivekananda Parvatiya Krishi Anusandhan Shala, Almora |
### Box 9: R&D Organisations under Council of Scientific and Industrial Research (CSIR)

1. CSIR Centre for Biochemicals, Delhi  
2. CSIR Complex, Palampur  
3. Central Drug Research Institute, Lucknow  
4. Central Food Technological Research Institute, Mysore  
5. Central Fuel Research Institute, Dhanbad  
6. Central Institute of Medicinal & Aromatic Plants, Lucknow  
7. Central Salt and Marine Chemical Research Institute, Bhavnagar  
8. Centre for Cellular and Molecular Biology, Hyderabad  
9. Indian Institute of Chemical Biology, Jadavpur  
10. Institute of Microbial Technology, Chandigarh  
11. National Botanical Research Institute, Lucknow  
12. National Environment Engineering Research Institute, Nagpur  
13. National Institute of Oceanography, Goa  
15. Regional Research Laboratory, Bhopal  
16. Regional Research Laboratory, Bhubaneswar  
17. Regional Research Laboratory, Jammu Tawi  
18. Regional Research Laboratory, Jorhat  
19. Regional Research Laboratory, Thiruvananthapuram

### Box 10: Organisations of Ministry of Environment and Forests (MOEF) undertaking R&D

1. Botanical Survey of India, Calcutta  
2. Central Pollution Control Board, Delhi  
3. Centre for Ecological Research and Training, Bangalore  
4. Centre for Environment Education, Ahmedabad  
5. Centre for Mining Environment, Dhanbad  
6. Forest Survey of India, Dehradun  
7. Govind Ballabh Pant Himalayan Paryavaran Vikas Sansthan, Kosi, Almora  
8. Indian Council of Forestry Research & Education, Dehradun  
9. Indian Institute of Forest Management, Bhopal  
10. Indian Plywood Industries Research Institute, Bangalore  
11. Institute of Arid Zone Forestry Research, Jodhpur  
12. Institute of Deciduous Forests, Jabalpur  
13. Institute of Forest Genetics & Tree Breeding, Coimbatore  
14. Institute of Moist Deciduous Forests, Jorhat  
15. Institute of Wood Science & Technology, Bangalore  
17. National Zoological Park, New Delhi  
18. Padmaja Naidu Himalayan Zoological Park, Darjeeling  
19. Salim Ali Centre for Ornithology & Natural History, Coimbatore  
20. Wildlife Institute of India, Dehradun  
Box: 11: Some Non-governmental organisations engaged in research

1. M. S. Swaminathan Research Foundation (MSSRF), Chennai
2. Foundation for Revitalisation of Health Traditions (FRLHT), Bangalore
3. World Wide Fund for Nature (WWF), India
4. SRISTI, Ahmedabad
5. Research Foundation for Science, Technology and Natural Resource Policy, New Delhi
6. Bombay Natural History Society, Mumbai

4.10.2 Gaps

There is a lack of coordination among the various organisations undertaking research on biodiversity. Some ecosystems are well-studied, while others have not received similar attention. Likewise, research on species diversity is widespread, whereas genetic diversity has not been studied adequately. Further, as yet even the parameters for research activities are not well defined, at least in some cases. Even where the R&D parameters are well defined and sharply focussed, the studies take a long time to conclude. The findings of research projects take even longer to be integrated into policy making.

Some of the significant areas where there are major gaps in R&D are: bioprospecting, molecular characterisation and upgradation of technologies.

The participation of industry and other private sector in R&D is as yet not substantial.

4.10.3 Action points.

- Identify a coordinated agency for R&D work pertaining to biodiversity.
- Develop research plans on priority areas such as molecular characterisation, bioprospecting and upgradation of technologies.
- Devise mechanisms to fully gear up the participation of private sector in R&D activities.
- Promote research on evaluation of threats to biodiversity.
- Accord priority to research in hot spot areas for understanding the ecological principles for conserving the endemic species.
Promote basic and applied research for different types of ecosystems and species, with special emphasis on hitherto unexplored/under explored areas and lesser known groups of plants and animals, e.g., lower groups.

Encourage research on microorganisms with special reference to their role in various functional aspects of ecosystems such as energy flow, nutrient cycling, decomposition etc.

Promote and strengthen infrastructure leading to development of techniques for sustainable use, including harvest or economically important components of biodiversity, e.g., wildlife ranching, horticulture propagation etc.

Develop appropriate biotechnologies for utilisation of biodiversity components, which are ecologically sound and economically viable.

Enhance research efforts on modified habitats such as agro-ecosystems, organic farming, use of biofertilisers and biopesticides and integrated pest management.

Promote research on evaluation of impacts of developmental activities on components of biodiversity, and ecosystems as a whole.

Set up regional centres of excellence of biosystematic studies on representative ecosystems to promote and pursue survey activities.

Establish Centres of Excellence for taxonomic research in priority areas.

Set up regional centres for microbiological research and centres to establish a microbial inventory for survey of bio-activity and future uses through publicity.

Undertake periodic review of R&D activities.

4.11 INTERNATIONAL COOPERATION

4.11.1 Current status

India is a Party to a number of multilateral environmental treaties. These are:

- Ramsar Convention on Wetlands of International Importance especially as Water Fowl Habitat 1971.
- Convention concerning the Protection of World Cultural and Natural Heritage 1972.
- International Tropical Timber Agreement 1983.
- Convention on Desertification 1994

For steering and supervising the process of implementing the Convention on Biological Diversity, the Conference of the Parties (CoP) is the supreme decision making body. In order to provide the CoP with scientific, technical and technological advice, the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA), was established. As per Article 20 of the Convention "the developed country Parties shall provide new and additional financial resources to enable developing country Parties to meet the agreed full incremental costs to them". At present, the Global Environment Facility (GEF) is the institutional structure on an interim basis for the financial mechanism of the Convention.

The Ministry of Environment and Forests in the Government of India cooperates actively on environmental issues with the United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), South Asia Cooperative Environment Programme (SACFEP) and International Centre for Integrated Mountain Development (ICIMOD). India is also a State Member of the International Union for Conservation of Nature and Natural Resources (IUCN).

India is a member of the South Asian Association for Regional Cooperation (SAARC), which is the forum for promoting regional cooperation in this region. Technical discussions on environmental related matters are considered under the SAARC Technical Committee on Environment and Meteorology.

4.11.2 Gaps

Concerted efforts are required to improve bilateral and multilateral cooperation, as also cooperation with UN agencies and other international organisations on issues related to biodiversity. India shares a number of components of biodiversity with neighbouring countries. hence there is an urgent need to promote regional cooperation to evolve strategies for effective implementation of the provisions of the Convention, without undercutting each others interests.

4.11.3 Action points

- Further consolidate and strengthen global cooperation, especially with UN agencies and other international bodies on issues related to biodiversity.
- Promote regional cooperation especially with neighbouring countries through fora like SAARC, ASEAN, ESCAP etc. which share components of biodiversity across their boundaries for effective implementation of suitable strategies for conservation of biodiversity.
- Within the provisions of the Convention on Biological Diversity, promote bilateral cooperation leading to conservation and sustainable use of biodiversity.
- Develop programmes/projects for accessing funds for conservation and sustainable use of biodiversity from external funds for conservation through bilateral, regional and other multilateral channels.
CHAPTER 5

The subject of biodiversity is cross-sectoral in nature. Besides, State Governments, local institutions and people play a major role in conserving and sustainably utilising biodiversity. Equitable sharing of benefits also require informed and vigilant action at all levels. Implementation of the action plan will therefore naturally be heavily dependent on the involvement of central sector ministries/departments and other organisations both Government and Non Government, research and development institutions, academic institutions for subjects and areas pertaining to them.

For implementation and monitoring of the Action plan, there shall be a supervisory committee under the chairmanship of the Secretary, Environment & Forests with the Inspector General of Forests, Secretaries of other concerned Central Ministries, representatives of State Environment and Forest Departments, NGOs and a few experts as members. Experts on specific subjects may be co-opted where required. Similar management arrangements shall be made at the State level.

All India coordinated projects on various themes and subjects, e.g., taxonomy, coastal and marine biodiversity, national data base, will be formulated and implemented to secure full utilisation of available infrastructure and funds with augmentation and further inputs and funds wherever the need is established. Sources of domestic as well as external funding will be explored and availed of.
LIST OF PHOTOGRAPHS

FRONT COVER (Clockwise)
- Upperhill Ecosystem
- Coral
- Thunia marshalliana Orchid
- Mangrove Ecosystem
- Bird – Chestnut headed Bee-eater
- Royal Bengal Tiger
- Endangered Pitcher Plant

SECOND COVER
- A pair of open Bill Stork Chick at Kulik Bird Sanctuary, West Bengal

INSIDE PAGES (Sequence wise)
- Neora Valley National Park
- Chital Herd at Kanha National Park
- Silk Worm
- Basaka (Medicinal Plant)
- Wild Elephant Herd, Garo Hills, Meghalaya
- Flowersing Jarul Tree (Lagerstromia Spp.)
- Shola of Western Ghats
- Peacock
- Cobra Lily
- Red Panda
- Leopard Cat
- Himalayan Fern
- Median Egret
- Fruit
- Lion at Gir National Park
- Great Indian Bustard
- Coastal Ecosystem
- Desert Ecosystem
- Neora Valley National Park
- Tropical Rain Forest
- Dry Deciduous Forest
- Gujrat Saline Area with Babul Shrubs
- Stilt Roots of Mangrove Ecosystem
- Wetland Ecosystem at Kulik Bird Sanctuary, West Bengal
- Wetland of Rashikbeel Eco-Tourism Complex, North Bengal

- Mangrove Ecosystem
- Hental (Phoenix paludosa)
- Coral
- Desert Ecosystem
- Sea Crab
- Magnolia
- Mugger Crocodile on river bank, Corbett National Park
- Pangolin
- Leather Back Sea Turtle
- Soil Erosion
- Plastic pollution and Bio-Diversity
- Degradation of Himalayas
- Vateria metacarpa tree
- Mangrove Degradation
- Pair of Hoolock Gibbon
- Pin tail
- Brahma Kamal
- Echinodermata
- Ribbon Fish
- Cinchona Tree
- Sea Urchin
- Coral
- Red Fiddler Crab
- Pitcher Plant
- Elephant Herd in Corbett
- Tiger in Water, Bandhavgarh
- Tiger Reserve
- Rhino at Jaldapara Wildlife Sanctuary
- Brow Antlered Deer, Kaibul Lamjao National Park, Manipur
- Lizard
- Tree Fern
- Himalayan Monal, Singhaila National Park
- Yellow Raspberry
- Lion Tailed Macaque
- Tissue Culture of Plant
- Male Rhino in Zoo
- Botanical Garden

- Butterfly at Bhitarankanika
- Cultivation of Oyster Mushroom
- Cray Fish
- Strobulus Flower
- Bamboo Roofing - Forest Nursery
- Sea Grass
- Glorisa superba (Glory Lily)
- Himalayan Newt, Zorpukhri, Darjeeling
- Forest Research Institute, Dehradun
- Grass Hopper
- Peilophorum pterocarpum(Radha Chura)
- Black Partridge, Corbett National Park
- Student at Exhibition
- Teachers in Nature Trail
- ZSI Publications
- Adult Education at Mizoram
- Radio Collaring of Elephant, Gorumara National Park
- Plant Culture in Laboratory
- Ladies Slipper Orchid
- Siberian Crane at Bharatpur Bird Sanctuary, Rajasthan
- Passion Fruit Flower
- Ashoka

THIRD COVER
- A colourful Kusum Tree

BACK COVER (Clockwise)
- Coral Fish
- Demoiselle Crane
- Brow Antlered Deer
- Marine Ecosystem
- Spectacled Monkey
- Legume Flower
- Spider Weaving
- King Cobra
- Cochlospermum gossypium Flower

Photo Credits

Ministry of Environment & Forests
Zoological Survey of India
Botanical Survey of India

Pronab Basu
S. Pal Chowdhury
Adland Publicity Pvt. Ltd.