

# Andaman and Nicobar State Biodiversity Strategy and Action Plan

Coordinating Agency: Andaman and Nicobar Environmental Team, Port Blair

The NBSAP process for the Andaman and Nicobar Islands was initiated in October 2000 with the constitution of a Steering Committee vide A & N I Administration office order No. F. 16 (G-1)/19-642 dated 6-10-2000 and the appointment of ANET as the Nodal Agency for preparing the SAP. A Working Group was constituted by ANET to prepare the SAP and the first meeting of the Working Group was held during December 2000. At this meeting ANET presented the NBSAP process, methods and submitted a statement of issues and problems to initiate the process of the SAP for the Andaman and Nicobar Islands.

The Working Group met several times until meetings were abandoned due to lack of quorum. A draft report was prepared by ANET, and was circulated to all members of the Working Group for comments as suggested by the Chief Wildlife Warden, the Member Secretary, NBSAP, A & NI. On December 10, 2001, a meeting at the Department of Environment and Forests (AND E & F) convened by the CCF went over this draft and the draft was then substantially modified and expanded. The Steering Committee met on April 12, 2002, chaired by the Chairman NBSAP (PCCF & Secretary, ANDE & F). This meeting was represented by the Vice Chairman (CCF), Member Secretary (The CWLW, A & NI), Dr. Wafer, NBSAP Technical Policy Core Group (TPCG), members of the working group, several officers from the ANDE & F and from various departments. The final draft report that was prepared and circulated by ANET was reviewed and discussed in detail. After the review and discussions it was decided that a drafting committee be constituted. This five member (ANDE & F, BSI, ZSI & ANET representatives) committee met on various occasions and finalized the final draft SAP.

Several important themes peculiar to these islands did come up during the entire process. One of the most important issues identified was the continued immigration, which is taking a major toll of the natural resources and the ecosystems of the islands. Tourism was also identified as a cause for concern, and steps needed to be taken to ensure that it is done in an environmentally sustainable fashion.

Logging has also recently become a very contentious issue, with a recent Supreme Court order (Appendix: 1). This allows logging to meet local needs only. The court also ordered that all post-1978 encroachments on forestlands be vacated. It has suggested restrictions on immigration, and on entry into tribal reserves.

Browsing by introduced herbivores is a major source of damage to these forests. This affects regeneration, and could be a serious cause in the degradation of natural resources unless populations of deer are controlled.

In terms of research the first priority is a detailed island-wise survey of all major taxa, and the preparation of a GIS-based platform on which future work is to be based. Added to this, work needs to be done on the fossil history of these islands. Endangered and endemic species that require additional research inputs have been identified. Finally, an effort to understand the wants of the tribal communities needs to be made.

The Andaman and Nicobar Administration has a Wildlife Advisory Board and a State Level Environment Council for the islands.

# Andhra Pradesh State Biodiversity Strategy and Action Plan

Coordinating Agency: Environmental Protection Training and Research Institute, Hyderabad

## Background

The Biodiversity Strategy and Action Plan (BSAP) for Andhra Pradesh has been built on the following sources: three sub-state sites and two eco-regions. Besides, it includes inputs from a large number of secondary sources, both documented and through personal communication. It is also supported by the timely guidance of the members of Technical and Policy Core Group.

The three Sub-state sites are (1) Andhra Pradesh: North Coastal Belt (including Visakhapatnam, Vizianagaram, and Srikakulam); (2) Andhra Pradesh: Deccan Area (Zaheerabad region) and (3) Andhra Pradesh: Southern Andhra Pradesh Region (Anantapur, Cuddapah, Kurnool and Chittoor, Prakasam, and Nellore).

The two Eco-regions are (1) Inter State Eco-regions: Eastern Ghats and (2) East Coast Region for Andhra Pradesh.

This draft has also gone through a preliminary review by the Technical and Policy Core Group and it was forwarded to the Ministry of Environment and Forests.

There are **nine main chapters** in the BSAP for Andhra Pradesh:

- The **first** chapter gives an introduction about NBSAP, BSAP for Andhra Pradesh and methodology.
- The **second** chapter gives the Profile of the Area (i.e. geographical, climate, socio-economic and political profile etc).
- The **third** chapter deals with Current Range and Status of Biodiversity. This has subsections dealing with the floral diversity of Andhra Pradesh, vegetation, floristic and phytogeographic diversity etc.
- The **fourth** chapter discusses the Problems Relating to Biodiversity. This includes some key proximate and root causes for the loss of biodiversity, terrestrial ecosystem, aquatic ecosystem and agriculture etc.
- The **fifth** chapter deals with Major Actors and their Current Roles Relevant to Biodiversity.
- The **sixth** chapter covers Ongoing Biodiversity and Related Initiatives with details on Joint Forestry Management (JFM) and Vana Samrakshana Samithi/s (VSS).
- The **seventh** chapter outlines the Gap Analysis - gaps in information, gaps of vision, gaps in policy and legal structure and gaps in institutional capacity.
- The **eighth** and **ninth** chapters deal with Major Strategies and Action Plans - required actions to fill the gaps and strengthen ongoing measures.

## Chapter 1

### Introduction

This chapter presents a background to National Biodiversity Strategy and Action Plan (NBSAP) and includes a brief description on species diversity, biodiversity and BSAP – Andhra Pradesh. The chapter also presents the methodology adopted for the present study.

## Chapter 2

### Profile of Area

This chapter contains **five** sub-chapters:

1. **Geographical Profile:** Gives an idea about area of Andhra Pradesh, its tropical region and geographical divisions based on topography viz. Eastern Coastal Plains, Deccan Plateau, Eastern Ghat Ranges, Wetland Soils, Agriculture, Horticulture and Pisciculture. This also deals with Climate and Rainfall of the State.
2. **Socio-economic Profile:** Deals with the population, tribal communities and cultural variations.
3. **Political Profile:** Explains about the kind of governance, administration and structure both general and relevant to biodiversity.

4. **Ecological Profile:** Deals with natural eco-systems, wildlife, agricultural systems and other land/water uses. This includes terrestrial biodiversity, aquatic biodiversity and agricultural biodiversity.
5. **Brief History:** Gives a picture about historical changes in land/water use and in governance/control of natural resources.

## Chapter 3

### Current Range and Status of Biodiversity

The chapter has been divided into 3 main sections:

Section 3.1 on **Floral Diversity of Andhra Pradesh** details the various geographic district regions viz. Circars or Coastal Andhra, Rayalaseema and Telangana. The **Vegetation** of these geographical landforms and the life forms therein are discussed in Section 3.2. This section also reflects the sub categories like strand vegetation, estuarine vegetation, scrub and riparian vegetation.

Section 3.3 discusses about **Floristic Diversity and Phytogeography** of Andhra Pradesh. This section covers endemism, status of agricultural biodiversity and also of the crops grown in AP. It also covers some classification of the crop varieties and their characteristics.

## Chapter 4

### Problems Related to Biodiversity

This chapter profiles biodiversity of Andhra Pradesh. It gives an outline on proximate causes of loss of biodiversity. It also includes three parts namely terrestrial ecosystem, aquatic ecosystem and agriculture.

The **Terrestrial ecosystem** part deals with types of plants to be cultivated, plantations in parks and about rocky promontories.

**Aquatic ecosystem** part deals with fresh water ecosystem viz. reclamation and encroachment, eutrophication of the ecosystem, conversion of mangrove forests, monoculture of prawns and construction of jetties.

The last part of the chapter **Agriculture** covers three aspects, viz., monoculture of agricultural crops, value addition to local crops and concept of organic farming.

## Chapter 5

### Major Actors and Their Current Roles Relevant to Biodiversity

This chapter has three sub-topics dealing with:

5.1 **Rapid Assessment Surveys** by Forest Department in three regions i.e. Andhra, Telangana and Rayalaseema on medicinal flora.

5.2 **Current status of Tiger in AP** - gives an overview of measures that have been taken to mitigate biotic pressure on tigers, poaching cases and tiger census till 2001.

5.3 **Major actors and their role** deals with role of Forest Department in long term initiatives of biodiversity conservation, recommendations and amendments made by Government agencies like Council for Scientific and Industrial Research (CSIR), Chief Wildlife Warden (CWW), Central Zoo Authority (CZA) etc.

## Chapter 6

### Ongoing Biodiversity

6.1 Gives information on participation of the Government in the conservation of biodiversity. It gives an overview of forest management in AP and development schemes, information on JFM in four north coastal districts of AP. It also deals with objectives of JFM by Forest Department and Operationalisation of JFM.

6.2 Describes role of VSS and JFM in AP.

6.3 Deals with impact of JFM as reported by AP forest department.

6.4 Explains about role of women in JFM.

6.5 Gives an account of case study - Women of Medipalli in JFM programme.

6.6 Deals with district-wise details and statement showing the district wise number of VSS formed and forest area brought and treated under VSS.

6.7 Contains evaluation of JFM, information about ICRISAT, National Bureau of Plant Genetics and Research (NBPGR), University departments, Government departments, National Remote Sensing Agency (NRSA) and NGOs like Deccan Development Society (DDS), Foundation for Revitalisation of Local Health Traditions (FRLHT) and ANTHRA.

## **Chapter 7**

### **Gap Analysis**

7.1 Deals with gaps in information

7.2 Deals with gaps of vision

7.3 Deals with gaps in policy, legal structure and amendments by Indian Wildlife Act (IWA), 1972

7.4 Deals with gaps in institutional and human capacity.

## **Chapter 8 & 9**

### **Major Strategies and Action Plans**

These chapters deal with the following.

- Required actions to fill these gaps and enhance/strengthen ongoing measures.
- Charter for the Eastern Ghats conservation by State Forest Departments and Agriculture Departments; modern techniques for rare and important species
- Action for conserving of mangroves
- Marine biodiversity
- Gender issues
- Inter-sectoral issues and crosscutting themes with neighboring States.
- Recommendations of four working groups namely a) Biodiversity, b) Technology, industry and biodiversity c) Education, training and research, d) Policy, law and planning.
- Strategies to conserve and sustainably use natural ecosystems and wild plant and animal diversity. Gives information on action plan, description, project, priority, responsible agencies and resources required.

Strategy 1: Protection and conservation of sacred landscapes and documentation of biodiversity resources

Strategy 2: Conservation of medicinal plant resources

Strategy 3: Conservation of biological resources of the Eastern Ghat forests

Strategy 4: Conservation of fresh water and salt-water lakes

Strategy 5: Coastal zone monitoring and management

Strategy 6: Conservation of marine bio-resources

Strategy 7: Strengthening of protected area networks

- Strategies to conserve and sustainably use agro-ecosystems and domesticated plant and animal diversity

Strategy 1: Conservation of crop plant genetic resources

Strategy 2: Establishment of botanical gardens and propagation of threatened species

Strategy 3: Zoological parks and captive breeding of endangered species

- Strategies to conserve and sustainable use microorganisms.

This is to provide an inventory of microorganisms encountered in the State of Andhra Pradesh

- Strategies to achieve equitable decision making, people's (including women) empowerment and participation, equitable sharing of benefits, cross sectoral integration, policy and legal changes, financial measures and other such steps.

Strategy 1: Sustainable marketing of medicinal plant resources

Strategy 2: Sustainability of VSS and effective Non Timber Forest Produce (NTFP) marketing.

Strategy 3: Environmentally sustainable industrial development

Strategy 4: Promoting awareness on biodiversity and its conservation

Strategy 5: Construction of State level database on biodiversity and dissemination of information to targeted sectors

Strategy 6: Effective legislative framework for conservation, sustainable use and equitable sharing of benefits of biodiversity.

# Arunachal Pradesh State Biodiversity Strategy and Action Plan

Coordinating Agency: State Forest Research Institute, Itanagar

Arunachal Pradesh is strategically situated in the extreme North-Eastern part of India having international border on three sides, Bhutan in the West, China in the North and North-East, and Myanmar to the East, and nationally with Assam in the South and Nagaland in the South-East. It has a land mass of 83,743 Sq. Km with rugged terrains of deep valleys and high mountains of the Eastern Himalayan elements. The wide ranging elevations from about 100 m adjoining Assam plains with Shiwalik hill ranges to a great height of 7000 m in the greater Himalayas with snow-capped peaks give rise to wide variations in topography, soil, river systems, climatic conditions with varying temperature, rainfall, humidity and accompanied diverse vegetation with unparalleled biodiversity - flora and fauna.

The state is a home of myriad life forms coexisting in diverse ecological situations in their pristine glory. The state, the then NEFA, variously referred to as "**Hidden Land**", "**Elusive Frontiers**", "**Dawn-lit Mountains**" etc. was less known until independence. With the dawn of development, the frontier state is today known for its rich biodiversity. Floristically there are more than 5000 species of flowering plants, 600 species of orchids, 89 species of bamboos, 18 species of canes, 400 ferns, 24 species of gymnosperms and an equally high number of unexplored algae, fungi, lichens, bryophytes, and micro-organisms inhabiting the state. Thus, this eastern Himalayan State harbors more than 33% of the total Indian flora with unique taxa and large number of genetic resources making it a "**cradle of speciation**" and center of origin of number of cultivated plants. Faunistically, the state is also rich in having more than 100 mammals, 650 birds, 83 reptiles, 130 fishes and 7 non-human primates and innumerable species of insects, micro-organisms and other life forms. Thus, the rich biodiversity both flora and fauna have contributed to its recognition as one of the 18 "**Biodiversity Hotspots**" in the world.

Obviously, such a biodiversity - a resultant of time-tested bio-geographical, ecological and environmental impact has greatly influenced the life and lore of a million indigenous people inhabiting the hills of the state with distinct identity recognised under 25 tribes and 110 sub-tribes living harmoniously with nature. The influence and impact of biodiversity have found beautiful expressions and manifestations in the diverse art and culture, life styles, food-habits, cultivation practices (Jhum), songs, dances, festivals, rituals, crafts, customs, traditions, self-governance and their enormous indigenous knowledge system (IKS).

However, with the recent development and administrative impact and influence, there is a considerable change in the life -styles and the consequent influence on the socio-economic development of the people of Arunachal Pradesh. The state is now at the crossroads of tradition and modernization, poverty and affluence and loss and gain. With the speedy development in various sectors like Education, Communication, Health, Power, Agriculture, Horticulture, Animal Husbandry, etc, there is an increasing demand and pressure on land and natural resources forests and environment, depleting it gradually and steadily. There are no industries other than forest-based, which have also come to a halt with the Hon'ble Supreme Court's directives. There is growing unemployment and hence new avenues are to be opened up. At this juncture, a well thought of policy and planning on the sustainable utilization of biodiversity striking a balance with man and nature is a need of the hour.

Realizing of the importance of biodiversity from the local level to global level, Ministry of Environment and Forests, Government of India has come up with a National Policy and Macro-level Action and Strategy on Biodiversity through a consultative process, termed as National Biodiversity Strategy and Action Plan. In tune with the same, government of Arunachal Pradesh also has initiated action by setting up a State Steering Committee (SSC) headed by the Chief Secretary as its Chairman, and Director, SFRI, as the Nodal Officer for implementing this process of SBSAP in this state. Over the past one year, the team headed by the Director, SFRI has been able to conduct 29 public hearings covering almost all parts of the state and several consultative meetings with various people at different levels, local headmen, leaders, officers, teachers, scholars, scientists, etc. and has documented and prepared an **exhaustive "State Biodiversity Strategy and Action Plan, Arunachal Pradesh"**. This incorporates the views of cross-sections from grass- root level to the elite societies of the state.

Thus, the Arunachal Pradesh State Biodiversity Strategy and Action Plan consists of twelve chapters dealing with the following aspects

1. Introduction
2. Profile of Area
3. Current (known) Range and Status of Biodiversity
4. Statement of the Problems Relating to the Biodiversity
5. Major actors and their current roles relevant to biodiversity
6. Ongoing biodiversity related initiatives
7. Gap analysis
8. Major strategies to fill gaps, and enhance/strengthening ongoing measures
9. Required actions to fill gaps, and enhance/strengthen ongoing measures
10. Recommendations
11. Bibliography
12. Annexures

In essence, while adopting the National goals set in the preparation of biodiversity Strategy and Action Plan, the state's needs for biodiversity conservation concerns in all its dimension have been dealt in detail. In the first chapter, brief back-ground and SBSAP process in Arunachal Pradesh have been given. The second chapter deals with geographical, socio-economical, political and ecological profiles dealing in detail with plants and wildlife, agriculture system, land and water use, etc.

In the subsequent chapters from 3rd to 7th, status of natural ecosystems, agriculture ecosystems, domesticated plant and animals, problems relating to biodiversity and their causes, biodiversity conservation initiatives, people and organizations involved and gap in understanding, vision, policy and capacity have been analyzed.

Based on the findings after discussions, deliberations, and consultations major strategies and action plans have been drawn up in the 8th and 9th chapters. Actions have been supported with adequate investment proposals to the tune of Rs. 3206.8 crores spread over 5/10/20 years depending upon priority. In order to facilitate planners and policy makers, sector-wise recommendations have been provided in the last chapter.

In the text, there are 11 numbers maps and 41 numbers of tables and appended by 25 numbers of photographic illustrations depicting the various profiles of biodiversity, its status, impact of man's intervention and developments.

No doubt, biodiversity is the gift of nature and the man as a stake-holder has absolute right over it. But, to what extent? There is a need to strike a balance and evolve a strategy for sustainable utilization-not depleting the resources, nor depriving the native inhabitants. For centuries, because of the inaccessibility, people of the state had remained isolated, backward and poor unaware of the advancement that had taken place elsewhere. With the increasing developmental activities, connectivity and education, now there is an urge and aspiration to catch up with the advanced states and world with modern amenities. Biodiversity and other natural resources that are abundantly found in the state are the only means to catch up fast with modernization. But at what risk! Should we deprive our future generation of the benevolent fruits of natural resources of the state? No.

Here it calls for regional, national and international interventions who also derive intangible benefits from the natural resources of the state. A helping hand to the peace-loving people of the state in order to enable them to share the benefits of its rich biodiversity in a sustainable manner is the need of the hour.

The State Biodiversity Strategy and Action Plan recognizes and recommends eco-friendly ventures in the field of Horticulture, Floriculture, Agriculture, Tourism, Industry, Textiles, Handloom and Handicrafts, Hydro-power, non-conventional energy and Forestry with an emphasis on Non-timber Forest Produces - Bamboo, Cane, and Medicinal Plants. It also envisages policy frame work in all the sectors respecting and adopting local customs, traditions and practices with refinements, peoples involvement and participation, protection of indigenous knowledge system and benefit sharing. Biodiversity conservation should get top priority in all the sectors with strict compliance of biodiversity conservation laws/forest and wildlife conservation acts that are in place or by enacting a suitable law where ever needed. The role of every individual, entire cross-section of the society, all the line departments of the government, NGOs of the state, region and nation is called for conservation and sustainable development of biodiversity of the state in the larger interest of the future of mankind.

# Assam State Biodiversity Strategy and Action Plan

Coordinating Agency: Assam Science Society, Guwahati

Biodiversity has currently emerged as an issue of global concern. Almost all the countries of the world irrespective of their locational and socio-political characteristics have now come forward in an organized manner to address the issues relating to biodiversity as there has been increasing threat and pressure on the biosphere. Different nations under the guidance of international bodies like UNO have developed their own plans and programmes for sustainable use and conservation of biodiversity. In India, although there have been large number of studies on biodiversity and related issues, these are not organized enough to formulate a national action plan for conservation of biodiversity.

The Ministry of Environment and Forests, Government of India and United Nations Development Programme (UNDP), Global Environment Facility (GEF) have, therefore, come together to create a scientifically organized base of the status, prospects and problems of biodiversity in the country so as to arrive at a common national policy applicable to all parts of the country with due recognition to regional realities favourable for sustenance of biodiversity. In Assam, depending upon the physical and cultural variations two areas have been identified for the purpose. The districts of the Brahmaputra and the Barak valleys and NC hills district (22 districts in total) have been considered as the state unit and the Karbi Anglong district as the sub-state unit.

In the background stated above, the present work attempts to provide a detailed picture of the status of almost all forms of biodiversity, threats and pressures on it, initiatives taken so far for sustainable use and conservation and finally a scheme of strategy and action plan for sustainable use and conservation of biodiversity in the state. It also tries to create an environment involving all the people and the administrative machinery that is expected to encourage all concerned to contribute positively to the mission of biodiversity conservation in the state.

As the biodiversity strategy and action plan encompasses all the geographical units, ecosystems, population groups and the economy and culture of the state, a wide range of information and data pertaining to biodiversity and related issues have been collected, and also generated wherever possible. This is really a Herculean task, the accomplishment of which requires utmost sincerity and seriousness. Therefore, since the beginning of the project a well thought-out multi-staged methodology has been chalked out and followed.

## **Geographical and Socio-Economic Profile**

Assam, a constituent state of India, holds a unique position in the country's strategically very important north-eastern region. The present physiographic configuration of Assam is characterized by diverse features such as floodplains, marshes and beels, scattered hillocks, folded hill ranges and old plateaus. Assam lies in the regime of monsoon climate with a hot and wet summer and a cool and dry winter. However, the state shows marked variation in its climatic pattern mainly because of its peculiar location and relief, natural vegetation and presence of waterbodies including rivers. The soils of Assam are generally divided into four groups-alluvial soils, piedmont soils, hill soils and lateritic soils. The alluvial soils are extensively distributed over the Brahmaputra and Barak plains. The Hill soils are generally found in the southern hilly terrains of the state. The lateritic soils in the state extensively occur in the N.C. hills district and some parts of southern Karbi Plateau.

The terrestrial natural ecosystems of Assam are mainly forest ecosystems covering both the hills and the plains, besides the grassland ecosystems. The aquatic ecosystems are of both lotic and lentic types. The lotic ecosystems are confined to the main rivers and their tributaries. The lentic ecosystems are mainly the large stagnant waterbodies locally known as beels, ponds, swamps and other waterlogged areas. Moreover, although limited in number and area, the national parks and sanctuaries in the state bear immense significance insofar as biodiversity is concerned. The national parks and sanctuaries in Assam cover around 3% of the state's total area as against the country's 4.3%.

Assam is the homeland of several population groups such as the tribals, the indigenous non-tribals, the Bengali Hindu immigrants, the Muslim immigrants, the Nepali immigrants, the tea labourers and several other groups from within the country. Although the process of assimilation among the different populations is still going on, the groups maintain considerably their traditions and cul-

tures in the territories under their occupation. Thus the composition of population in the state exhibits great diversity. So far the scheduled castes and tribes are concerned, there are altogether 16 scheduled caste communities constituting 7.4% of the state's total population, while the scheduled tribes (ST) accounts for 12.82% (1991 census). Demographically, Assam is characterized by a very high rate of population growth throughout the last century. At the beginning of the 20th century the state had a population of 3.29 million. It increased to 8.03 million in 1951 and to 22.41 million in 1991 witnessing an average annual exponential growth rate of 1.80% during 1901-51 and 2.60% during 1951-91 as against the country's corresponding growth rates of 0.83% and 2.15%. The present population (as per 2001 census) of the state stands at 26.63 million.

## Status of Biodiversity

### Plant Diversity

The vegetation of Assam is primarily of tropical type covering areas of evergreen, semi-evergreen, deciduous forests and grasslands. Stretches of riparian forest found along the river banks are also very important. Due to incomplete reporting from certain areas like North Cachar hills, parts of Tinsukia district that contains patches of tropical rain forest and parts of Kokrajhar district, the exact number of species in Assam still remains uncertain. However, the available records and enumeration lists suggest that there are 3017 species of flowering plants.

Assam houses quite a good number of medicinal plants including several rare, endangered and endemic species. A comprehensive list prepared on the basis of existing literatures contributed by various workers has been presented in the report. This list includes indigenous and wild plants, which have certain medicinal uses. The state is also rich in bamboo diversity, where 10 genera and 42 species can be found. In the case of cane, the total number of species reported stands at 14.

Orchids belonging to the family Orchidaceae are one of the largest groups of flowering plants. N.E. India claims the largest share in the world with about 72% species that covers around 825 species under 145 genera. Most of the epiphytic orchids are lost due to mass clearance of forests for other developmental activities. Besides, the problem of grazing, some unplanned human activities and interference through collection for ornamental, medicinal and commercial purposes, many terrestrial and saprophytic orchids are now on the verge of extinction. In Assam, about 192 species of orchids are distributed in the plains and hilly areas.

A large part of Assam is covered by wetlands rich in both flowering and non flowering plants. The rural communities rely upon the wetlands for various purposes and harvest a variety of products like fish, fodder, food items etc. The aquatic plant species of Assam belong to diverse habitats and have distinctive characteristics. Many wetlands of the state are in a process of eutrophication, indicating unproductivity due to both natural and human factors. The extensive growth of water hyacinth (*Eichhornia crassipes*), one of the most cumbersome aquatic weeds of this region, is becoming a constant threat to the productive wetlands.

Although there is no exhaustive list of the endemic flora of Assam, a search on the basis of the exploration of BSI and other workers reveals the occurrence of as many as 102 species belonging to 75 genera which are considered to be endemic. Due to the lack of adequate information, it is difficult to ascertain the number of rare, endangered or threatened taxa of Assam. However, a list of 60 rare, endangered and threatened species from the state has been compiled.

### Animal Diversity

The North-East including the state of Assam represents the transitional zone between the Indian, Indo-Malayan and Indo-Chinese biogeographical regions. It is, therefore, considered as one of the most biological diverse areas in the whole of South Asia. Here, the forests are extremely rich and diverse with wide varieties of primate, carnivore, herbivore and birds. About 193 species of mammals and more than 958 species and subspecies of birds are so far reported from Assam. The state possesses 16 important wildlife areas, which house nearly 44 types of endangered and rare species of mammals and 14 types of reptiles and amphibia. Altogether 230 forms of mammals including species and sub-species have been recorded so far from Assam. There are 14 species of primates in Assam, which constitute 1/6th of the total primate species of the world. As many as 19 cat families are reported to be found in the state. Moreover, Assam holds the entire known world population of Pigmy hog, 75% of the world population of the Indian rhinoceros and Wild water buffalo and a sizable population of Asian elephants and tigers.

Diversified habitats and various ecological associations have significantly enriched the avian diversity in Assam with more than 950 avian species belonging to 302 genera and 68 families. The largest family being Sylviidae followed by Muscicapidae, Accipitridae, Corvidae, Anatidae, Scolopacidae, etc. The state represents 53.5% of total birds species of Indian sub-continent.

Reptiles constitute an important vertebrate group. Assam with its varied topography and habitat types support a species rich reptilian fauna. Members of three living Orders namely Crocodylia (Crocodyles and Gharials), Chelonia (Turtles and Tortoises) and

Squamata (Snakes and Lizards) are found in the state. The records of reptilian resource of Assam show the presence of 1 species of Crocodylia, 19 species of Chelonia and 77 species of Squamatas.

North-East India supports a well-diversified amphibian fauna and so far 70 species are reported from the region. The amphibian fauna of Assam is very poorly evaluated and most of the records are that of undivided Assam. In the state, so far 185 species belonging to 98 genera under 34 families have been recorded. This group has 33 representatives endemic to the region. So far fish is concerned, 25 species have been identified as threatened.

The fresh water molluscs constitute an important part of the ecosystem. The Brahmaputra and the Barak river systems of Assam with their large number of perennial tributaries, hill streams, swamps, beels, man-made ponds, reservoirs, floodplains etc. are the main habitats for the snails. In Assam, 10 species of freshwater snails are used as food by different tribal communities. The family Thiariadae has the highest number (10) of species but the family Planorbidae, Achatinidae, Bithyniidae, Cyclophoridae, Ariophantidae and Unionidae have the lowest number (1) of species.

Butterflies and moths are the living jewels of the landscape. In India, about 1500 species of butterflies have been identified so far and among these about 50% species are reported from Assam. The large and beautiful Swallowtail butterflies like Great windmill, Rose windmill, Golden birdwing, Common birdwing, Batwing, Tailed redbreast, Sword tail, Dragon tails etc. are very rare and restricted to some small areas only.

In Assam, much work has not been done so far to assess the microbial diversity of the region. The cultivated lands of Assam harbor large varieties of useful microbes. The nitrogen-fixing bacteria and blue-green algae are abundant in the soils of the state. Already some amount of work has been done on Rhizobial species from soil wherein leguminous crops like *black and green gram*, *lentil*, *cowpea*, *chickpea*, etc. are cultivated. These rice fields contain a large variety of nitrogen-fixing blue-green algae along with *Aspergillus fumigatus*, *Chaetomium thermophile*, etc.

### **Agricultural Diversity**

The North-East India including Assam is in the core of the widely recognized centers of diversity of several field, horticultural and cash crops. The geographical location, physical features and historical realities have made the state an area of unique ethnic and cultural diversity. Variation among different ethnic groups in their traditional knowledge of uses, quality preferences and farming practices are the additional factors adding to the diversity of the plant species.

Assam is a part of the region widely recognized as the center of diversity of rice. The indigenous rice germplasm of the region is endowed with wide genetic diversity and represents a wealth of valuable gene systems. The rice germplasm stock maintained at the central Rice Research Institute (CRRRI), Cuttack includes 2054 from Assam alone out of 12256 collections from all over India which explains the extent of diversity of rice in the region. The present stock of rice germplasm in Assam Agriculture University amounts to around 4000 accessions, including local varieties and improved strains.

North East India including Assam possesses reasonably rich diversity in several grain legumes. Altogether 61 lines of greengram, 59 lines of blackgram, 44 line of lentil, 12 lines of arhar and 29 lines of fieldpea are being maintained at the Regional Agricultural Research Station (RARS), Shillongani. Sugarcane has been in cultivation in Assam since long past. Out of 24 wild species of sugarcane in the country, 12 are found in north-eastern region including Assam.

Assam is known for its tea plantation. The gene pool of tea consists of cultivated species, non-cultivated or wild species, weedy relatives, old seed *jats* or land races, improved clones and breeding lines/hybrids. It is noteworthy that the collection of diverse tea germplasm at Toklai Experimental Station, Jorhat was started in the early part of the last century. The station so far has collected 1074 germplasms which indicate the broad base of genetic diversity in the state.

The diversified ecology of Assam is unique for growing a large number of fruits and vegetables of tropical, sub-tropical and temperate origin. Assam is exceptionally rich in citrus and banana germplasm. Another unique feature of the state is the occurrence of aquatic fruits like *makhana* or gorgon fruit (*Eurale ferox*). Besides, large number of minor fruits of medicinal and therapeutic values are grown all over the state either in backyard gardens or in forests. Vegetables grown in the state include tropical vegetables like cucurbits, various kinds of bean, some varieties of leafy vegetable, lady's finger, etc. and temperate vegetables like cole crops, tomato, pea, carrot, beet, etc. Almost all-temperate, tropical and sub-tropical commercial vegetables are being grown in Assam. The state is exceptionally rich in genetic resource of cucurbits, non-tuberiferous solanums, and beans and tuber crops.

The state is endowed with rich germplasm of different livestock and poultry species. The indigenous livestock and poultry consti-

tute the major chunk of the states population. Over the years the population of livestock and poultry species viz., cattle, buffalo, goat, pig, sheep, fowl and duck have shown a steady increase with varying annual growth rate at different periods. However, there have been growing threats and pressures on domesticated livestock diversity both from natural and human fronts. Among others, the process of urbanization and industrialization and the resultant change in the lifestyle of the people on the one hand, and the problems of flood and bank erosion etc. on the other, may put increasing pressure on the domesticated livestock diversity.

Sericulture and weaving are the part of the cultural heritage of the people of this region. It exists in the Brahmaputra valley from time immemorial. It was practiced by the tribal of the North-East even before the Arayan migrated to this region. The indigenous people of the North-East were well acquainted with the product of wild worms such as Doyang muga, Deo muga, Kotkari muga, eri etc. All types of native food plants of silkworm grow abundantly throughout North East and especially in the Brahmaputra and Barak valley and the foothills of Naga, Khasi and Garo hills. Muga silkworm is a polyphagous insect, which feed on several food plants, of which the primary ones are Som (*Machilus bombycina* K) and Soalu (*Litsea polyantha*, Juss).

### **Causes of Biodiversity Loss**

The causes of biodiversity loss are grouped into two: proximate causes and root causes. The proximate causes include (i) population growth and density, (ii) habitat destruction caused by anthropogenic factors, (iii) overgrazing, (iv) poaching, (v) flood and bank erosion, (vi) application of agrochemicals, (vii) biopiracy and (viii) political problems. The root causes of biodiversity loss on the other hand are perceived as stated below:

1. The development activities adopted so far in the state in most cases have not paid required attention to the delicate aspects of the environmental systems. This has obviously resulted in a growing unconformity between the natural and the human systems. A general lack of scientific understanding and negligence of the attributes of nature and their functioning in various ecosystems in the state is commonly observed in the process of formulation development plans and programmes.
2. The traditional modes of agricultural and household industrial production which more or less maintain a harmonic relation with nature are being increasingly replaced by the modern modes, many of which are, however, exotic in nature. The exotic modes of production such as tea farming, coal mining and oil exploration, paper manufacturing, etc. generally care little for sustainability of the local resources.
3. The economic developments attained by the state in different production sectors are not properly oriented to the diversity of the available and potential natural resource base. In many cases, the development process and generation of employment are being diverted to such sectors which have very little to do with the rich natural resource base of the state. Overwhelming and unmanageable concentration of working force in the government service sector is the best example in this regard.
4. The rich natural diversity of the state in wilderness was exposed in the early part of nineteenth century to an economy basically colonial and exploitative in nature. The virgin lands with rich biodiversity were extensively used for capitalistic production of tea, coal, oil and timber which was quite unfriendly to the local natural environment. The legacy of such an exploitative system is still found to continue in some forms, direct or indirect.
5. The streams of migration of people experienced by the state in different periods from within and outside the country having different traditions and economic backgrounds have been found, in most cases, to be not conducive for long-term sustenance of the biodiversity. The uncontrolled migration of people particularly to the delicate ecosystems of foothills and river banks are, in fact, no less responsible for causing substantial erosion of the very broad base of the state's biodiversity.

### **Major Actors: Roles and Initiatives**

It is encouraging to note that there has been a growing awareness among the people on the vital roles played by biological diversity on the survival of natural system and human culture during the recent period. It is further encouraging to note that a section of the people have, at least, voluntarily come forward under the initiatives of some NGOs to understand the importance of biodiversity and act accordingly for its conservation. The growing initiatives and positive activities of the people and the NGOs in this regard have been able to draw attention of the government and to initiate something from its end in this direction. Parallely, insurgency and political uprising of certain communities for their identity and right have also played some role, negative or positive, in regard to biodiversity conservation. The roles and initiatives of the people, various departments of the government and the NGOs for conservation of biodiversity have been discussed. The policies and programmes currently adopted by the departments of forest, agriculture, sericulture and fisheries are mentioned. The diverse activities performed by different NGOs in the state have been summarized as follows:

- i environmental education and awareness;
- ii people's participation in forest and wildlife conservation;

- iii sustainable use of biological resources;
- iv promotion of traditional values relating to environment and biodiversity conservation;
- v integration of interdepartmental activities of the government and bridging gap between the people and the government in the fields of environment and biodiversity conservation.

### **Gap Analysis**

Gap analysis has been made in terms of gaps in understanding, sustainable use and conservation of biodiversity. This includes analysis of gaps in information, gaps in vision, gaps in policy and legal structure and gaps in institutional and human capacity.

### **Strategy and Action Plan**

Based on the philosophy and methodology as suggested by NBSAP, the inputs provided by the government/non-government agencies, the network of local working groups created for the purpose, public meetings (*raij mel*) held at different places of the state, opinions derived from individual experts, a conceptual framework has been developed to formulate strategy and action plan for conservation and sustainable use of biodiversity in Assam. The strategies formulated cover almost all the issues and problems concerning biodiversity as visualized by the project group to be important, relevant and workable. In some cases, however, the suggested actions could not be pin pointed to the expected level owing to paucity of authentic data and concrete picture of the concerned themes and issues. It is not that there is no scope for further incorporation of strategies and actions, if someone goes for the finer details of the issues and problems. The set of strategies and action plans stated below tries to prioritise the themes and issues relevant to sustainable use and conservation of biodiversity in the state-

#### **Strategy**

1. Dissemination of education and awareness among all sections of people including those in political, administrative and legal fields.
2. Revitalization of traditional perception, knowledge and skills which have significant positive values in the rational use and conservation of biodiversity resources.
3. Expansion of scientific studies on various facets of biodiversity and integration of them to strengthen the total understanding of biodiversity and to explore measures for its sustainable use and conservation.
4. Reorientation of the economy towards sustainable use of biological resources and generation of employment opportunities for the weaker sections and women in ecofriendly occupations.
5. Integration of the existing conservation efforts to strengthen their efficiency and evolving new measures for conservation of biodiversity in view of the emerging problems and prospects.
6. Identification and management of the threats and pressures on biodiversity.
7. Maintenance of agricultural biodiversity and planning for sustainable management of the farming system.
8. Conservation of the aquatic environment and safeguarding their rich biodiversity for sustainable use and development.
9. Formulation of policy and laws for conservation and sustainable use of biodiversity.

Under these nine strategies as many as 48 actions have been suggested for implementation. It is desired that transparency, people's involvement, NGO's help and co-operation, guidance from experts and more importantly sincere efforts from the government departments should be ensured within the existing and changing administrative framework of the state for successful implementation of the actions suggested.

# Bihar State Biodiversity Strategy and Action Plan\*

Coordinating Agency: Environment Wing, Forest and Environment Department, Patna

Biologically, economically, culturally and politically Bihar was state of immense and growing stature and importance in a rapidly changing national and global scenario/environment. In terms of the extent of diversity and uniqueness of its biological and natural resources, it was one of the richest states of India. But unfortunately, a part of Bihar was separated and formed in to a new state of Jharkhand on November 15, 2000 which was full of mineral wealth and dense forests. As a consequence of the rich mineral wealth the Steel plants like TISCO, Bokaro Steel, Hindustan Co. Ltd., Coal Industries, Uranium Co-operation of India and Cement Industries was established in the new state of Jharkhand erstwhile Bihar. It also had a rich biodiversity because of the dense forests located in that region. Thus the undivided Bihar had a very unique feature i.e. South Bihar was full of mineral wealth beneath the ground and North Bihar bestowed with fertile land for agriculture, above the ground. But the state of Bihar after partition which is left with only fertile land and that too is at the mercy of God, sometimes flooded and sometimes drought. Bihar is one of the most flood and drought prone states of India, hence poverty in Bihar has increased because of the following reasons:

1. Overpopulation and apathy towards family planning.
2. Very fertile land but poor management of flood control and irrigation facilities and sometimes leading to complete drought
3. Illiteracy.
4. Poor health care.
5. Lack of industrialization due to poor infrastructural facilities even for agro-based industries. Heavy industries can not be established because of the lack of raw material and the alluvial soil conditions in North Bihar. Thus, only agro based industries can be established in the truncated Bihar but that too is not coming up due to lack of infrastructural facilities.

In the truncated Bihar, population is about 7.5 crores. Its land area is 94786.72 sq km which means 791 people per sq km. which is quite high from the national standard. Hence, there is an urgent need to reduce population and steps should be initiated soon.

Bihar lies in the tropical to sub tropical regions. Rain fall here is the most significant factor in determining the nature of vegetation. During monsoon, the average rain fall is 1200mm. Most of the forest has gone to the state of Jharkhand and in the present state of Bihar, the sub Himalayan foot hill of Someshwar and Doon ranges in the Champarn district constitute the moist deciduous forest which have a luxuriant sal forest, Seesam, Khair, and Semal.

It was therefore, considered timely and essential to develop a comprehensive plan for the state of Bihar that would ensure that aspects relating to conservation and sustainable use of biodiversity are better understood and managed. For his purpose, the development of a State level biodiversity Strategy and Action Plan has been initiated in pursuance of the U.N. Convention of Biological Diversity in June 1992, a draft for National Biodiversity Strategy and Action Plan (NBSAP) for the conservation, sustainable and equitable use of biodiversity and biological resources was published in October 2002 by MoEF, Govt. of India. In this context "the Biological Diversity Act, 2002" has also been enacted by Govt. of India and as per section 22 (1) of the Biological Diversity Act, 2002 each state shall have to constitute State Biodiversity Board to implement the action plan.

The Department of Environment and Forests, Govt. of Bihar decided to request an independent agency namely Centre for Environment and Nature Conservation, Department of Zoology, Patna University, to prepare the State Biodiversity Strategy and Action Plan for the State of Bihar. While formulating the State level Strategy and Action Plan, the attempt from the very beginning had been to be participatory in nature with open-ness to all points of views of interested groups reaching out to a large number of local level organizations, NGOs, academicians and scientists, government officers of different departments, the private sectors and others who had stake in biodiversity. A two-day workshop on Biodiversity Strategy and Action plan for the State of Bihar was organized in which large number of participants from all walks of life participated. The inputs of the workshop have been incorporated in the Action Plan. In short, efforts have been towards decentralizing the planning as far as possible and proceed upwards from the grass-root level. Media outreach has also been one of the main components of the State Action Plan.

The ethos of conservation is engrained in Bihar's cultural heritage. In the past, the subsistence of life styles of different group of

people was shaped by their natural surroundings. The cultural diversity helped to maintain a range of biological diversity by the introduction of selective species. In doing so, people in different parts of Bihar have evolved appropriate conservation and management approaches based on their cultural, religion, ethics and traditions. For e.g., the unique tradition of marinating sacred grooves has been responsible for preserving the biological diversity in various parts of Bihar. The protection of biological diversity is important not for only cultural, historical or scientific reasons but also for practical reasons.

**The structure of this document.** The document consists of **five parts** and **three appendices**.

The first part: Conditions and Provisions for Developing National Strategy for Biodiversity Conservation include:

1. ***an introductory section detailing the international context,***
2. ***a section outlining the socio-economic and land use background;***
3. ***a section summarizing the status and value of biodiversity in India; and***
4. ***a final section describing the legislative and institutional context for its protection and sustainable use.***

**The second part: the Biodiversity conservation strategy includes a brief analysis of previous information, and then a description of the national goals, objectives, means to achieve them.**

**The third part: the National Biodiversity Conservation Action Plan elaborates on the strategy described above and includes details of concrete actions required to achieve objectives, and a timetable for action-plans.**

**The fourth part: Action Plan for Biodiversity for the state of Bihar, which contains:**

1. Historical background and present status
2. Cultural and religious diversity
3. Geomorphology of Bihar
4. Map of Bihar
5. Area, Population, Division and Districts
6. Agro climatic resources
7. Domesticated Biodiversity
8. Natural Resources
9. Forest cover and green belt/protected areas in Bihar (Parks and Sanctuaries)
10. Valmiki Tiger Reserve
11. Dolphin Sanctuary
12. Sanjay Gandhi Biological Park
13. Location of Bihar in Lower Gangetic Plains-Boons and Banes
14. Wetlands and swamps
15. Directory of wetlands of Bihar
16. Drought prone Areas of Bihar

**The fifth part: Bihar Biodiversity strategic challenges and options which include:**

1. Controlling land degradation
2. Arresting deforestation
3. Preventing degradation and depletion and water resources
4. Wetland Biodiversity Protection
5. Developing fisheries
6. Developing wild life sectors
7. Developing the domesticated Biodiversity
8. Restoring and conserving Biodiversity
9. Developing human settlements
10. Controlling Air Pollution and managing climate change
11. Preventing noise pollution
12. Managing hazardous substances
13. Eradicating poverty and controlling population growth
14. Political advocacy for proper management of natural resources and environment.

## **Policy and Objectives**

The National Forest Policy of 1988 recognized the rights of excess of local people, specially tribal people and members of the dis-

advantaged class to biological resources in forests. The policy laid down several principles regarding the rights and responsibilities of the local people in using these resources:

- **Access:** rights and concessions of the tribal people and disadvantaged class must be recognized and protected.
- **Regulation:** grazing and harvest rights of local people should be controlled and related to forest carrying capacity.
- **Participation:** people exercising customary rights of access to forest resources should be involved in their protection.

## Goals, Objectives and Outputs

### Goal

Through conservation and sustainable use, to protect and maintain Bihar's biodiversity as critical components for its sustainable development for the benefit of people of Bihar, both present and future.

### Objectives and Outputs

#### Objective 1

**Protected Areas System:** To establish a system of protected areas with strong legal protection and effective management which is properly representative of the range of the Bihar's ecosystem and species.

#### Institutional and Legal Provisions

- i. Review of the suitability and adequacy of existing institutional arrangement for administration and management of protected areas.
- ii. Review of legal provisions for protected areas including its adequacy of various types of protected areas, status is required.

#### Protected Areas System, Reorganization and Expansion

- i. Based on the available data, maps should be developed showing ecosystems the location of key biodiversity areas and habitat and current status.
- ii. Through an expert consultative process, gaps should be identified and reach an agreement to current needs.
- iii. Appropriate consultation, procedures at all levels.
- iv. Procedures should be completed for the protected areas.

#### Objective 2

**Awareness, Participation, Education and Research, Training and Monitoring:** Achieve at all levels, an adequate understanding and appreciation of the full value of biodiversity to Bihar's sustainable development and support for efforts to adequately conserve the state biological resources.

#### Increased Public Awareness

1. Develop a media programme (print, radio, television, etc) designed to convey a broad understanding of full value of biodiversity to Bihar's sustainable development.
2. Gain public support for major biodiversity conservation and sustainable use, activities particularly protected areas.
3. Develop local and community biodiversity awareness programme for areas particularly high value/importance to biodiversity conservation and sustainable use.

#### Education

1. Through an expert consultative group, fully identify gaps and problems with current schools and higher education curricula. Hon'ble Supreme Court of India has directed MoEF, Govt. of India to include in the school and college curricula in the field of environment for achieving the environmental policy of Govt. of India. U.G.C. Delhi has asked all the Universities in India to include the curricula from the current session.
2. Identification of other ongoing activities and initiatives in the field of environmental education.
3. Identification of priority action required to develop a state level biodiversity education plan.

#### Research, Training and Monitoring

1. Identify research priorities and gaps in information.
2. Conduct gap filling exercises.
3. Adopting a multidisciplinary approach in biodiversity research.
4. Initiate a biodiversity information facility.
5. Strengthen funding.

## Public Participation

1. Identification and developmental means and mechanism for encouraging public participation in biodiversity conservation particularly by local level support groups.

### Objective 3

**Sustainable use of Biodiversity:** Through controlled use of biodiversity resources achieve the maximum economic, scientific, recreational and cultural benefits for all the people of Bihar, while at the same time ensuring long term conservation of biodiversity and viability of ecosystem.

### Objective 4

Regional and local level biodiversity action plans:- Within the frame work of state biodiversity strategy and action plan should be carried out by the regional and local authorities, scientists, NGOs and other interested groups.

### Operational Period

The strategy should be implemented on the basis of ten year operational period. A review of the strategy and its implementation should be taken up every five years.

## Recommendations

1. Protected areas development is to be enhanced and strengthened. Protected area in Bihar is 3.53% against the International target of 10% by the year 2010.
2. Public awareness, education and participation are to be made more effective.
3. Sustainable use of biodiversity is to be evolved for utilization of the full potential of biological resources.
4. Within the framework of National Biodiversity strategy and action plan regional/local action plans are to initiated to meet regional/local needs.
5. Arresting deforestation.
6. Development of the wild life sectors.
7. Development of the domesticated biodiversity (Agribiodiversity; Livestock biodiversity and cultured fish species and honey bees).
8. There is no provision in the Wild Life Act to protect fishes as in the case of birds. Therefore to conserve the biodiversity of fishes, there should be incorporation of some provision in the Wild Life Act.
9. Controlling population growth and poverty.
10. To have a base line data regarding the biodiversity of Bihar, inventorization and compilation of the flora, fauna and microbes should be initiated.
11. To develop and maintain comprehensive and accessible biodiversity information systems linking national and local records.
12. To take direct measures to conserve species and habitat diversity in particular through the conservation of threatened and protected species and important sites.
13. Conservation of germ plasm.
  - i. Species selection, prioritization and development of captive reserves for the state's endangered species.
  - ii. Research incaptive breeding.
  - iii. Development of *ex situ* at each state level laboratory with modern tools and technologies.
  - iv. Motivation, training and involvement in *ex-situ* conservation.
14. To implement the Action Plan; State Biodiversity Board should be established as per Section - 22(1) of the Biological Diversity Act, (2002).

**In annexure II flora of Bihar including the medicinal plants and endangered species are given in detail.**

**In annexure III the fauna of Bihar including endangered species are given in detail.**

\* This BSAP came in at the very end of the process, and is being considered an incomplete draft.

# Chandigarh State Biodiversity Strategy and Action Plan

Coordinating Agency: Department of Environment, Chandigarh

## Chapter I

### Introduction

This chapter deals with the process of formulation of Biodiversity Strategy and Action Plan, its scope, objectives, contents and key participants. The Plan has been prepared after holding public meetings and detailed deliberations in various meetings of the Steering Committee of U.T. Chandigarh U.T. is primarily a city state having more than 70% population as urban and its villages are also urbanized. Under this plan five major strategies and seventeen actions have been proposed.

## Chapter II

### Biodiversity Profile of U.T. Chandigarh

This chapter contain five main sections:

Sec.2.1 Genesis and historical background of the city.

Sec.2.2 Geographical profile of Chandigarh.

Sec.2.3 Socio-Economic profile of residents.

Sec.2.4 Chandigarh Periphery Zone,

Sec.2.5 Current Range and status of biodiversity.

- Urban biodiversity.
- Microbial diversity.
- Domesticated biodiversity.
- Sukhna Lake eco-system.
- Sukhna Wildlife Sanctuary.

## Chapter III

### Gap Analysis and problems relating to Biodiversity

This Chapter deals with the gaps in information, vision, policy and legal structure, awareness and education, linkages, institutional and human capacity related to wild biodiversity, domesticated biodiversity, urban biodiversity, diversity in medicinal plants and microbial biodiversity. The problems created by lantana parthenium (weeds) are also highlighted in this chapter.

## Chapter IV

### Ongoing Biodiversity initiatives and their Major Actors

This chapter deals with the following initiatives which have already been taken by Chandigarh Administration for the conservation of biodiversity:

- 4.1 **Greening Chandigarh Action Plan:** Greening Chandigarh Task Force has been constituted in March, 2001 to prepare an annual Greening Action Plan for Chandigarh emphasizing 'Biodiversity Conservation.'
- 4.2 **Setting up of a Botanical Garden:** A Botanical Garden over 176 acres of land near village Sarangpur is being established for ex situ conservation of plant diversity. This will also facilitate research in plant species, their propagation and conservation.
- 4.3 **Constitution of Medicinal Plant Board and development of Medicinal Plants Garden:** After constitution of a Medicinal Plant Board of U.T., a Medicinal Plant Garden is being developed over 30 acres of land.
- 4.4 **Removal/suppression of Lantana and Parthenium:** Lantana weed is being suppressed/removed by Forest Department to make way for regeneration of indigenous flora. Parthenium is also being removed by Horticulture Departments.
- 4.5 **Preparation and use of Vermi-compost:** Chandigarh Administration has initiated a project 'Sahyog - Waste to Wealth' for total

waste management in active collaboration with Municipal Corporation, Institutions, Resident Welfare Associations, NGO's like CAWEDS and Yuvsatta.

4.6 **Microbial Diversity related initiatives:** Studies are going on to describe and prepare a fungal flora of Chandigarh. Initiatives in collection and analysis of Bacterial diversity is also going on.

4.7 **Preparation of Baseline data and R & D:** For documentation of fauna of Chandigarh, a project has already been given to Zoological Survey of India (Solani).

## Chapter V

### Strategies and Actions for Biodiversity Conservation

#### Strategy 1

To establish mechanism for inventorization, monitoring and evaluation, awareness and implementation of biodiversity programmes.

##### Action 1

*Formation of Biodiversity Conservation Board:* For systematic review of existing policies and programmes and to ensure integration of Biodiversity Conservation with sustainable use of resources, it is proposed to form a 'Biodiversity Conservation Board' of U.T.Chandigarh.

##### Action 2

*Biodiversity Inventorization Monitoring and Evaluation:* Floral and faunal biodiversity inventorization will be completed within 2 years and thereafter every ten years, this exercise will be repeated to assess the change in its status.

##### Action 3

*Creating Awareness about Biodiversity and its Importance in the Eco-System and Identification of Bio-Heritage Sites:* A biodiversity awareness committee is proposed to be formed under Biodiversity Board to achieve this purpose.

#### Strategy 2

Conservation and sustainable use of wild biodiversity.

##### Action 1

*In Situ Conservation of Wild Biodiversity:*

- Systematic suppression of lantana weed from forests to ensure natural regeneration and proliferation of endemic species.
- Education and sensitization of the villagers of the villages on the periphery of wild-life sanctuary and other forest areas for biodiversity conservation.
- Tackle human-wildlife conflicts through innovative preventive measures, provision of compensation etc.
- Involve villagers on the periphery of forest areas in prevention and control of forest fires. Provide rewards, jobs and other community development works to the villagers.
- Promote genuine eco-tourism and involve local people in eco-tourism activities.
- Promote conservation of medicinal plants in the wild.
- Prepare biodiversity management plan of wildlife sanctuary and other forest areas.

##### Action 2

*Ex Situ Conservation of Wild Biodiversity:*

- Establishment of Botanical garden, Medicinal Plants Garden, Kitchen garden and utilization of green spaces, Leisure valley and farm houses for ex-situ conservation of wild biodiversity.
- Establishment of aquariums, Butterfly parks.
- Culture collection of micro organisms and creating new collections in areas most neglected.

##### Action 3

*Sustainable use of wild Biodiversity:*

- Strengthen and expand the sustainable use of medicinal plants.
- Promote eco-tourism activities which should be oriented towards ecological, cultural and social sensitivities and be managed by local communities.

#### Strategy 3

Conservation and sustainable use of domesticated biodiversity.

**Action 1***In situ Conservation:*

- Creation of a database on domesticated biodiversity and monitor the status of biodiversity at village level.
- Assess the value of traditional domesticated biodiversity and biodiversity based systems to the agriculture, horticulture, fisheries, health and livelihood security of villagers.
- Conserve cultivated fields, and other domesticated biodiversity hotspots as agro-biodiversity protected areas under Environment Protection Act or the Biological Diversity Bill/Act.
- Conserve and re-introduce threatened taxa (Desi varieties of foodgrains, fruits, fishes poultry etc.) of domestic biodiversity by providing incentives to farmers and growers.
- Stop destructive development projects to reduce threat to domestic biodiversity.
- Encourage kitchen garden culture through rewards and other incentives.
- Encourage organic farming and discourage the use of chemical fertilizers, insecticides, pesticides etc.

**Action 2***Ex Situ Conservation and Cultivation:*

- Strengthen existing crop gene bank at state level.
- Strengthen domesticated animal breeding centers with special focus on threatened breeds.
- Integrate domesticated biodiversity into botanical gardens, green spaces, kitchen gardens etc.

**Action 3***Sustainable use of Domesticated Biodiversity:*

- Orient the Public Distribution System (PDS) towards the use of agro-biodiversity by procuring and distributing local foodgrains through PDS.
- Provide incentives to farmers/growers for revival and continuation of agro-biodiverse farming.
- Promote use of compost/vermin compost manure, water harvesting structures.
- Promote eco-tourism by encouraging the use of diverse indigenous organic foods and cultivated landscapes.
- Empower marginal farmers and women to manage the enterprises to derive direct benefits.

**Strategy 4**

Conservation and management of Sukhna lake eco-system.

**Action 1**

*Setting up of Sukhna Lake Management Committee.*

**Action 2***Conservation of Sukhna Lake:*

- Division of lake into two zones. One zone will be purely for conservation of aquatic flora and fauna and other zone for tourism activities.
- Enhance the pondage capacity of the lake by dry-desiltation and other measures.
- Strengthen enforcement system to discourage fishing, bird hunting etc.
- Strengthen and continue conservation measures.

**Strategy 5**

Promotion of eco-friendly practices in Chandigarh.

**Action 1**

*Promotion Of Waste Management Programme.*

Guiding principles for waste management are:

- Reduce
- Recover
- Recycle
- Reuse
- Repair and
- Restore Resources.

**Action 2**

*Promotion of Rain Water Harvesting and Ground Water Recharge.*

**Action 3**

*Development of Efficient Sewage Disposal System.*

**Action 4**

*Pollution Control and Promotion of use of Cycles in the City.*

**Action 5**

*Management of Green Spaces and Control of Parthenium.*

**Action 6**

*Raising Awareness about Natural Resources (Specially about the rational use of drinking water and propagation of use of Solar energy).*

# Chhattisgarh State Biodiversity Strategy and Action Plan

Coordinating Agency: Chhattisgarh Forest Department, Raipur

## Chapter 1: Brief Introduction about Biodiversity of the Site/Theme

The Govt. of Chhattisgarh identified the state forest department as nodal agency to prepare the CSBSAP.

CBSAP is a scientific document having a human face, and has been formulated through widest participation process by:

- Assessment of existing reports, Action plans, Sectoral plans and policies.
- Identification of available information and data;
- Identification of available expertise and experience,
- Capacity – building exercises on authentication of data, monitoring, etc.
- Gathering inputs from local resource persons and stakeholders in Forest circle level workshops.
- Soliciting inputs from a wide range of individuals/agencies, through; Letters, Public meetings and workshops, Advertisements, Print and electronic media and Folk media

The nodal agency kept following state specific priorities also in mind, while preparing CBSAP:

- To ensure food security by enhancing the productivity of the small and marginal agricultural lands by conserving the local agro-germplasm and propagating it by local innovative and available Biotechnology knowledge. (*With special emphasis on Paddy.*)
- In situ and Ex situ conservation of Herbal Plants having medicinal value as one of the means to ensure livelihood security of the tribals of the State.
- Sustainable Utilisation and Conservation of the vast NTFPs potential, through participatory mechanisms.
- Improving the productivity of the State's 40% degraded forests through peoples' participation and harvesting its true potential sustainably for the development of tribals.
- Conservation and Sustainable Development of existing Ground Water Resources in the State.
- To maintain an equilibrium between Biodiversity Conservation and Development of Mining and Mining based industries; through introduction of Eco- friendly and Green Technologies; both for exploitation as well as reclamation.
- To promote a scientific based approach to the planning, management, and development of Eco-tourism products and activities in the region.
- To check annual temporary migration of local populace, and to assure their dynamic contribution in the socio-economic development of the State.
- To create a mechanism to conserve traditional and religious beliefs of tribals concordant to Biodiversity conservation and to float package of justified sustainable use of customary practices for their livelihood security.

## Chapter 2: Brief Description of Major Biodiversity Related Issues at the Site or on the Theme

### Biodiversity Status

#### Forests

The forest cover in the State is placed at 56,693 Sq. Km (FSI, 1999). Out of this, 39,557 Sq. km i.e. 41.93% is dense forest and 17,136 Sq. Km. i.e. 12.67% is open and degraded forest. However, as per the legal status; the State has 59,772 Sq. Km. of forest area, which accounts for 44.21% of the geographical area of the State.

#### Wild Flora/Fauna

- 27,000 plant specimens of different plant species have been collected. Till now 1685 species belonging to 785 genera and 147 families have been identified.
- Ten dominant families of Chhattisgarh are Fabaceae, Malvaceae, Asteraceae, Euphorbiaceae Acanthaceae, Convolvulaceae, Malvaceae, Scrophulariaceae, Rubiaceae.
- National Botanical Research Institute, Lucknow has identified 45 species as Endangered taxa of the State.
- There are 8 Endemic and Rare, 13 Critical and vulnerable flora in the state.

- There are 3 National Parks and 11 Wild Life Sanctuaries in the state having 227 Tigers and 1140 Panthers.
- Probably the largest population of snakes in our state is found in the Farsabahr area of Jashpur district.
- The exclusive survey done by ZSI for Butterflies in Bastar Distt., has revealed 60 species and subspecies belonging to 38 genera under nine families.
- 86 Species of Birds have been identified in the state, till date.
- In the year 1974 and 1978-79, inventory of fishes in Rivers Mahanadi and Hasdeo showed 60 fish species. Later in 1987, recorded Mahasheer in the Rivers Hasdeo, Mahanadi, Maniari, Seonath and Indravati in the Chhattisgarh region. In the River Indravati, a survey in 1991 recorded 49 species.

### **Herbal Flora Status**

An exclusive survey conducted by the Central Council for Research in Ayurveda and Siddha, New Delhi, made an inventory of 750 herbal species belonging to 499 genera in 147 families. A total of 190 traditional health care claims based on 113 medicinal plants have also been recorded.

### **Subterranean Fauna**

Kotumsar caves and many other caves in Kanger Valley National Park are truly limestone caves. The cave fish, *Nemacheilus evezardi* has successfully colonized the Kotumsar Cave, Although people know them as blind, they are not really blind.

### **Agro-Diversity**

- Agro-diversity
- Rice diversity
- The Indira Gandhi Agriculture University, Raipur, is at present maintaining 22972 Rice accessions, out of which 15121 are local accessions. The world's largest rice "Dokara-Dokari" is found in C.G.
- 8 millets, 8 oil seeds, 8 Pulses and 18 species of Tuber crops are being sown in Chhattisgarh.
- About 83 mushroom varieties are reported till date in the State. The mushrooms reported most commonly are; Agaricus Tuber, Russula, Boletus, Volvariella, Lactarius, Lepiota etc.

### **Wetland Diversity**

There are 14,677 irrigation reservoirs (80,760 ha) and 45,250 village ponds and tanks (63,498 ha). Besides this 3,575 Km long rivers (viz, Mahanadi, Sheonath, Indravati. etc) along with their tributaries also flow in the State.

## **Threats and Problems Related to Biodiversity**

### **Proximate Causes**

- Spread of invasive weeds like Parthenium, Lantana, Eupatorium
- Destructive harvest practices of flora and fauna for various food component requirements.
- Problems with natural regeneration of Sal forests.
- Difference of vision for forest fire hazards.
- Inadequate investments in the forestry sector.
- Problem of inter-departmental co-ordination in legislative settlement of forest encroachments.
- The collection of fuel wood; unregulated grazing for sustenance.
- Diversion of forest lands for non-forestry purpose like Minor and Major irrigation projects; Hydro-electric Power Projects Roads; Industrial Estates and other development projects.
- Poaching
- Destruction of natural habitats due to the growth of settlements, biotic pressures.
- Over emphasis of Govt. policies on introducing high yielding varieties and improved farming practices.
- Scientific community, because of weak horizontal and vertical linkages, doesn't gather enough feed back from grass root level regarding efficacy of local crops.
- Traditional cultivation of tubers and vegetables is losing ground since being sensitive to various fungal diseases, quality and quantity is under threat.
- High cost of available technologies.

### **Root Causes of Loss**

- Breakdown of traditional C.P.R. based institutional regimes due to various policy interventions.
- Impending settlement of rights and rationalization of boundaries.
- Virtual non-existence of appropriate and strong intellectual property rights regimes.

- Disregard of local knowledge and institutional factors, user needs and perceptions.
- Acceptance of CPRs as open access resource i.e., no collective efforts to enforce user obligations, regulations.
- The means of alternative sources of livelihood are not expanding rapidly enough to take the pressure off the land.
- Loss of "Social capital ability to act jointly".
- Development of uniform cultivars, grown in uniform environments. The spread of these cultivars is leading to an erosion of primitive crop genetic variety.
- Lack of crop security from domestic livestock and thus find single crop of rice is the best alternative.

### **Chapter 3: Brief Description of Ongoing Initiatives and Key Gaps**

#### **Diagnostic Initiative**

Hon'ble Chief Minister has declared the State of Chhattisgarh as a Herbal State on 4th July 2001. The State Medicinal Plant Board has been formed.

#### **Miscellaneous Initiatives**

- Promoting agro and forest based industries.
- Formation of Chhattisgarh Environment Conservation Board.
- Promoting Crop rotation with focuses on cash crops.
- Achieving best environmental standards while perusing industrial development.
- Promotion of Fly Ash based industries.
- Master Plan for solid waste, Bio-medical and industrial Waste management.
- Culture impact assessment as a component in the formulation and implementation of mega developmental projects.
- Development of Eco and Ethnic Tourism.
- Achieve a five fold increase in the revenue from MFPs.

#### **P.A. Network and Forest Initiatives**

- 3190 Village Forest Committees, 3057 Forest Protection Committees, and 165 Eco-development Committees; in total 6412 Societies are protecting 28.38 lakh ha. Forest Area. This shows that roughly 17 % of the total forest area of the State is under Participatory Forest Management. The JFM has so far involved 7,36,328 members in 3.75 lakh families spread over 7388 villages across the State.
- GOI(MoEF) has been approached by the State Government to include it's 3 Sanctuaries i.e. Udanti, Sitanadi and Achanakmar under "Project Tiger".
- Eco-tourism has been started in many Wild Life Sanctuaries of the State.
- Efforts are on to create a "Biosphere Reserve" comprising areas adjoining Amarkantak in the Chhattisgarh State.
- Wild buffalo and Hill Myna declared as State Animal and State Bird.
- People's Protected Areas (Medicinal Plant Reserves ) have been created in all forest divisions of the State for the conservation, development, collection, value addition and Improvements in the marketing of the medicinal plants.

#### **Gaps**

##### **Gaps in Vision**

- Considering local bio-resources as a food unit, some times for bonafied sustenance needs, irrespective of its caliber to regenerate naturally.
- Perception of a Common Property Resource as an Open Access Resource by marginalised population without any accountability for its sustainability.
- Advocacy for settlement of forest encroachments, on compromise basis, has in fact acted as an incentive for the increased incidences of encroachments on forestlands.
- Consumptive uses such as drinking water supply, irrigation and industrial use adversely affect the availability (e.g. for fisheries, and hydropower generation) besides degrading the water quality indirectly (waste inflow/discharge).
- Despite of enormous scientific data available on the well established wild life habitat management practices, Indian wild life bureaucracy is still hesitant to use such management practices, due to some hypothetical apprehensions.
- Belief of the Agro-scientific community in HYV related technology packages without caring for the financial constraints and genetic extinction of local races, faced during the implementation of such packages.
- Faith of scientific community in the economic viability of exotic breeds against local ones.

##### **Gaps in Information**

- Documentation of Macro and Micro floral and faunal species both in terms of recognition and status is incomplete.

- The baseline data on species and genetic diversity, particularly intra specific diversity, in various eco-systems is inadequate.
- Use of biotechnology including its probable adverse impact on the biodiversity is at bare minimum level.
- Lack of effective and comprehensive inventories especially in medicinal plants is a great risk to counter the patent claims.
- Inventory of folk and other public domain knowledge, both oral and written, related to uses of biodiversity is undocumented.
- Lack of authentic database of traditional healers and folk healers including their healing practices.
- The study of clinical - efficacy of traditional herbal remedies is missing.
- The status of ecological succession in the various forest sub ecosystems has not been explored.
- Detailed Inventory and Monitoring of impact of Exotic and Invasive species on the Biodiversity components is missing.
- Documentation of traditional systems of CPR management of natural resources including Sacred Groves and their socio-cultural linkages with the Bio-resources has not been done.
- Identification of insects causing epidemics affecting forest sub ecosystems has not been studied in detail.
- No comprehensive Geographical Information Systems for ecological habitats.
- The State's rich agro-germplasm especially pulses, millets and tubers has not been preserved, documented and registered in the gene bank within the State.
- The thrust in the research and development on local crops have not been given proper priority.
- Effects of livestock breed substitution or modification by crossbreeding on native breeds have not been analyzed meticulously.

#### **Institutional Arrangements and Human Capacity**

- Mechanisms not in place to monitor the grant of Intellectual Property Rights (IPR) protection on the local biological resources and associated knowledge. A sui-generis system is also missing.
- Equitable sharing mechanisms for the protection and utilization of local bio-resources between primary and end users are largely under developed.
- Non-availability of young, energetic and technically trained manpower for forest protection, wild life management etc.
- Under the Joint Forest Management the process in terms of empowering forest committees and strengthening their institutional mechanisms is still incomplete.
- No clear policy for sustainable utilization of local/small water bodies which could act as a supplement to water supply.

#### **Gaps in Policy, Legal Structures and Implementation**

- Branding of local, indigenous wild biodiversity resources as "Common Heritage" where as commercial units (GMO's) produced through the very use of these indigenous resources become "Private object" available on purchase.
- Non-permission of implementation of people's participation management of Protected Areas.
- Govt. initiatives for the progressive improvement in the production potential are an in-built insecurity for the survival of indigenous breeds.
- Lack of assistance in terms of incentives and loans for rearing of indigenous breeds.
- There is wide gap between the demand and production of location specific biofertilisers.
- The following legal aspects require examination and analysis in terms of legal implications and challenges facing protection of biodiversity, sustainable use of biological resources and enhancement of biodiversity:
  - Laws regarding trusteeship/ownership of domestic genetic resources in gene banks outside the country.
  - Laws prohibiting/permitting use of genetic resources/material, and punitive measures for infringements.
  - Terms, conditions, rights, and obligations in such transactions involving third parties and further transfer of genetic resources.
  - Transfer of genetic resources for commercial use and research - rights and obligations, and benefit sharing.
  - Laws on the piracy and acquisition of classified data on domestic genetic resources.
  - Regulations on networking with global agencies.
  - Legal guidelines on negotiations for bilateral agreements.
  - Legal frameworks for the establishment and working of databanks.
  - Laws regarding benefit sharing by parties and local communities.
  - Laws covering breed registration societies and other similar organizations.
- GAPS TO BE FILLED ON PRIORITY
- Indigenous plant species are threatened by the introduction of G.M.O.'s (Genetically Modified- Organisms. No laws on Bio-safety exist.
- No State laws to put a stop to bio-piracy by multinationals especially for rich herbal biodiversity in the State.
- Definition of IPR is built around patents (i.e. TRIPS) and it rejects the informal and often unrecorded knowledge systems of traditional communities. Legal protection to the indigenous knowledge systems is essential since undocumented knowledge is not being accepted to be in public domain.
- Absence of any legislation for regulating bio-prospecting in the State by national level organizations like ZSI, NBRI, TFRI, SFRI etc or by the scientific community of the State itself, without proper MoU between different stakeholders including scientific

community and state government.

- Lack of legislation to deal with the external agents so as to take first the prior consent of locals and then sharing of profits in case some one wishes to use their resources commercially.
- No comprehensive State legislation to regulate, access, and facilitate flow of economic benefits of local bio-resources to all sectors of society with special attention to local and indigenous communities.
- Forest encroachments has been a critical factor responsible for the loss of biodiversity in forest ecosystems. The **implementation of laws** like Indian Forest Act, 1927 is gradually becoming **difficult due to complex socio-politico environment**.
- Statutory provisions of Wildlife Protection Act, 1972 regarding relocation of local populations from within PAs by settlement of rights is still to be implemented.
- Specifications prescribed in National parks from management view point; doesn't exist in Wild Life Sanctuaries.
- Introduction of provisions of Core/Buffer area in every NP/WLS.
- Development of all available potential corridor areas especially inter-state connections as to facilitate the normal undisturbed movements of the animals.
- State govt should initiate to conserve the BD of such (corridor) areas on priority.
- Implementations of land reforms have so far proved regressive in effect causing curtailment of CPR areas and has also reduced local control of local resources.
- Some legal and policy issues related to land ceiling act, forests and wasteland policy, fodder policy and grazing policy need to be studied and analysed.

#### **Chapter 4: Detailed Description of the Proposed Strategy and Action Plan**

Strategies have been fabricated on the basis of the Gaps, Actors and the ongoing initiatives. After careful analysis of the se 3 components; the gaps which have formed the backbone of 5 strategies, are

1. alarming low level of documentation (making local bio-resources prone to bio-piracy),
2. low level of R&D,
3. difference in vision of scientific community and the end-user,
4. Exploitation of the virtual stakeholder by middlemen with many faces.

Following is the list of the Strategies, with Projects under each Strategy thrust areas of some important Projects are specified:-

##### **Strategy 1**

Expanding inventorization of available bio-resources, its documentation into digital database and mapping of ecosystem with the help of satellite imagery and GIS.

##### **Project 1. A.**

Documentation, compilation and monitoring of available bio-resource base.

- Maintenance of peoples biodiversity register at local level.
- Creation of digital database of local bio-resources with the facilitation of esteemed organization like ZSI,NBRI,CDRI,ICFRE and others.
- Integrations of Satellite Imagery based BD mapping and its ground truthing.

##### **Project 1. B.**

Identification, inventory and the study of the impact of exotic species on the sustainable conservation of biodiversity

##### **Strategy 2**

Enhancing and integrating existing and planned in situ and ex situ conservation efforts.

##### **Project 2. A.**

Protected area (P.A.) network conservation strategy.

- Introduction of Core/Buffer concept in WLS also.
- Introduction of crop insurance scheme in PAs
- Declaration of Eco-fragile zone of 5 kms. around PAs.
- A comprehensive corridor policy to maintain genetic continuity of flora and fauna.
- The Wildlife Protection Act mandatory provisions for relocating populations should be implemented in Buffer Zones of WLS.
- FCA, 1980 be amended to prohibit any diversion of forest land within 5 Sq.Km. of any Protected Area.
- Investment in the Wild Life conservation in non PA areas should become State priority.

**Project 2. B.**

Environmentally sound sustainable development of ground water through integrated approach.

- Emphasis on Integrated watershed management.
- Identification and mapping of over- exploited areas.
- Application of new technology options like water saving devices, crop diversification and subsurface drainage.

**Project 2. C.**

Conservation of domestic livestock on sustainable basis for the economic well being of poor.

**Project 2. D.**

Establishing international institute of agro and herbal biodiversity studies.

**Project 2. E.**

*In situ* and *ex-situ* conservation of herbal plants being traditionally used for local healing practices to ensure livelihood security of the tribals of the state.

- Identification of herbal - potential areas in the State.
- Documentation and growing stock estimation of all herbal species in the identified areas with the assistance of local healers by undertaking detailed, stratified sampling survey and threat status studies.
- District wise and region wise Inventorization of Green, Yellow and Red list of herbal plants in the state.
- Documentation of traditional but non-sustainable harvesting practices and formulation of sustainable norms of harvesting.
- Introduction of *ex-situ* conservation efforts of various threatened herbal species inside the natural habitats of the species.
- Cultivation of marketable medicinal plants by local farmers should be promoted by facilitating the availability of planting material and technology packages.
- Use of bio-technology in creating GMOs of selected green list species having export potential.

**Project 2. F.**

Rehabilitation; conservation and sustainable utilisation of wetlands.

**Project 2. G.**

Ensuring conservation, preservation, sustainable utilisation of local agro-germplasm

- Characterization and evaluation of already collected local rice germ- plasm.
- Storage facilities to be improved with latest technology inputs.
- Innovative intercropping of local germ-plasm be promoted.
- Plucking the informational gap between communities and the scientific community.
- Establishment of legal cell in agriculture university to cope up with challenges of global treaties.
- Introduction of local agricultural produces into Public Distribution System.

**Project 2. H.**

Ensuring conservation, preservation, sustainable utilization of local bio-resource by advanced conservation techniques.

**Project 2. I.**

Use of biofertilizers in enhancement of agro-productivity.

**Project 2. J.**

Conservation of the surface water ecosystems.

**Strategy 3**

Promoting integrated approach for the sustainable utilization of available biodiversity resources to ensure livelihood security.

**Project 3. A.**

Augment the nature tourism potential in the state in order to strengthen biodiversity conservation and local economy.

- Using this natural asset as a tool to conserve the bio-resource of the area and disseminating the idea of recreational/educational tourism
- Comprehensive planning and aggressive marketing strategies to be introduced to explore this green industry
- Developing sites having potential for nature tourism as "Conservation Areas/**Heritage sites**".

**Project 3. B.**

Creating a favorable environment for establishing agro and forest based industries by promoting investments in private, degraded wastelands.

- Initiate use of available 60 lakh hect. of degraded productive forest land, coupled with favorable physical climate, to be the site of livelihood security of the disadvantaged class.
- Creation of sufficient database of raw material (like herbs, NTFP, Timber, Bamboo, Sericulture, Horticulture, Rice, Other agricultural and Bio mass based) for establishment of agro and forest based industries

**Project 3. C.**

Creating mechanisms for harvesting, value addition and marketing of medicinal plants.

- District wise and region wise Green, Yellow and Red lists would be declared and the State Board would notify the quantities of Green species for sustainable harvesting every year.
- Nature of herbal trade will be free trade.
- Services of reputed marketing experts in order to explore the national and international markets. A separate marketing cell be established.
- Royalties recovered from the traders will be used for the herbal diversity conservation and welfare programmes for the herb collectors.
- Providing legal cover to prohibit any marketing of Red and Yellow listed herbs.
- Establishing full proof legal mechanisms for trade of permitted herbs only.
- Creating legal and policy frame work for compelling herbal-based industries and pharmacies using local raw material to create value addition and industrial facilities in the State itself.

**Project 3. D.**

Economics and valuation of biodiversity.

**Strategy 4**

Formulating an integrated policy and legislative framework for the conservation, sustainable harvest and equitable sharing of benefits of biodiversity.

**Project 4. A.**

Developing policy and legislative measures to control ground water extraction and recharge.

- Ecological functions performed in the forest - water ecological system needs to be given a priority.
- Society-water interaction needs to be institutionalised. The communities responsible for managing water should also be partially responsible for raising the resources required to manage water extraction, storage and distribution.
- Strengthening the existing institutional and legal framework for participatory watershed development in rain fed lands.
- Recognizing best traditional practices by locals in water conservation.
- Encouraging the reuse of wastewater and sewage effluents in Industrial, commercial and domestic sectors.
- Research and development for building innovative indigenous site specific technology packages for water conservation.

**Project 4. B.**

Bring into force an effective policy and legal framework for conservation and sustainable utilization of bio resources.

- Declaration of Forests as a priority sector in the state.
- Need to have political will to regulate diversion of forest lands.
- The appropriation of indigenous peoples rights of intellectual ownership to the bio-resources and knowledge by third parties; making suitable laws should protect equitable sharing of benefits.
- In line with the Central Biodiversity Bill 2000, there is an urgent need to have an exclusive State legislation for the conservation and sustainable utilization of biodiversity.
- A State level Biodiversity Conservation Board with a two tier Biodiversity Conservation Committees at the District and Panchayat level to assist the Board.
- Permission for diversion of forest lands for mining only with the introduction of eco-friendly exploitation and reclamation mining technologies.
- The task of setting revenue forestland border disputes in a fixed time frame.

**Project 4. C.**

Large scale extension of non-conventional energy sources.

**Project 4. D.**

To build up a comprehensive legal and policy frame work for protecting ipr as well as ensuring benefit sharing of the local bio-resource and knowledge.

- Comprehensive Inventorization of species under all ecosystems in order to counter the patent claims
- Making available sufficient legal protection to the indigenous knowledge systems by first making local populace aware of it.
- Introduction of State legislation for prohibiting bio prospecting by Multinationals externally aided organizations working within the country.
- Development of system of petty patents to protect grass root innovations.
- Compelling IPR application to disclosed original source of information and status of prior public knowledge.

**Project 4. E.**

Institutionalization of various horizontal and vertical linkages pertaining to traditional medicinal practices existing in the state of chhattisgarh.

- Identification of traditional and folk healers and the documentation of their traditional medicines and healing practices.
- A proper, transparent and honest collaboration between healers and scientists and patenting their products is proposed so that traditional healers would be able to pass on their secrets freely to scientists and avoid exploitation.
- It is suggested that in order to develop traditional medicinal sector, a separate legislation on the above lines be introduced.
- Formation of **Traditional Medical Practitioners Forum** at local level comprising of local traditional/folk healers themselves.

**Project 4. F.**

Rejuvenation of traditional bio-cultural institutional mechanisms concerning common property resource for the rehabilitation of cprrs and rebuilding of "social capital".

- Involve promotion of user groups of Common Property Regimes (CPR) with the help of civil society.
- Develop mechanism to institutionalize local institution to inject biodiversity concerns in their functioning.
- Ensuring intuitional capacity development for civic bodies.

**Project 4. G.**

Implementation of urban environment rehabilitation plan by launching eco-townships projects in Raipur, Durg, Bhilai, Korba, Bilaspur, Raigarh and Jagdalpur.

- Undertaking eco-rehabilitation projects in these townships through well organized public-private partnerships.
- Legislative framework for the declaration of a minimum radial distance around the identified wetlands in these cities as prohibitory zone.
- Imposition of "**Green tax**" on the use of plastic shopping bags and revenue to go into "**Environment fund**".
- Due to the rising number of thermal power projects in the State :-
- **Need to introduce clean coal technologies like IGCC.**
- Better utilization of fly ash by
  - A suitable form of subsidising transport.
  - Building codes be amended in such a way that only fly ash is used for road making and in the making of bricks.

**Strategy 5**

Applying integrated mass awareness and education programme for the conservation of biodiversity.

**Project 5. A.**

Strengthening the civil society institutions for their active participation in biodiversity conservation.

**Project 5. B.**

Empowering and mobilising the marginalised local population by addressing the problem of "ecological poverty" and developing natural wealth based local economy.

**Project 5. C.**

Mobilizing an integrated education and awareness programme for local communities.

- Two separate approaches, and tools one for rural and other for urban areas need to be planned and executed.
- In the rural areas, the communication approach should be with greater emphasis on learning or untapping the vast treasure of local knowledge.
- The civil society to play the major role in creating mass awareness.

# Delhi State Biodiversity Strategy and Action Plan

Coordinating Agency: Department of Environment, Delhi

Delhi has suffered enormously as a consequence of developmental activity. Pollution of air, water land, overexploitation of natural resources – all have taken their toll on the biological diversity of the area. Inappropriate forms of urbanisation and associated infrastructure development also particularly threaten ecosystems.

This study shows that the threat to biodiversity in Delhi is mainly due to inequity of resource use. Here, the distribution of resources and infrastructure facilities is determined by social and spatial disparity. Only few privileged strata are enjoying the bulk of the common resources. The government on its part deliberately favours the powerful and justifies their unsustainable lifestyle, while continually prosecuting and harassing the weak. The outcome is violation of all procedures and rules - both by design by the powerful, as well as by default by the weak.

This trend is likely to increase if appropriate measures to reduce the effects of pollution and of economic pressures connected with the overexploitation of natural resources are not immediately undertaken. While several policies to conserve the local biodiversity have been framed, a co-ordinated and effectively managed system of protected areas does not exist and institutional arrangements for nature conservation and protected area management have not yet been clearly defined. Consequently there is an urgent need to define lead responsibility, and to further develop the field capacity, to address the rapidly increasing and changing needs for protected area management and biodiversity conservation.

This study also attempts to produce a concise and workable assessment of the existing local biodiversity status of the area. It helps in identifying the gaps in information, vision, policy and institutional and legal structures in relation to biodiversity conservation. To fill those gaps and to enhance ongoing measures towards conservation, broad strategic level interventions are proposed. Then specific actions are also proposed in accordance with the strategy statement specifying the required time period, responsible organisation/agency for carrying out the task.

The following strategy has been evolved from the study:

- Re-examination of the legal provisions and the powers vested with different agencies, which impact on biodiversity conservation.
- Formulation of policies for sustainable use of resources, which shouldn't be in excess of the processes of natural growth and restoration.
- Minimising anthropogenic pressures on the existing biodiversity.
- Assessment of the effects (both short term and long term) on existing biodiversity status in Environmental Impact Assessment (EIA) for any developmental project - new or expansion - with specific guidelines for the rejection of severe impact projects.
- Educational content on biodiversity issues up to secondary level with due emphasis on nature studies and conservation.
- Mandatory courses for policy-makers, planners, and administrators on the conservation and preservation aspects of development policies.
- Ensuring wider public participation in policy decisions with mandatory representation for all affected parties.
- Priority areas for applied research should be identified.
- Ensuring technical and financial support for biodiversity-based research and conservation programs at the school/college as well as university level.
- Preparation of an inventory database of the existing biodiversity in the regional language to ensure continuous involvement in updating and management by local communities.
- Establishment of a viable co-ordination mechanism for the relevant Government departments, universities, industry, trade and Non-governmental Organisations (NGOS) working in the area of medicinal plants.
- Demarcation of the forest area according to the use and management of natural vegetation of the area.
- Plantation of different varieties of exotics and ornamental tree species of low ecological value in place of indigenous species should be stopped immediately.
- An integrated water management plan covering all the water bodies along with river Yamuna and proper review of "The Yamuna Action Plan"

# Goa State Biodiversity Strategy and Action Plan

Coordinating Agency: Goa Foundation, Mapusa

The Goa Biodiversity Strategy and Action Plan (GBSAP) is the first conservation oriented, exploratory report on the issues relating to biodiversity in the State of Goa conducted under the auspices of the National Biodiversity Strategy and Action Plan.

Earlier, there have been studies relating to biodiversity but these have focused narrowly on individual species or habitats and have remained largely the domain of academic scientists.

The Goa BSAP was the result of a collaborative effort between a coalition of NGOs, scientific researchers and indigenous knowledge practitioners. The Government maintained contact through the group's work through the participation of one of the two nodal agencies, the Forest Department. (The second nodal agency was the Goa Foundation, an NGO concentrating exclusively on environmental monitoring of the State's ecological assets).

The Goa BSAP examines the variety of habitats, the number of species and the variation within each species that exist in the State.

The State presents an astonishing diversity of endemic species, habitats and ecosystems. Since it was liberated only in 1961, development started late here and hence the threat to biodiversity from developmental activities remained small. This is no longer the case today with accelerated development and invasion of industrial production in all walks of life.

The scope of the exercise, besides collection of information and data on individual species or life forms, also included estimation of ecotheological practices and documentation of diverse agrosystems.

The principal objects of the exercise included not just the conventional ones associated with projects like these, viz., precise data on species, endemism, and threats to diversity, but also included evaluation of the manner in which indigenous knowledge was declining with the advent of industrial culture, leading to corresponding decline in the use of biological resources within the area.

The Goa BSAP highlights the fact that Goa is a rich biodiversity area. A significant number of villages are named after animal or plant species. Some villages owe their names to specific natural features including sand dunes. While animal species like the crocodile are worshipped, other practices like *ghanv bhovni* sanction the hunting and consumption of wildlife. The State plays host to 55 sacred groves, preserved and maintained because of their association with various deities, but neither the Regional Plan of Goa 2001 nor the draft Regional Plan for Goa 2010, which purport to control land use in the State, make any reference to biodiversity. The GBSAP goes into fairly detailed documentation of the state's three broad ecozones and the various habitats they harbour: forest, wetland, island, coastal, continental shelf and diverse agro-systems. The diverse agro-systems are in fact adaptations and include the system of the khazans, purans and kulagars.

The causes of biodiversity loss are related to events of a long-term nature including Sea Level Rise and soil erosion. More proximate causes indicated are scientific agriculture, mining and quarrying, tourism and urbanization.

Structural causes like improper land use and the changing structure of traditional institutions set up for management of ecological resources (like the tenant associations and comunidades peculiar to Goa) are also highlighted.

The BSAP enshrines a comprehensive list of stakeholders involved, consciously or unconsciously, with the issues of biodiversity and its conservation. It outlines major ongoing conservation initiatives like the ban on monsoon fishing, restrictions on aquaculture, creation of additional wildlife sanctuaries and the implementation of the Coastal Regulation Zone (CRZ) notification.

It follows this up with a detailed list of eleven items of poorly explored ecosystems in the State.

Finally, the Goa BSAP proposes certain strategies for the conservation of biodiversity within the State. There is, according to it, a

formidable knowledge vacuum within the government system concerning biodiversity issues that must be remedied and filled. For this it seeks the creation of a Goa Biodiversity Board that will signal the State's commitment to biodiversity conservation issues and make them an important ingredient in the State's planning and investment decisions.

As far as civil society is concerned, it proposes a Goa Biodiversity Protection Council to replace the present State Steering Committee. The GBPC will act as a pressure group on biodiversity issues in the long term. It will organize annual local food and wild food festivals, generate and publish directories of traditional seed-keepers, set up mobile and permanent exhibitions and museums to ensure that public attention on biodiversity conservation is maintained till official remedial measures come into play.

# Gujarat State Biodiversity Strategy and Action Plan

Coordinating Agency: Gujarat Forest Department, Gandhinagar

Located between 20° 1' to 24°7' N latitude and 68° 4' to 74°4' E longitude, the state of Gujarat encompasses an area of 1,96,024 sq.km. Geomorphologically the same can be divided into six regions viz. (i) Kachchh peninsula, (ii) Saurashtra peninsula, (iii) Alluvial plains of north and central Gujarat; (iv) Hills of north (Aravali), (v) north east (Malva plateau) and east (Vindhya) Gujarat; (vi) South Gujarat and (vii) Bhal region. The area enjoys three distinct seasons i.e. Monsoon, Winter and summer with temperature ranging from lowest of 4° C to the highest of 46° C and rainfall varying from 400 mm to 2000 mm. Biogeographically the area is divided into 4 biogeographic zones viz. The Indian Desert, Semi Arid, Western Ghats and the Coasts, which are further sub-divided into 5 biotic provinces, viz. Kachchh, Gujarat, Malabar Coast, Western Ghat Mountains and the West Coast.

With only 9.9% (19119.69 Km<sup>2</sup>) of the geographic area under forests the state due to its unique geomorphological conditions the area is having rich ecosystems diversity, harboring a wide range of flora and fauna, including the Asiatic Lion and Indian Wild Ass which are unique to the area. Total 4320 plant species including Angiosperms 2198, Algae 1993 have been recorded from the area, while 3054 species of animals (Mammals-154, Birds-479, Fish- 606, Reptiles -107) have been recorded from the area.

The diversity of natural ecosystems includes Coastal and Marine ecosystem, mangroves, corals, wetlands, forests, grasslands and desert. The State has declared 4 national parks and 21 sanctuaries with a view to protect its natural heritage. The total area under PA's is 16902.4 km<sup>2</sup>, which is about 8.6% of the total geographical area, which is quite higher than the national average of 4.7%. For the development and management of these p A's funding is provided under State Government schemes as well as under the Central assistance. In addition to it sizable funds were also received under GEF project for Gir P A while under JBIC funded IFDP project funds were made available for various activities pertaining to forestry and wildlife throughout the state.

Almost 50% (96087 km<sup>2</sup>) area of the state is under agriculture. Wheat, cotton, rice, maize and groundnut are major crops cultivated in Gujarat. Gujarat Agriculture University undertakes research for development of high yielding and disease resistant varieties of various crops and horticulture plants. They have also identified indigenous varieties of various species. Amongst domestic animals 13 breeds indigenous to the area have been identified.

Studies pertaining to the microbial biodiversity have been initiated in the State, but most of them are at initial stage and detail studies are yet to be done.

As far as medicinal plants are concerned Forest department of the State has taken up a detailed study. Use of various plants by forest dwellers and tribals has been documented. Central Government has also established a research centre in the state. Trade in medicinal plants and threats have also been identified in the study.

Impacts of industrialization and mining activities on biodiversity have been studied. Actions taken by Gujarat Pollution Control Board, Gujarat Industrial Development Corporation etc. for minimizing the impacts have been included in the report. Initiatives taken by various Government departments, Semi-Government organizations and NGOs for conserving biodiversity have also been included.

Role of universities, research institutions and other organization in conserving biodiversity have been identified.

The Plan includes various initiatives/ongoing schemes taken up for the conservation of biodiversity of the same and achievement made are as under:

- Average annual financial provision of Rs.176 crores for development of forests and wildlife in the State.
- Management plans for most of the P A's have been prepared and approved.
- About 1,21,400 ha. area in 1020 villages are managed under JFM. At many places JFM activities has shown impressive results. Contribution of NGOs like VIKSAT, AKRSP and FES in implementation of JFM activities is noteworthy.
- Remote sensing studies have shown an increase of 921-sq.km area under forest cover, especially mangroves between 1993 and 1999.

- Eradication of *Prosopis* from grassland habitats under PA's has been taken up and had shown excellent recovery .
- Comprehensive biodiversity studies have been taken up for most PA's. Census of waterfowls is being done in the important wetland sites. Many organizations NGOs and individuals contribute in this aspect.
- Germplasm of various crop varieties are preserved in various research centres of Gujarat Agricultural University. NGO's like SRISHTI, JATAN, SKM making contribution in generating information regarding indigenous knowledge and promoting traditional methods of agriculture.
- The State Government through Department of Animal Husbandry have taken up steps to preserve genetic potential of native breeds of domesticated animals and to impart training.
- Population of wildlife species is on increase. Species focused conservation measures taken up for rare and endangered species. Breeding centres for crocodiles and sea-turtles have been established.
- Activities to curb the pollution has been taken up by Gujarat Pollution Control Board. At many places common effluent treatment plants have been established.
- Large number of NGO's working in the state who can contribute significantly in biodiversity conservation, protection and preservation.

The plan identifies various issues related to biodiversity conservation. Major issues identified are:

- Settlement procedures for certain P A's are yet to complete resulting in to legal disputes.
- Some of the biogeographic zones are over represented while some are inadequately cornered under PA's.
- Increased man-wildlife conflict.
- Some of the PA's needs more effective management.
- Forest protection, encroachments, fire and grazing, inadequate political will, settlement of rights and demarcation of boundaries are hindrance in development of forest resources.
- Unsustainable development activities, weed infestation and absence of well defined land use policy resulted in degradation of grasslands
- Multiple use and overlapping jurisdiction of Protected wetlands, scarcity of database, inadequate knowledge of handling wildlife, unsustainable fishing within PA's non-inclusion of wetlands in rural development plans and industrial activities/development around wetlands adversely affect wetlands biota.
- Lack of detailed survey of wild relatives of cultivated plants/crop varieties and of conserving domestic biodiversity and lack of incentives for it.
- Lack of research, field work and resources for studying microbial diversity.
- Unregulated exploitation of medicinal plants, low natural regeneration and inadequate control over pharmacies using medicinal plants.
- Low implementation of environmental laws, weak EIA studies and unsound location of industrial areas adversely affect biodiversity in many areas.
- Poor coordination between institutions/organization working in the field of biodiversity, lack of lucrative careers in the sector, low priority to basic science disciplines like taxonomy, botany, zoology in universities and inadequate funding jeopardize development of institutional and human capacity.

The salient features of strategy and action plan suggested for conservation of biodiversity of the state include:

- Creation of Gujarat Biodiversity Preservation and Development Board (GBPDB) to act as an independent advisory board. The board may have 20 members of which 10 may be from Universities, relevant institutions and NGOs while the rest may be from various government departments of the State. It is suggested that the Board may be headed by the Chief Minister of the State. The Board may also act as an umbrella organization and may review various policies.
- Rationalization of boundaries of various PA's and inclusion of new potential areas, strengthening of PA network and development of corridors have been suggested.
- Critical review of existing plans/schemes for wildlife conservation has been taken up. Stress has been made upon research studies, monitoring, awareness programmes and strengthening of NGOs have been suggested.
- Restoration of degraded forests through JFM, conservation of natural dense forests, afforestation of degraded-forest areas, enhancing people's participation in forest and wild life conservation, extension activities, afforestation in non-forest areas and human resources development have been suggested.
- For conservation of grasslands, improved protection, restoration programmes, recurrent sowing of palatable grasses, gradual removal of *Prosopis juliflora* from grasslands, soil moisture conservation works and development programme for Maldharis (grazing community) have been felt necessary.
- Research and monitoring of wetlands irrespective of PA's -non PA's, study of rare and endangered species of waterfowls, discouraging transfer of mangrove areas for other purposes have been felt necessary. Establishment of Joint Wetland Management and Wetland Protection and Management committees have also been suggested.

- Gulf of Kachchh and Gulf of Khambhat have been proposed as twin marine biosphere reserves, preparation of action plan as per directions of National Committee on Wetlands. Mangrove, wetlands and Coral reefs; Establishment of Research Centres for monitoring pollution; restoration of mangrove cover; enhancement of role and coordination among Coast Guard and Navy in protection have been suggested for conservation of coastal areas.
- Compilation of information pertaining to depleted land races, inventorization of wild genetic resources held by various agencies, assessment of native edible wealth in traditional agro-ecosystems, identification of various issues related with domestic animal conservation, monitoring population of each breed which are at the risk of extinction, conservation of genetic resources have been suggested for conservation of domestic biodiversity.
- Breeding and reintroduction programme for threatened species like Chausinga, Barking deer, Caracal, Otter etc; conservation programme for rare and threatened plants including locally endangered species; protection of areas supporting rare and threatened plant species in wild, plantation of suitable species for supporting vultures. Hombill etc have been suggested-
- Strengthening of hatching programme of sea turtles, *ex situ* conservation programme for plants and animals through botanical gardens, tissue culture technologies and zoological parks, identification of non-P A areas supporting threatened species and conservation measures for such sites have been recommended.
- Development of technology and tools for culture and identification of microbes, documentation of microbial wealth in various ecosystems, development of manpower in the field of systematic microbiology and establishment of an autonomous Research Institute in microbiology with focus on pathological and applied aspects is suggested for conservation of microbial diversity.
- Workshop for "Rapid Threat Assessment" of medicinal plants, short listing areas rich in medicinal plant diversity as MPCA, formation of local community based management and protection committees, developing suitable protocols of germ-plasm of clinically important species, creation of database on nursery techniques and seed storage methods for prioritized medicinal plant species, training programme for collection and cultivation of medicinal plants; development of scientific harvesting technologies and development of a certification agency for use of plants used by pharmacies, have been felt necessary for conservation of medicinal plants.
- Initiating and supporting research on industrialized toxicology and eco-toxicology; ban on permission of industrial units within 5 km radius of PA's, EIA and public hearing for new industrial units; treatment of wastes; encouraging eco-friendly industries/technologies; River/coastal Action plans to clean up polluted rivers; strict enforcement of Mines Act and establishment of "Follow up Performance Board" to ensure restoration of mined areas have been suggested to reduce and minimize impacts of industrialization and minimizing activities on biodiversity .
- With a view to reduce man-wildlife conflict. Suggestions have been made including making process of paying compensation more faster and transparent in case of human death and livestock predation by wildlife; translocation of animals from certain areas, exploring possibilities of culling in case of species which are in abundance; paying incentives to farmers in whose farms Sarus crane nests is made, and exploring possibilities of introducing insurance policies for human/livestock/crop loss and damage.
- Harnessing political support by circulating translated copies of GBSAP and NBSAP and forming committees of interested MLAs/Panchayat Presidents to lobby the cause; introduction of natural resource account systems; Increasing funding in the biodiversity sector including from private sectors; facilitating and increasing cooperation between government departments through workshops and informal meetings; Greater cooperation between the Government and NGOs etc. have been recommended.
- Steps to reduce the consumption of natural resources including need to establish segregation and recovery mechanism for solid waste; rewards to households for producing clean garbage; encouraging waste product recovery mechanism; promoting use of non-environmental energy sources.
- With a view to achieve active participation of the people appropriate economic share to local people/communities in case of use of any product, process or technology used by them and use of resources by outside agencies such as tourism, mining etc; incentives for biodiversity conservation measures on private lands; developing qualified and trained human resources and providing lucrative careers to them; tax incentives to sectors for biodiversity conservation measures and keeping land aside for the purpose; soliciting greater involvement of media for raising awareness and active role of women in biodiversity conservation measures have been suggested.
- Discouraging subsidies on chemical fertilizers; control over number and depth of bore-wells; encouraging use of bio-pesticides and bio-fertilizers by providing subsidy for its use have also been suggested.
- Restoration of degraded lands, particularly wastelands and gauchers and use of them in sustainable manner; encouraging NGOs and individuals to take up tree planting activities and providing benefits/incentives for such activities have been recommended.

Proper implementation and periodic review and monitoring of State biodiversity strategy and Action Plan with adequate funding for the purpose and continuous feedback is suggested.