Rajasthan State Biodiversity Strategy and Action Plan

Coordinating Agency: Development Commissioner (Rajasthan), Jaipur through Harish Chandra Mathur Rajasthan Institute of Public Administration, Jaipur

The state of Rajasthan recognises not only the intrinsic value of its biological diversity, it is also aware of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components. The biological diversity of the state is critically important for maintaining life sustaining systems of the biosphere and their productivity. Conservation of biological diversity is a common national concern and the state, while sharing this concern, has committed itself to align its programmes with the national goals in this regard. The biological diversity and biological resources of the state are being significantly reduced by certain human activities. There is a general lack of scientific information and knowledge regarding biological diversity in the state, and there is a clear and urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures. There is a general lack of public policies and political understanding in the state regarding the importance of conservation of its biological resources and their diversity. There is an urgent need to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at source. Within the state there is a close and traditional dependence of many indigenous and local communities on biological resources, and it is necessary to ensure sharing equitably benefits arising from the use of traditional knowledge, innovations and practices relevant to the conservation of biological diversity and the sustainable use of its components. Conservation of biodiversity can synergize well with the programmes of economic and social development and poverty eradication, which are the first and overriding priorities of the state. Conservation and sustainable use of biological diversity is of critical importance for meeting the food, health and other needs of its growing population.

In view of the above reasons, the state of Rajasthan considers it an extremely important task to prepare a comprehensive strategy and action plan to conserve its biodiversity and biological resources. Preparation of the present *Biodiversity Strategy and Action Plan* is an opportunity that the state has seized to achieve this important task.

Process Followed

The Rajasthan Biodiversity Strategy and Action Plan has been evolved over the period of last two years involving participation of a large number of persons, organisations and institutions. The process involved consultations with various sections of society, including experts and scientists in the field of conservation and related fields, local communities and community leaders, local knowledge holders in the field of biodiversity, panchayats and local leadership, Village Forest Protection and Management Committees, political leadership, academia, school teachers and students, NGOs and voluntary agencies, media persons, industry and corporate sector, officers of various government departments, forest officers esp. protected area managers, grassroots level workers in forest, agriculture and related departments, women and vulnerable sections of society.

Consultations were organised at different levels. There were several in-house informal discussions held during the first three months on various thematic aspects. Later Many of the consolations were organised by the regional experts during their own process of formulation of regional plans. The state process was also linked with the national process through participation of the nodal agency and regional experts in national consultation events. The state team also participated in the Mid term National Workshop at New Delhi and Western Region workshop in Ahmedabad organised under the national process.

Structure of the Report

The present document is structured into eight chapters and thirteen appendices and an index. Appendices contain substantial amount of bibliographic information which can be used a starting point for building up database of literature on biodiversity in the state in future. A detailed glossary of technical terms has also been included so that readers not having an academic background in biology and related subjects may understand the document better.

Chapter 1 presents briefly the scope, the need for the BSAP and the aims and objectives of this exercise in planning for conservation of the diversity of the biological resources of the state.

Chapter 2 of the report discusses the geographical and socio-economic profile of the state of Rajasthan. Conservation of natural

resources has been a very old concern for the people of this state. Communities are known to have sacrificed their lives and built whole religio-cultural faiths around the theme of conservation and compassion for living beings including plants and animals. The process of state-led development programmes have not been so meticulous or concerned about this aspect however. A historical delineation of these processes and how they have adversely impacted the biological resource base of the state will lead to a better understanding of the future plans and processes and their expected responses and success.

Chapter 3 provides a brief account of the biological resources of the state, their diversity, and their use and management. It covers both the natural ecosystems (wild biodiversity) and the managed ecosystems (the domesticated biodiversity). An overview of how the resources are being utilized, impacted adversely, threatened or being exploited unsustainably is also provided. An account of the institutional arrangements for managing and conserving conservation of biodiversity has been given. The biological resources are so diverse, widespread and important in the state's economic, social and cultural life that the range of stakeholders and key players affecting the future of biodiversity is vast and complex.

Chapter 4 considers the underlying causes (the *root causes*) of biodiversity loss and degradation of the environment such as overpopulation; over consumption; negative externalities and ineffective structures of institutions, inappropriate policies and attitudes. Also considered are the impacts of human activities on sustainability of biological resources in general and biodiversity in particular.

Chapter 5 outlines the ongoing initiatives and programmes in the state for biodiversity conservation. Biodiversity has not yet been recognised as a concern in its own right in the state. There is no state level body or institutional mechanism whose domain includes management of biodiversity across protected areas, forests, pastures, farms, ponds, rivers, lakes and different kinds of public lands in an integrated manner. As a result, there are no initiatives or programmes that are explicitly designated as biodiversity conservation initiatives. Nevertheless, certain sectoral programmes and activities are being taken up in different sectors either with conservation of biodiversity as main focus or biodiversity conservation as part of their objective or a by-product (positive side-effect) of sectoral objectives. This chapter aims to summarise such initiatives currently under way in the state.

Chapter 6 presents detailed strategies and action required in view of the challenges outlined in the previous chapters and the importance of biological resources and their conservation in the state, it becomes necessary to devise a comprehensive strategic plan of action. This chapter presents a structured summary of the strategies and actions that are required in the immediate future as well in the long term. This strategy addresses full range of causes of destruction of biodiversity and embraces widest opportunities that a conservation programme may provide for realising the maximum human welfare from the biological resources of the state. The strategy and action plan presented here forms a foundation for conservation of biodiversity in the state for future. Although this baseline action plan will have to be reviewed from time to time as and when the need arises, yet it will provide a framework in which to base all the broad programmes and policies.

Strategies and Actions

The strategies and actions categorised by themes are summarised herein under.

Protected Areas

Action 1
Complete the legal process of boundary demarcation and settlement of rights in the existing protected areas.

Action 2
Prepare management plans for all the PAs incorporating long term and short actions and get them appraised in a consultative and participatory process.

Action 3
Provide for adequate infrastructure, human and financial resources to strengthen the management of the existing protected areas.

Action 4
Assess the adequacy of the present network of protected areas and draw up a long-term plan to make the network CAR, and to enhance their role in biodiversity conservation.

Action 5
Develop policy measures and incentives for establishment of private and community protected areas in the state.

Action 6
Broaden community participation in management of the PAs, through actions initiatives such as ecodevelopment plans.

Action 7
Broaden the objectives of management of PAs to include the full range of issues enshrined in the CBD.

Action 8
Create a better physical and human context for managing the protected areas.

Action 9
Enhance the ecological and social value of the protected areas by increasing level of benefits flowing to the people in and around these areas.

Action 10
Set up a mechanism for continuous monitoring of the status, processes, trends, and management needs and practices in the protected areas of the state.

Domesticated Biodiversity

Action 11
Prepare inventory of domesticated and agrobiodiversity resources of the state including all the components of such biodiversity.

Action 12
Identify, delineate, map and study the principal agro-ecological zones of the state and the current and potential changes under way in their status, health and their environment, including measures to contain these changes.

Action 13
Research and document the prevalent traditional practices, knowledge of local farming methods in the state and how these contribute to conservation of domesticated biodiversity.

Action 14
Launch an awareness raising campaign focused on the value and importance of domesticated biodiversity and managed ecosystems, esp. among the practitioners and policy makers.

Action 15
Develop programme of incentives encouraging cultivation of local species and varieties of crops, livestock, fish, fruits and vegetables, esp. those that are being forgotten or abandoned.

Action 16
Change the sectoral policies in order to make biodiversity-rich farming practices profitable and productive vis-à-vis intensive monoculture.

Forest Biodiversity

Action 17
Launch a programme of identifying and inventorying the species and genetic diversity of flora and fauna found in the forests of the state.

Action 18
Identify and map the plant community ecosystems across all forest lands and classify these according to prevalent scientific system to understand their status, trends and changes under way.

Action 19
Recognise and address the concern of biodiversity conservation as integral part of forest management by amending policies and legislation.

Action 20
Prepare a macro-level forest biodiversity management plan by delineating various types of management areas and assessing complementarities in their management in consultation with forest dwellers and surrounding populations.

Action 21
Adopt silvicultural practices in particular and sustainable forest management practices in general, to manage and work forests without causing loss of their biodiversity.

Action 22
Involve local populations in management of forests to ensure that they obtain benefits which will motivate them to support conservation of forest resources.

Action 23
Demarcate the permanent forest estate of the state and enter it accordingly into all relevant public records to ensure its protection against encroachment and misuse.

Action 24
Bring additional land under the reserve system esp. those lands that are well-forested but do not constitute part of the formal forest reserve system.

Action 25
Encourage private and public land holders to manage the native vegetation by setting up private forest conservation areas.

Action 26
Launch a programme regenerating native forest vegetation in degraded areas in forest reserves.

Action 27
Evolve a sustainable energy use policy with special focus on bio-fuels in order to reduce pressure of fuelwood gathering from forests.

Action 28
Develop a programme of reducing grazing pressure on state's forest resources by addressing both the supply-side and demand-side problems.

Action 29
Launch a continuous programme of tree improvement so that tree cultivation becomes a viable economic activity vis-à-vis crop cultivation and the overall production of fuel, fibre, forage, timber and other ligneous products increases to meet demands.

Action 30
Identify economically important non-timber forest produce and develop these resources and enhance the overall economic value of these products to the local populations.

Action 31
Develop policies and incentives to encourage cultivation of trees in agroforestry systems as a mainstream economic activity.

Action 32
Develop policies, programmes and incentives for promoting recycling of forest based products and their effective substitution.

Action 33
Bring the wastelands outside forest reserves under social forestry programmes to increase their productivity.

Grassland Ecosystems

Action 34
Prepare a detailed functional inventory of the major grassland habitats in the state, including catalogue of the biodiversity that they harbour.

Action 35
Set up a network of preserved or protected grasslands habitats, representative of the diversity of overall grassland resources of the state and mark these out of bound for general development activities, possibly by bringing these under the category of protected areas.

Action 36
Put in place clear polices and guidelines regarding human manipulation of grassland ecosystems, esp. by way of utilisation, altering tree density, species composition, and introduction of exotics.

Action 37
Launch a programme of eradication of invasive species in major grassland habitats of the state with a carefully designed plan of ecological restoration.

Wetland Ecosystems

Action 38
Prepare a detailed inventory of the wetland resources of the state including a GIS enabled database capable of being used in project planning for conservation of these resources.

Action 39
Designate a representative network of critically important wetlands of the state and put in place a system of their management.

Action 40
Prepare management plans for all the wetland sites in the state and have these management plans implemented over the next few years.

Action 41
Enforce mandatory requirements of Environment Impact Assessment of development projects situated in hydrological basins of wetland areas.

Action 42
Launch a programme of scientific research on the management of wetlands and dissemination of results among policy makers, and local populations, and the public at large.

Action 43
Provide economic incentives for conservation of wetlands esp. in situations where wetlands are closely linked with the livelihoods of local populations.

Action 44
Launch a programme of information, environmental education, and awareness (IEEA) about wetlands, their role in the state's ecological security and economic well-being, and the importance of their conservation.

Dryland and Desert Ecosystems

Action 45
Conduct surveys and research to build up databases and inventories of the components of biodiversity in the desert area.

Action 46
Identify the unique ecosystems at local level, representative of all habitat types, study their ecology, the external (physical and human) environment and driving forces (natural and anthropogenic) determining the trends and changes in these ecosystems.

Action 47
Conduct detailed scientific survey and study in the command and transboundary areas of Indira Gandhi Nahar Pariyojana where deep level ecological changes are taking place.

Action 48
Develop a natural resource management plan for the desert region, with special focus on land use patterns, with a view to reducing the region's vulnerability to unpredicted change upon alteration of its unique habitats.

Action 49
Create a special regional network of protected areas that is comprehensive, representative, and adequate and that includes corridors, buffers and transboundary conservation areas.

Action 50
Declare a portion of the desert region as biosphere reserve by completing the current process under way.

Action 51
Develop policies and guidelines to regulate all sectoral programmes in the region, esp. land-based activities, by subjecting these to comprehensive review in view of their environmental impact in general and their impact on biodiversity in particular.

Action 52
Launch a regional programme of building awareness among the local populations, building complementarities with their local knowledge, and integrating biodiversity management with their livelihood.

Policy and Support

Action 53
Develop and declare official goals, objectives and mission statement to guide the process of conservation of biodiversity in the state.

Action 54
Create institutional mechanism for overall planning and implementation of the biodiversity conservation programmes in the state.

Action 55
Incorporate the concerns of environmental conservation in general and biodiversity conservation in particular into development planning in the state at all stages, right through local plans to the district plans to the state level plan.

Action 56
Develop guidelines and practices across all the sectors of development for taking into account the value of biodiversity and avoid its waste while planning and implementing their sectoral plans.

Action 57
Reform economic policies that directly or indirectly encourage loss of biodiversity.

Action 58
Develop policies and practices to reduce demand for biological resources

Sikkim State Biodiversity Strategy and Action Plan

Coordinating Agency: Sikkim Forest, Environment and Wildlife Department, Gangtok

The National Biodiversity Strategy and Action Plan (NBSAP) is a project of the Ministry of Environment and Forests, Government of India. Its execution is being done by a technical and policy core group of various experts from all parts of India, headed by the reputed Indian NGO, *Kalpavriksh*. The Biotech Consortium India Ltd is coordinating its administration.

The state government of Sikkim approved this project in September 2000. Since June 2001, the Department of Forest, Environment and Wildlife tried to reach out to all sections of people across the length and breadth of the State in a massive effort to formulate the Sikkim Biodiversity Strategy and Action Plan in a participatory manner. This involved the full participation of maximum number of people from all walks of life, having any sort of traditional/scientific knowledge to contribute. Some of the remotest villages were visited as also villages on the peripheries of wildlife protected areas. Besides intensive public hearings, two biodiversity festivals were held at Yuksam in the west and Chungthang in the north. The first state level steering committee meeting of various luminaries in the field was held at Gangtok on 20th August 2001.

The initial publicity blitzkrieg followed by public hearings deep in rural areas and the first State Level Meeting of the SSC, struck a very positive and hopeful chord among the people of Sikkim. It was heartening to note that everyone was very concerned about the increasing biodiversity losses and mistakes of faulty development strategies. At the community level, there is a lot of expectation from the government for implementing various schemes, which may lead directly or indirectly to biodiversity conservation. The second state level steering committee meeting was held on 7th December 2001 to finalize the GSAPs. The basic strategy used for Sikkim was conducting Community SAPs (CSAPs), which included organizing public hearings in about 39 locations and two biodiversity melas at Chungthang in North Sikkim and Yuksam in West Sikkim. These 39 CSAPs were tabulated village-wise in their ecoregions, giving the problems and issues, major actors and expectations from them. These were then condensed ecoregion-wise followed by informal brain storming sessions involving all the stakeholders to synergize the CSAP and GSAP into one holistic SAP. CSAP + GSAP led to the State BSAP.

Final comments received from Ms. Seema Bhat and Mr. Ashish Kothari of Kalpavriksh on the State BSAP were incorporated in the document as were those from local informal brain storming on the executive summary of the same. The latter, translated into the four local languages, Nepali, Limboo, Bhutia and Lepcha was released officially on the occasion of State Biodiversity Park inauguration by the CM of Sikkim at Damthang, South Sikkim on 29th April 2003.

Tamil Nadu State Biodiversity Strategy and Action Plan*

Coordinating Agency: Tamil Nadu Forest Department, Chennai

1. Brief Introduction about Biodiversity of the State
2. Brief description of major Biodiversity related issues pertaining to Tamil Nadu
3. Brief description of on going initiatives and key gaps
4. Detailed description of the proposed Strategy and Action Plan

1. Brief Introduction about Biodiversity of the State

Tamil Nadu (the land of Tamils) is situated at the South-Eastern extremity of the Indian Peninsula and it is the Southern most state of mainland India. Andhra Pradesh in the North, Karnataka in the Northwest, Kerala on the West, Bay of Bengal in the East and Indian Ocean in the South bound it. It is located between 8^{o} 05' and 13^{o} 34' North latitudes and 76^{o} 14' and 80^{o} 21' East longitudes. With a coastline of 938 Km and land boundary of 1200 Km, the total area of the State is 1,30,19,000 ha covering 4.08% of the country. Chennai is the capital.

Tamil Nadu shares the Western Ghats Biodiversity (one of the 25 Global Hotspots of Biodiversity) with Western Ghats States of Kerala, Karnataka, Maharastra and Goa. It shares the Eastern Ghats Biodiversity with Eastern Ghats States of Andhra Pradesh and Orissa. It also shares the East-coast Biodiversity with East-coast States of Andhra Pradesh, Orissa, West Bengal etc.,

Forest Biodiversity in the State is mainly confined to Western Ghats and Eastern Ghats. It includes a Recorded Forest Area of 22.6 lakh ha. covering 17.4% of Geographic Area of the State. However area under forest cover according to FSI is only 17.07 lakh ha covering 13.13% of the Geographic Area. There are about 3,072 hamlets bordering the forest areas of the State.

The term Forest is used in the administrative sense implying areas notified as forests. It is a generic term and not a specific one. It includes Grass land Ecosystems, Wetland Ecosystems and Aquatic Ecosystems like Rivers and Dams.

There are nearly 47 Forest Types in the State of which 13 types are Climax formations, 8 types are Edaphic formations and 6 types are Seral stages and the rest are degradation types. Tropical Dry Deciduous Forest covers an area of 12.23 lakh ha constituting 54.30%, Tropical Thorn Forest covers an area of 5 lakh ha constituting 22.10%, Tropical Moist Deciduous Forest covers an area of 2.60 lakh ha constituting a percentage of 11.10%. The Biodiversity rich forest types are the Tropical Wet Evergreen Forest covering an area of 0.60 lakh ha constituting 2.67%, Tropical Semi Evergreen Forest covering a area of 0.23 lakh ha constituting 1.01%, Subtropical Broad leaved Hill Forest covers an area of 1.14 lakh ha constituting 5.04%, the Tropical Dry Evergreen Forest which is a unique type of Tamil Nadu covers an area of 0.26 lakh ha constituting 1.16%, the mangrove forest covers an area of approximately 0.23 lakh ha constituting 1.01%.

The Aquatic Biodiversity of the State includes 33 river systems covering a length of 8,957 km. Tamil Nadu shares the watershed with Karnataka, Andhrapradesh and Kerala.

The Coastal Biodiversity covers a length of 938 km along the East Coast. The ecologically sensitive areas along the East Coast are the Mangrove forest area of Pichavaram near Parangipettai (Porto Novo), Bird Sanctuary and Wildlife and forest conservation zone near Point Calimere, Oyster beds near Point Calimere, Coral reef near Mandapam, Shell fishing area within Tuticorin harbour, Sanctuary for coastal fauna at Kurusadai island, Sponge beds at Manoli and Putti Islands, Windowpane shell fisheries at Point Calimere. The Gulf of Mannar Biosphere Reserve is a very important Biodiversity region of the East Coast.

The wetland Biodiversity includes approximately 40,000 tanks and 56 dams and reservoirs. The important wetlands are Pitchavaram mangroves, Muthupettai mangroves, Pulicat lake, Point Calimere sanctuary and other Bird Sanctuaries.

Biodiversity Conservation has been structured covering the Ecosystem Diversity, Species Diversity and Genetic Diversity. Species Diversity has been structured separately for plants and animals. Wild Plant diversity has been structured on the lines of Red-listed

plants, Endemic plants, Medicinal plants, Wild relatives of cultivated plants, allied species of cultivated species and others. Wild Animal diversity has been structured on the lines of Red listed animals, Endemic animals, Flag ship species, Key stone species, Pollinators and others. Domesticated species diversity has been structured on the lines of Cultivated plants and Domesticated animals.

Various departments control Biodiversity in the State. Forest Departments manages Forests, Grasslands, Freshwater Wetland Bird Sanctuaries, Estuarine Wetlands like Mangroves, Coastal Biosphere Reserve like Gulf of Mannar Biosphere Reserve and entire spectrum of Wild Species Diversity. Forests also includes the rivers that pass through the notified forest areas, dams located inside the notified forest areas and tanks and ponds inside the forest areas.

Agriculture Department and the farmers manage the Agro Biodiversity. Animal Husbandry Department and the farmers manage the Domesticated Animals Diversity. Public works department controls the fresh water wetlands, tanks, dams/reservoirs and rivers. Panchayats control minor irrigation tanks, Fisheries department control the coastal fisheries. Revenue department controls the biodiversity of the poromboke and other village common lands.

2. Brief Description of Major Biodiversity Related Issues Pertaining to Tamil Nadu

Major issues pertaining to the forests are Delay in settlement of the forest lands, diversion for Development Projects like Dams and Hydro-electric power stations, Mining, Encroachment, Recurrent Fire, Grazing, Poaching, Smuggling, Head loading, felling and lopping of Trees for small timber and timber, Collection of green-leaf manure, MFP collection, Unsustainable collection and overexploitation of Medicinal plants, Disaster management like flood and drought, Man-Animal conflict, Habitat destruction and habitat fragmentation, Elephant corridor related problems, Inter-State smuggling and poaching gangs, Extremism and Terrorism, Exotics plantations and Natural spread of Exotics, Poverty in the vicinity of forests and forest dependency, Alternative livelihood system for the forest dependants and sustainable livelihood system for other forest fringe dwellers through micro-finance and micro-enterprises, Population growth of the forest dwellers, forest fringe dwellers and enclaves dwellers and Tribals livelihood security.

Major issues pertaining to Riverine and Wetland Biodiversity are Encroachment, Siltation, Pollution, Lack of Management System, Disasters like flood and drought.

Major issues pertaining to Coastal Biodiversity are Habitat destruction and conversion, spread of Exotics like Prosopis, Pollution, Hunting and Poaching, Over Exploitation, Global climatic changes and other causes.

3. Brief Description of on Going Initiatives and Key Gaps

The ongoing initiatives include Joint Forest Management in about 1000 hamlets (out of a total of 3072 hamlets), Eco-Development in Kalakkad Mundanthurai Tiger Reserve, Western Ghat Development Programme in Western Ghats, Hill Area Development Programme in Nilgiris and Forest Development Agencies in some divisions. The ongoing Wildlife projects are the Project Tiger and Project Elephant. Recently Gulf of Mannar Biosphere Conservation Project has been launched.

The ongoing programmes adequately addresses the issues of Participation, Empowerment, Equity, Poverty eradication, Gender Sensitization etc., The Key Gaps are JFM has to be extended to another 2000 hamlets and Eco Development model of KMTR has to be extended to all the Sanctuaries, National Parks and Biosphere Reserves. The ongoing initiative of bringing more divisions under Protected Area has to be expedited. The working plans and management plan has to be prepared focussing the biodiversity conservation.

4. Detailed Description of the Proposed Strategy and Action Plan

Joint Forest Management, Eco Development, Watershed Management will be the major forest ecosystem based strategies. Eco Development and Joint Forest Management are more or less similar concepts except that there is no benefit sharing in Eco-Development. Eco-Development is practiced in protected areas whereas Joint Forest Management is practiced in other forest areas.

Joint Forest Management and Eco Development will address the issues of empowerment particularly women, equity focusing on tribals and other deprived sections and poverty eradication. Both these strategies aim at creation of sustainable alternative livelihood system for forest dependents and livelihood security of the tribals and other forest fringe dwellers. These strategies will also address the issues of reduction of head-loads, reduction of grazing, production of fuelwood and fodder etc.,

1. JFM is practiced in 1000 hamlets out of 3072 hamlets in the State. JFM practices will be strengthened further in all these 1000 hamlets by laying special emphasis on sustainable alternative livelihood system for the forest dependent people by adopting the KMTR model.

2. JFM will be extended to another 2072 hamlets in the state by adopting the present model.

3. Eco-Development initiatives will be further strengthened in KMTR.

4. KMTR model of Eco-Development will be extended to all the other sanctuaries, National Parks and Biosphere Reserves.

5. The present policy of total biodiversity conservation in the state will be continued.

6. Biodiversity conservation will be integrated in forest planning by incorporating a chapter on biodiversity conservation in all the working plans and in all the wildlife management plans.

7. Agro Forestry will be promoted in wastelands and in dry-lands as a alternative production strategy for meeting the fodder, fuel-wood, small timber and timber requirements, so that pressure on forest resources can be minimized thereby saving the forest biodiversity.

8. Social Forestry outside the forestland will be continued in the existing social forestry areas and tank beds. Production of fuel-wood from these areas have reduced the pressure on forests. Plantations will be raised in the tank beds as and when the existing growth is harvested.

9. Watershed management will be promoted by integrating the management of the aquatic, agro ecosystem and forest ecosystem biodiversity focusing on water management and appropriate land management.

10. Forest Management issues like delay in settlement of forest lands needs to be tackled by appointing conservators as forest settlement officers as the present system causes enormous delay, there by destroying the forest biodiversity. Issues like diversion of forestlands for non-forestry purposes has to be regulated by Central Government. Mining is a serious threat to forest ecosystem and should not be allowed. The existing encroachment will be evicted and it will not be regularized. Future encroachments will be prevented by constant monitoring.

11. Poaching and Smuggling requires interstate coordination. Extremism and Terrorism inside forest areas also need interstate coordination. Existing strategies for controlling poaching and smuggling is adequate

12. Disasters like flood and drought take a heavy toll of biodiversity, there is a need for disaster management plan in each forest division.

13. Man Animal conflict seriously threatens the existence of wildlife and it also affects the agriculture of the forest fringe villages. Adequate compensations for the victims of wild animal attack has to be ensured. Crop insurance has to be promoted in all the forest fringe villages.

14. Habitat destruction and habitat fragmentation seriously threatened the wildlife and *in situ* conservation of plants. The root causes of Forest bio-mass dependency has to be analyzed. Green leaf manure collection will not be permitted from forests as it destroys the habitat.

15. Wildlife corridor particularly Elephant Corridor problems are serious in many elephant habitats. The stake holders of elephant corridor regions have to be sensitized and appropriate awareness programs should be launched during migratory season.

16. Further planting of exotics will not be carried out in the existing exotic plantations will be converted to indigenous species plantations in future.

17. Ongoing strategies of Medicinal Plants conservation by adopting medicinal plants conservation area and medicinal plants development area approach will be strengthened.

18. Recovery strategies for all the Red-listed plant species and Red-listed animal species will be evolved taking in to account the present extent of occurrence, area of occupancy and population dynamics of each species.

19. *In situ* conservation of all the endemic plant species and endemic animal species will be taken up by adopting area oriented approach. The endemic plant species of the State and the endemic animal species of the State will be grouped location wise

and their extent of occurrence and area of occupancy and population dynamics will be studied for promoting conservation.

20. Special emphasis will be laid on conservation of wild relatives of crop plants and wild relatives of domesticated animals.

21. Permanent biodiversity registers for each forest division indicating the plant diversity and animal diversity will be maintained and it will be updated every month as and when more species are recorded. Benchmark information will be generated for each division taking the available publications in to conservation.

22. In some of the forest areas enclaves are existing. The management approach to these enclaves could be three fold. (i) acquisition of these enclaves by the Forest Department, (ii) relocation and rehabilitation of residents of these enclaves/settlements and (iii) maintain the status quo with proper monitoring and further restrictions imposed. While the first option is the best, but, in many cases it may not be feasible. Therefore, whenever possible, the encroached and unused areas should be taken under the management control of the Forest Department and for the remaining areas, very strict control with regular monitoring protocols need be imposed.

23. The management and conservation strategies indicated in the National Forestry Action Plan, National Wildlife Action Plan, National Policy on Biodiversity etc., will be followed.

24. Monitoring protocols will be evolved for important species and key habitats.

25. *Ex situ* conservation strategies will be adopted for Red-listed plants and over exploited medicinal plants. The existing zoos will be used for exsitu conservation of Red-listed animals.

26. Regarding domesticated biodiversity the ongoing National initiatives of NBPGR, NBFGR, NBAGR etc will be strengthened.

27. Regarding Aquatic biodiversity management system will be evolved for the Riverine and Wetland biodiversity.

28. Regarding coastal biodiversity the recommendations of the east coast ecoregion will be followed. It includes setting up of expert centres for taxonomic identification of marine biodiversity. A permanent monitoring team for monitoring coastal biodiversity, conservation of mangrove by creating alternative livelihoods and by development of small scale development projects in and around mangroves. Demarcation of fishing zones for non mechanized and mechanized fishing boats in critical habitats like mangroves, coral reafs and sea grass beds under CRZ-1, formation of eco clubs in fisherman villages, Identification of degraded sites for inclusion under protected areas, creating centres for eco tourism, awareness creation etc.

* This BSAP was not completed, but has been accepted subject to final revisions being incorporated.

Tripura State Biodiversity Strategy and Action Plan*

Coordinating Agency: Tripura Forest Department, Agartala

Background

The National Biodiversity Strategy and Action Plan (NBSAP) is a project of the Ministry of Environment and Forests, Government of India, and funded by the Global Environment Facility through United Nations Development Programme (UNDP). It aims to produce a series of planning documents dealing with the conservation of India's biodiversity, sustainable use of its biological resources and equity including in decisions regarding access to such resources and the benefits accruing from them. The Tripura State Biodiversity Strategy and Action Plan-TSBSAP focuses on existing resources, exploration into the causes for degradation of resources and suggestions for developing management strategies for maintenance and improvement of biodiversity.

The stakeholders were well informed about the subject by using mass media, official and personal communication methods. The information collected and compiled during the public hearings and workshops, and issues emerged during review of related literature were discussed in the State Level Workshop.

Geographical Profile

The State of Tripura, with a geographical area of 10,491 sq. km, is predominantly hilly. The climate of Tripura exhibits a strong seasonal rhythm. Five broad groups of soil are found in the State. Anthropologically, the people can be divided into two categories, namely Tribals and Bengalis with distinct physical features and cultural habits. The main occupation in the State is agriculture. The tribals have been practising shifting cultivation (*jhuming*) on hill slopes since time immemorial.

Status of Biodiversity: Variety of ecosystems such as forests, agriculture, aquatic, etc., are found in different places. **Forest:** around 60% of geographical area is under forest. Tripura is rich in natural biodiversity. It (Tripura) has only 0.32 % geographical of the country but harbours about 13%(1573 Texa comprising 1545 species and 28 extra typical varities in 862 genera and 192 families of Vascular plants) of plant species of India. There are unique and endemic species, 14% species are restricted in distribution. About 7 species of plants have been reported in the State for the first time outside their known habitats. Out of 15 non-human primates found in India, 7 exists in this small State. About 341 species of birds and 90 species of land mammals are present. **Agriculture:** (about 27% of the total geographical area) is one of the important land use activities in Tripura. There has been increasing cropping intensity, consumption of chemical fertilizers, introduction of HYV and use of insecticides and pesticides. The region has a large variation of agricultural crops, viz., rice, maize, millets, beans and pulses, horticultural crops including fruits, guava, ber, jackfruit, mango, papaya and a good number of indigenous fruit species. The vegetable crops such as brinjal, cucurbits, chillies, leafy vegetables, beans, colocasia and alocasia have huge genetic variation. In Tripura, 15 - 20 domesticated species are observed. Most of these species are indigenous, but over a period of time, exotic varieties have been introduced mainly because of high productivity. There are a large number of bacteria, algae, fungi, bryophytes and Pteridophytes, 19 species of edible mushrooms are present in the State. Another well-established agricultural system is *jhuming*. It is practised in forest areas and is totally rainfed. Varieties of crops (traditional and indigenous) are grown in same piece of land under *jhum* cultivation. **Aquatic diversity:** A total of 289 species of faunal and floral aquatic diversity are listed as per available records. There are 118 species of macro-aquatic fauna and 40 species of macro-aquatic flora. The micro level diversity is not fully known yet. So far only 69 species of aquatic microfauna and 62 species of aquatic microflora are known. The richness of biodiversity in the state is important for its people. It is the source of food, shelter, constructional material, medicine, etc.

Problems related to Biodiversity: Biodiversity is a natural phenomenon primarily based on geographical situation, geological formation, altitude, annual rainfall, etc. This natural phenomenon is influenced by anthropogenic factors i.e., the activity of man in different ways, which are detrimental to environmental conditions by way of deforestation, construction of roads, urbanisation, agricultural extensions, and so on. The biodiversity of the State is under threat, a number of species have disappeared and more species are about to be lost because of various factors such as: Shifting cultivation (*jhuming*), Un regulated grazing, Forest fires, large scale smuggling of forest produce across the border, Heavy infestation of some aquatic macro flora, introduction of high yielding varieties of plants and animals due to increase in demand causing lesser propagation of indigenous varieties, degradation of natural

forests, excessive removal of Non-Timber Forest Products (NTFPs) such as seed, leaves, medicines, bamboo, orchids, fibre, thatch etc. without compensating by re-planting or natural regeneration, poverty and Large population means high demand of life sustaining commodities. The people have hardly any alternative means to earn livelihood.

Major Actors: There are a number of agencies related to protection, conservation and utilisation of biological resources. Their actions, mostly directed towards improving the well-being of the human race in the state, directly and/or indirectly affect the biological diversity. A plethora of government departments are involved in activities that affect the biodiversity status. A number of NGOs have mushroomed in recent years. Many of them are involved in forestry, environment, agriculture and health related activities. The local people have formed village/panchyat level bodies for specific purposes. The Forest Department initiated formation of JFM Committees.There are also Fish Cooperative Societies for propagation and harvesting of fish.

Ongoing Initiatives: Biodiversity is relatively new subject for the people of the State. It is yet to penetrate the minds of people and planners. The resource planning is yet to be influenced by issues concerning it and not much has been done for its conservation. The Department of Animal Resources Development has taken up 10 schemes for increasing/maintaining livestock and bird population of the State. The plant Breeding Division of the Agriculture Departments Research Station is doing the work of collection, evaluation, documentation and maintenance of different local varieties existing in Tripura for future breeding purposes. It has collected 28 varieties of rice for gene bank. Efforts have recently been made for collection and maintenance of germplam of fruits, vegetables, and medicinal and aromatic plants at Nagicherra by the Directorate of Horticulture and Soil Conservation. For *in situ* conservation and development, a network of 4 sanctuaries had been established. For *ex situ* conservation efforts, a zoo at Sepahijala has been established. The zoo houses 455 animals (as on 31.5.2002) belonging to 55 different species. Captive breeding programme on leopard cat, binturong, spotted deer and primates along with awareness promotion efforts have been by and large successful. Documentation and identification of 266 species of medicinal plants (68 trees, 39 shrubs, 71 herbs and 88 climbers) have been completed so far. The programme of JFM has been adopted in the State to regenerate, protect and manage the degraded forest lands with the involvement of local communities with or without the help of NGOs. The thrust of the programme is management of the forests on benefits sharing basis through Microplanning.

Gap Analysis: There is big difference between biodiversity conservation and actual policies, schemes and activities in vogue.

Gaps in Information: In most of the biodiversity related fields, the basic information is not available. Full spectrum of existing species is not known. Their identification is under process. Only 1545 species of vascular plants are known. No listing of non-vascular plants, algae, bryophytes and fungi has been attempted. Only 19 species of edible mushrooms are recorded. Similarly very little information is available about species variation in aquatic flora and fauna. Knowledge of micro flora and fauna is abysmally low. No specific studies have been initiated for impact assessment of various plans, use of inorganic fertilizers, plant protection chemicals and HYV, introduction of exotic varieties of fish, cattle, poultry, agri-horticulture crops and forest species on biological resources. Traditional knowledge on conservation practices, use of medicinal plants, mixed cultivation of crops to maintain soil fertility have not been taken into consideration.

Gaps in vision: Development schemes are formulated aiming at immediate gains.

Most of the concerned agencies did not plan for considering the propagation of indigenous varieties. Afforestation policy with economically important species, especially with teak did not with biodiversity conservation.

Gaps in policies: The policy of rehabilitation of *jhumias* through rubber plantation may prove to be the nemesis of other floral and faunal species in such areas. The planners have not considered the role and value of biodiversity in preparing developmental plans. There is a serious gap between research and field needs. Departmental research stations and others rarely consult the farmers and local communities and their problems while pursuing research. Harvesting, storage and distribution/marketing of various products such as timber, NTFPs, foodgrains, horticultural products, etc, are not yet streamlined

Proposed Strategy and Action Plan: *In situ* and *Ex situ* conservation of biological resources are required. **Forest Ecosystem:** The policy of creating monoculture plantations replacing the natural vegetation has to be stopped. The degraded and deforested area should be brought under vegetation cover by large-scale afforestation programme. To meet the increasing demand of timber and fuel wood it is required to increase the forest productivity through: Technology inputs, Silvicultural practices for multiple use forestry, Cultural operations to promote natural regeneration, *In situ* soil conservation, use of quality seeds, clones, tissue culture, Development of management techniques for multilayered forests. Substitutes for construction material, fodder production on private lands and use of fuel saving devices are to be adopted. For protecting natural resources the patrol parties should be strengthen by providing vehicles, wireless sets, arms and ammunitions along with more powers to the officials.

To check smuggling of forest produce across the borders the matter should be taken up at Government of India level. More border outposts/check posts of Border Security Force with the provision to post forest officials also for looking into technical aspects of seizure etc of forest produce is required. Check posts over vulnerable locations of rivers should be established. Participatory management is going to be the dominant theme in Forest Management in coming years. Eco-development schemes for providing immediate benefits should be implemented. This should include development of water area; raising people's nurseries; distribution of fuel saving devices at subsidized rates; providing machines for value addition to forest produce (e.g. machine for making sal-leaf plates); raising of broom grass (for making brooms); mushroom cultivation etc. Apart from this, training programme should be taken up to bring about the change in the attitude of forest personnel. Forest fires cause damage to biodiversity; a fire-fighting scheme with sufficient infrastructure and budget provisions should be adopted. Specific management plans should be developed for PAs and other such areas including the Conservation Hot Spots. To conserve the gene pool the Protected area network need to be increased. 4 wildlife sanctuaries do not cover the entire spectrum of biodiversity in the State. It is, therefore, necessary to bring more representative areas under protected area net work. *Ex situ* conservation efforts should also be strengthened by improvement of existing Sepahijala zoo and by establishing arboretums, bambusetums, botanical gardens, gene banks and medicinal farms. These would also serve as a means of earning income without causing damage to the resources. **Bamboo:** Development and conservation of bamboo resource should be given highest priority. Community based development approach for the sector should be adopted through Joint Forest Management (JFM), to ensure sustainable return to these communities. To ensure *ex situ* conservation of the bamboo resource, gene banks of different cohorts of species should be developed. Immediate corrective steps should be taken to tackle ongoing bamboo flowering of Muli (Melocanna baccifera) and other species in different areas. These steps should include covering maximum area under plantation programme, preferably with superior species having wider uses. Bamboo industrial products should be promoted as an economic and successful new industrial sub-sector.

Jhum: To halt the practice of *jhuming* by weaning away the tribal people, they have to be provided with alternative means of livelihood. The activities under such projects should include raising of plantations of mixed species, animal husbandry, orchards and gardens, fishery, infrastructure development, establishment of small cottage and industrial units based on raw material supply from the local area, value addition programmes, etc. The regrouping of tribal villages is one of the efforts by the State Government in this direction.

Domesticated Animal Biodiversity: A grazing policy is must for the State. Cattle should not be allowed to move and graze freely in forests. Animal Husbandry department can be requested to take up, on massive scale, improvement of cattle stock of inferior breed.

Aquatic Biodiversity: The existing aquatic resources and aqua fauna and flora can be maintained for economic benefit without hampering the aquatic ecosystem.

Agriculture Ecosystem: The harmful effects of use of inorganic fertilizers and plant protection chemicals in agricultural fields must be studied and the results should be provided to the farmers. The help of NGO should also be taken in the Extension Programme. Traditionally, farmers of Tripura are using conventional method of pest control in their field. These traditional knowledge requires proper documentation and further dissemination. The Agriculture Department has to play an important role in this direction and traditional knowledge has to be documented immediately. The local variety cannot compete with the HYV in the market and hence farmers are shifting to HYV, hence marketing facility is to be improved.

A gene bank (pool) is required to be setup with the help of National Bureau of Plant Breeding and Genetic Resource (NBPGR) to collect and preserve the germ plasm of local varieties of Tripura. Apart from this Genetic garden should be set up for *ex situ* conservation of local plant varieties, since average land holding capacity is too less (0.97 ha). For *in situ* conservation of local plant varieties awareness campaign is required to be done in effective way. The Research Center of Agriculture Department is conducting the aforesaid trials mostly in the cultivators' field, it requires a shift towards indigenous variety in which Tripura can take lead role in Northeastern States.

Medicinal Plants: Traditional medicinal practices by *Kavirajs* , *Vaidyas* using local herbs and medicinal plants for treatment of various ailments with success such practices are needed to be documented immediately. The natural resources (gene-pool) of medicinal plants occurring naturally in the state should be conserved for future biotechnology. The Health and Family Welfare Department has to play active role in this direction.

Resource inventory: The different resources of the State need to be surveyed. A database should be created. The University would be associated for the purpose of data collection, documentation (including traditional practices that support biodiversity conser-

vation) and monitoring the state of biodiversity in Tripura. The monitoring and evaluation is the continuous process and this has to be carried out by the Department dealing with Biodiversity matter. An amount of Rs.25.0 lakh for 5 years will be required for this purpose. Community Biodiversity Registers need to be opened in each village to record biodiversity related information on a continuum basis. For resource mapping of the State making use of GIS, Remote Sensing and also taking help from North Eastern Land Use and Water Resources Organization, IIT, etc is required.

Miscellaneous: Rural Development Department can play a very important role by linking the biodiversity action plan with the Gramodaya programme. Conservation of biodiversity would be included in school and college curricula. This way the youth will be able to understand the value of biodiversity in their formative years. Awareness campaign is very important to inculcate in everyone respect for and intrinsic value of biodiversity. The Lawyers and Judges can be made aware of the importance of biodiversity conservation through workshops and seminars. There is a need for capacity building on biodiversity at the levels of Panchayati Raj Institutions through training at regular intervals.

IPR: The *Kali Khasa* rice variety is specific to Tripura. This variety has a distinctive aroma and taste. It is also location specific. Similarly, there is traditional technology for introducing infection in Agar tree for inducing deposit of Agar oil in the stem of Agar Plant. This know how is needed to be registered and patented. The Kabiraj of this State are having traditional knowledge of treating bone fracture, osteomylitis, Asthama, etc. with the use of herbs and plants; although these are kept as trade secret by them but it needs registration and trade mark (TM) under IPR so that holder of traditional knowledge receives compensation through IPR etc.

Watershed Approach: The agricultural lands are honey-combed with forest areas in the state. Therefore, to conserve the ground water and to increase the productivity of the agricultural lands which directly affect the prosperity of the people, the watershed approach to the biodiversity conservation is very crucial in Tripura.

Matching Financial Outlay: The Biodiversity conservation can only be achieved by providing at least the minimum required financial support for this noble cause. The concerned departments should provide necessary fund by keeping it in their Annual Plan.

Action Plan

Short Term: Resource inventory, Watershed approach of biodiversity Conservation, Environmental awareness campaign.

Medium Term: P.A and formation of sanctuary, Preparation of Management plan for Hot spots, Forest Protection, Participatory Resource Management (JFM), To discourage Monoculture, Studies on natural resources demand , Aforestation Programme in degraded area, Forest fires, Environmental awareness campaign and other activities, Aquatic Biodiversity, Agricultural research Marketing and quality control, Organic Manure Farm and awareness campaign, IPR, Marketing of indigenous varieties of crop, Concept of biodiversity to be included in curriculum of school/colleges, Population policy and traditional know of medicinal plants, Grazing policy and up- gradation of breed of cattle, Employment generation in rural areas, Development of economic development project for tribal, Development of Bamboo resources.

Long Term: Domesticated diversity conservation, Agri Horticultural conservation, Gene Bank(pool), Reducing pressure on existing forest resources, To increase forest productivity, Jhum control, Regrouping of tribal villages, Monitoring and Evaluation.

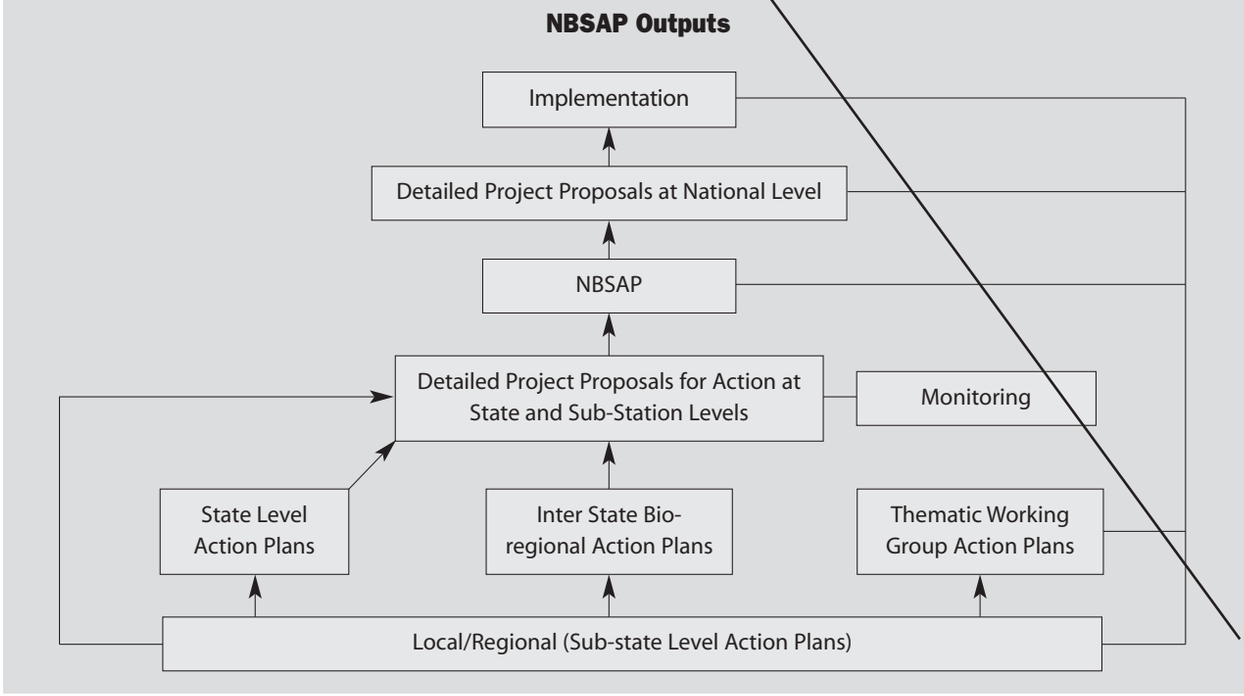
Executing Agency: Forest Department, Agriculture Department, Animal Resource Development Department, Horticulture and Soil Conservation Deptt., Science Technology and Environment Deptt., Health and F.W. Department, Education Department, Fishery Department, Industries and Commerce Department, Tribal Welfare Department, Department dealing with Biodiversity and Tripura University, ICAR, NGOs.

* This BSAP was not completed, but has been accepted subject to final revisions being incorporated.

Table 1.Ratification Status of Global Conventions in the Asia Region and Status of National Biodiversity Strategy and Action Plan

Nations	CBD R= ratified S= signed	Ramsar P= party	CMS R= ratified	CITES P= party	Status of NBSAP C= completed D= draft
Bangladesh	R	P	–	P	D
Bhutan	R	–	–	–	C
Brunei	–	–	–	P	–
Combodia	R	P	–	P	D
China	R	P	–	P	C
India	R	P	R	P	D
Indonesia	R	P	–	P	C
Japan	R	P	–	P	C
North Korea	R	–	–	–	C
South Korea	R	P	–	P	?
Laos	R	–	–	–	D
Malaysia	R	P	–	P	C
Maldives	R	–	–	–	D
Mongolia	R	P	R	P	C
Myanmar	R	–	–	P	?
Nepal	R	P	–	P	D
Pakistan	R	P	R	P	In prep.
Philippines	R	P	R	P	C
Russia	R	P	–	P	C
Singapore	R	–	–	P	D
Sri Lanka	R	P	R	P	C
Thailand	S	P	–	P	–
Vietnam	R	P	–	P	C

CBD = Convention on Biological Diversity; Ramsar = Convention on Wetlands of International Importance especially as Waterfowl Habitat; CMS = Bonn Convention on the Conservation of Migratory Species of Wild Animals; CITES = Convention on International Trade in Endangered Species of Wild Fauna and Flora; NBSAP = National Biodiversity Strategy and Action Plan; All Information as of November 2000, except status of NBSAP [May 2000]
Source: BirdLife Int., 2002, Threatened Birds of Asia.



Uttaranchal State Biodiversity Strategy and Action Plan

Coordinating Agency: Uttaranchal Forest Department, Dehradun

Although the State of Uttaranchal is well endowed with biological resources, the past decades have seen an increase in pressure on the state's natural ecosystems. The entire Siwalik ecosystem of Uttaranchal has been virtually degraded of its forest cover, and forested landscape has been pushed to the Upper reaches of the State. It is thus considered timely and necessary to develop a comprehensive plan for the State so as to ensure, that aspects relating to the conservation and sustainable use of biodiversity are better understood and managed. For this purpose the Ministry of Environment and Forests, Govt of India, has initiated the present exercise (1999) as part of environment/development planning process under project funding by GEF/UNDP. Kalpavriksh, an NGO has been asked to undertake the technical execution, and the Biotech Consortium is to coordinate the administrative execution. Further in the process a Technical and core group (TCGP) has been created.

In the meantime, the development of a State level Biodiversity Strategy and Action Plan was also initiated under the World Bank assisted Uttar Pradesh Forestry Project (2002), which was prepared through a consultative process involving multiple stakeholders.

Objectives

The issues and objectives relating to the conservation and sustainable use of biodiversity that were identified as being key to the development of such a strategy (and which have been addressed in the Strategy and Action Plan) include:
Identification of flora, fauna, agro-biodiversity and plants of ethno botanical importance and their conservation strategies

- Identification of major threats to biodiversity in Uttaranchal
  Identification of ecosystems and habitats important for conservation lying outside Protected Area Network and suggested ways to protect and manage them

  Assessment of adequacy of conservation and management measures, plans, socio-economic aspects, research and monitoring needs for Protected Areas and Non Protected Areas such as reserved, protected and unclassified forests, fresh water and other wetland systems, avifauna wintering areas, agricultural ecosystems and landscape systems, sites of anthropogenic importance

  Linking biodiversity with livelihood of local people

  People's participation in biodiversity conservation

  Role of Ecotask force in biodiversity conservation

  Status and effectiveness of ex situ conservation in the State including rehabilitation of endangered and threatened species and captive breeding programmes

  Biodiversity education, training, awareness, public outreach, skills development and involvement of voluntary sector.

  Review of laws, policies, institutions, regulatory structures and procedures including cross-sectoral coordination and cooperation in relation to biodiversity conservation and sustainable use, assessment of effectiveness of wildlife protection in controlling the trade in wildlife products including medicinal plants and law enforcement and coordination between agencies

Vision and Goals

- Conservation of the natural heritage of the State including the unique, biodiversity rich and fragile ecosystems of the State such as forests, grasslands, wetlands and mountain ecosystems and their species including wild and domesticated biodiversity, genetic resources and ecological and environmental processes.
- Primacy to be given to *in situ* conservation of the State's biological and cultural diversity located both within and outside the State's protected areas,

- The *ex situ* conservation of flora, fauna and flora and faunal genetic resources
- To develop strategies and actions for conservation of agriculture, livestock, fodder and Ethno botanical diversity
- Sustainable use of biodiversity and natural resources
- Development that is compatible with sustainable use of natural resources,
- Biodiversity as integral to human-existence and permeating developmental planning and implementation
- Culturally sensitive conservation and management that recognises and protects traditional knowledge and resource use
- Pursuit of a landscape and ecosystem approach
- Meeting of the State's forest based needs of timber, etc. from non-forest farms and degraded lands by encouraging afforestation, plantations, etc
- Focus on developing people oriented sustainable management
- Encouraging and providing incentives for private and public sector investments
- Creation of a just and equitable society based on sustainable resource use.

The Strategy

1. Identification of important ecosystems of conservation value

Ecosystems were identified from amongst the forested landscapes, grasslands, agrilands, and wetlands of Uttaranchal.

For the areas identified various conservation and management strategies are suggested such as creation of community and conservation reserves (based on the proposed amendment of the Wildlife (Protection) Act, 1972 as amended in 1991), wildlife ranges, mini-biodiversity cores and for very exceptional areas, Protected Area status (Nandhaur valley, Pindar valley, Ladhiya valley).

Areas identified from the forested and grassland regions include:

Biogeographic Zone 02. Himalayas

Biogeographic Province 02B West Himalaya

- Sandra, Kotigad and Singtur ranges of Tons forest division
- Yamnotri range of Upper Yamuna forest division
- Areas of Taknor range of Uttarkashi forest division
- Dudhatoli massif in Pauri forest division
- Upper Pindar catchments in East Almora forest division
- Kalamuni ridge in Pithoragarh forest division
- Athansi, Madkani and Golpha blocks of Pithoragarh forest division
- Sandev area in N. Pithoragarh forest division
- Ladhiya valley in S. Pithoragarh (Champawat) forest division
- Kilbury forest in Nainital forest division
- Dasoli VIII and Nandakini 1 blocks in Badrinath forest division

Biogeographic Zone 07. Gangetic Plains

Biogeographic Province 07A: Upper Gangetic Plains

a. Yamuna-Sharada sub montane region stretching from the Yamuna in the west to Sharada in the East

- Timli range of Kalsi forest division
- Asarori, Malhan and Barkot range of Dehradun forest division
- Laldhang, Kotdwar and Kothri ranges of Landsdowne forest division
- Ramnagar forest division
- Haldwani forest division
- Lower Kosi catchments in W. Almora forest division

Areas identified from the wetlands include

Biogeographic Zone 02. Himalayas
Biogeographic Province 02B West Himalayas

- Lower stretches of the Ganges and its tributaries in the hills
- Assan barrage, Dehradun

- Tumeria barrage, Udham Singh Nagar
- Nanaksagar, Udham Singh Nagar
- Haripura, Udham Singh Nagar

Sub State Plan
- Munsiari
- Nahikalan

2. Landscape Approach to Biodiversity Conservation

Adoption of a landscape approach using watershed approach in the hills and forest continuums in the foothills and plains as indicated below:

Landscapes	PA's	Forest Divisions	Districts	Major Forest Types (Champion and Seth, 1968)
Yamuna – Tons	Govind WLS	Tons, Chakrata Upper Yamuna Mussoorie (Part)	Uttarkashi, Dehra Dun.	9, 10, 12, 13, 14, 15, 16
Bhagirath – Bhilangana	Gangotri N.P.	Uttarkashi, Tehri, Narendra Nagar, Mussoorie (part)	Uttarkashi, Tehri	9, 10, 12, 13, 14, 15, 16
Mandakini-Alaknanda – Dhauliganga (West)	Kedarnath WLS, Valley of Flowers, Nandadevi NP	Kedarnath, Badrinath, Garhwal, Pauri,		9, 10, 12, 13, 14, 15, 16
Pindar	–	East Almora Badrinath	Bageswar Chamoli	9, 10, 12, 14, 15
Sarju- Ramganga (Snowed)	–	East Almora Pithoragarh Champawat (S. Pithoragarh)	Almora Pithoragarh Champawat	9, 10, 12, 14, 15
Goriganga- Dhauliganga Kali	–	Pithoragarh Champawat	Pithoragarh Champawat	9, 10, 12, 13, 14, 15, 16
Ramganga (Rainfed) Kosi- Ganla	–	Kedarnath West Almora Nainital	Nainital Almora Chamba	9,10,12

3. Biodiversity Conservation and Management in PAs and non-PAs

Protected Area Management (PA Management)

Strengthening management planning on par with Working Plan (WP) formulation
- Transfer management of sanctuaries in non-wildlife divisions to territorial/social forestry DFO's
- Create new wildlife divisions
- Complete final notification
- Rationalise PA boundaries
- Multi-stakeholder PA management

Biodiversity Conservation Outside the Protected Areas (PAs)
- Biodiversity concerns in WPs
- Working plan code amendment
- Enlarge scope of wildlife overlapping circles
- Declaration of community and conservation reserves
- Creation of wildlife ranges in territorial/social forestry divisions
- Creation of mini biodiversity cores in forest divisions
- Management of wildlife populations in the plains

- Policies and strategies for corridors and buffer areas

Wetland Strategy
- Inventory and prioritisation
- Wetland management at landscape level
- Conservation of migratory waterfowl
- Wetland research and training
- Waterfowl census
- Integrated water resource management
- Water hyacinth and weed control
- Development of institutional capacity
- Community involvement
- Development of a wetland management code
- Incorporation of EIA for wetland drainage
- Development of Ramsar sites
- Identification of two sites Asan barrage, The Bhimgoda reservoir on the Ganga adjacent to Chillla and also the only surviving wetland that exists in the Doon valley at Golatapar and Laltapar as single cluster for survey and conservation programme.
- River management

4. Management of the State's biodiversity

Habitat Improvement
- Weed Control
- Control of exotics
- Polyculture plantations
- Protection of springs in the Outer Himalayas
- Fire protection and water management

Anti-poaching Strategies
- Implement Subramaniam committee recommendations (GOI, 1994)

Trans Border Issues
- Inter-State and Inter-country
- Poaching and illegal trade

5. Land Use Practices and Their Management

Forestry Considerations
- Adopt silvicultural prescriptions for Reserve Forests
- Enhance management of civil-soyam areas including their transfer to JFM/Van Panchayats
- Enhance forest plantations in combination with judicious forest management aimed at regenerating degraded areas and prevention of soil erosion
- Agro forestry: Encourage the plantation of fodder and other multipurpose trees on agricultural lands to meet people's forest based needs
- Revive the silviculture division at Haldwani to promote farm forestry in the foothills and terai
- Non-wood forest products including medicinal plants
- Alternative energy technologies and interventions
- Agricultural practices

Revive and Strengthen Agri-diversity
- Provide good market system to the marginal farmers specially women practicing traditional method of farming and producing diversity in agriculture (like practicing Baranaja and keeping different varieties of rice and pulses)
- Link agridiversity to the Public Distribution System, replacing wheat and rice with local millets, maize, amaranthus, and other foods that are grown locally, thereby providing farmers the incentive to continue growing them, and consumers with more nutritious food
- Promote locally grown and indigenous food grains in balavadis, Food for Work, and other such public schemes

- Declare the state agri product as 'Organic' to catch the national and international market
- Promote also the domestic market through organised consumer groups in cities, which can be facilitated to link directly with organic farmers.
- Declare the state agri product as 'Organic' to catch the international market.
- Nutritional status of the agri product of the state is very high (like : Mandua, rich in calcium; Ramdana -rich in protein and many more). Involve media to popularize them.
- Initiate and promote the system of integrated pest management
- Revive the traditional methods of farming
- Integrated pest management
- Encourage tourism based on agri biodiversity
- Universities and institutions should include traditional methods of farming, ethno botany and biodiversity in their curriculum
- Safeguard the farmer's right to their indigenous seeds, livestock and agriculture knowledge.
- Encourage the *Beej Bachao andolan* in the State
- Empower women in Agriculture by securing land rights for women and by providing incentives to women for maintaining agro- biodiversity
- Develop policies to preserve traditional agricultural system
- Work on land consolidation in hills
- Expand the scope of botanical gardens to allow valuable and unique agricultural diversity to be grown
- Expand the scope of zoological gardens in each region to allow indigenous livestock and poultry to be displayed
- Encourage the replacement of chemical fertilizers with organic ones through integrated Nutrient Management
- Phase out of chemical fertilizers and pesticides in catchment areas

Grazing, Fodder Management and Animal Husbandry – Strategies Suggested are

- Stall feeding
- Encourage fodder development schemes through agro forestry, replacing weed infested area with fodder generating,
- Provide training to field level forestry staff on pasture and fodder development programme
- Set up a silvi pasture unit
- Channelise efforts to propagate good animal husbandry practices
- Provide health care and good management schemes for local varieties
- Carry out livestock breeding programme emphasis should be given to improve the native varieties through selection breeding rather than introducing new breeds.
- Weed out feral cattle causing damage to regeneration and competing with wild herbivores for feed
- Mitigate man animal conflict
- Boost productivity of varied types of perennial feeding grounds suitable for different agro climatic conditions
- Promote various models, systems and technology for intense fodder production with indigenous species
- Link up with other departments involved in such programme
- Provide immediate ground cover by growing grasses, legumes, fodder and fuel trees
- Regulate cutting of grasses
- Provide training to officers and foresters on aspects of fodder development
- Channel funding for specific livestock breeding programme
- Relocate feral cattle population. Cattle pens should be opened outside the forested areas where feral cattle may be stall fed
- Involve international NGOs/Corporate sectors to check the diseases in livestock

Trans Humane Grazing in Himalayas: Sub alpine and alpine grasslands called *bugyals* cover extensive areas in Himalaya. It is generally believed that agro pastoralists in this region keep excess cattle because of easy access to free grazing areas and inability to cull the populations due to religious practices. This has led to uncontrolled grazing in these areas.

Actions thus suggested to regulate or control grazing in the high altitude grassland are:

i. Determine the optimum level of grazing
ii. Restriction on grazing in crucial wildlife areas while providing alternative fodder sources to graziers.

Water Resources

- Soil and water conservation
- Surface and ground water conservation and management
- Catchments area treatment

Impact of Development Projects

- Environmental Impact Assessments (EIA) essential
- Mitigation and amelioration measures
- Forest department involvement
- Environmental management plans and EIA to be reviewed by independent evaluation committee
- Water development projects, fish ways and fish migration
- Assessment of pre and post project environmental impacts

Integrated Land Use Planning and Policy

- Finalise Land Use Policy
- Facilitate degraded land development/regeneration-terai landscapes
- Enforcement through incentives and legislative means

Integration of Rural Development and Biodiversity

- Integration of biodiversity issues in the DRDA governing body meetings
- Chief Development Officers of forest districts and other important ecosystems from Forest Department (FD)
- Route all planned development within 10 km of the forest boundary through the DFO

6. Research and Monitoring

- Identify research priorities and gaps in information
- Conduct gap filling exercises
- Strengthen funding
- Initiate a Biodiversity Information Facility
- Carry out participatory Research
- Strengthen wildlife and biodiversity research in FD
- Strengthening monitoring mechanisms in PAs and forest divisions
- Establish and rejuvenate system of Preservation Plots
- Develop research areas in ethno botanical biodiversity

7. Training

- Institutionalise induction and in-service training for frontline staff
- Restrict wildlife postings to those trained in this field
- Development of State level institute for Wildlife Research and Training for Uttaranchal
- Training in organic farming and vermiculture compost to School children
- Technology and Training Development Centres by Forest and Rural Development Branch, Uttaranchal
- Training to prepare the crafts and other items from ethno botanical source to School and college Students

8. People in Biodiversity Conservation

- Joint Forest Management.
- Tribal community and biodiversity conservation
- Ecodevelopment
- People-Animal Conflicts
- Incentives for community based conservation-regulated access to NWFP in buffer zones, entry fees to PAs, revenues from tourism operators
- Religious tourism
- Eco tourism
- Joint Management and employment avenues such as fire, poaching management
- Forest Area Development Agency
- Local community needs-identification and stakeholder analysis
- Traditional resource use-role of sacred groves, Van and Lath panchayat's and other community based initiatives
- Role of eco task force

9. Awareness and Conservation Education

- Education and awareness policy with key focus on biodiversity
- Biodiversity education and awareness board
- Enhance training and awareness levels of teachers and educators

- Biodiversity cell in NCERT, SCERT
- Target group specific curricula training
- Biodiversity education in higher education-law, MBA, etc.
- Training for multiple stakeholders-government departments, army, police, etc.
- Use of nature as a learning laboratory-camps, walks, interpretation centres
- Enhanced interpretation and role of FD
- Rejuvenation of Van Chetna Kendra's
- Use of mass media and outreach media and partnership with the voluntary sector
- Enhanced financial flows for conservation education
- Innovative methods-junior wildlife wardens, NCC, students and teachers for biodiversity monitoring

10. *Ex Situ* Conservation

- Species selection, prioritisation and development of captive reserves for the State's endangered biodiversity
- Research in captive breeding, behaviour, natural history
- Rehabilitation, reintroduction and planned conservation breeding
- Development of *ex situ* site master plans
- Zoo management, design and infrastructure and creation of a zoo cadre
- Medical screening procedures
- In-house research and training
- Motivation, training and involvement in ex-situ
- Enhanced motivation, training and involvement in *ex situ* conservation
- *Ex situ* sites as centres for conservation education
- *Ex situ* conservation of plants and plant genetic resources
- Modern tools and techniques for *ex situ* conservation

11. Conservation of Wild and Endangered Fauna and Flora

- Enlist threatened species for the State
- Organise State level CAMP workshops
- Develop and Implement Conservation plans for wild endangered species
- Carry out Scientific surveys to determine population status and threats
- Focus on natural habitat management
- Develop single species management plans with local communities and relevant agencies

12. Legal Issues

- Amend the Wildlife (Protection) Rules of Uttaranchal to include guidelines/principles/criteria for designation and administration of protected areas as well as to bring them in line with the 1991 amendment
- Develop the criteria for diversion of forestland to other purposes beyond what is provided under the Forest Conservation Rules of 1981
- Develop the definition of forests in the Indian Forest Act
- Bring forest villages as distinguished from 'village forests' under a legal definition
- Upgrade the provisions relating to the medicinal plants under the Wildlife Protection Act
- Address the numerous conflicting legal issues in the JFM regime
- Explore the possibility of providing protection to biodiversity under the Environment Protection Act
- Provide legal recognition to "critical habitats" that exist outside the PA network such as wetlands
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- Sensitise Judicial Officers on ecological significance of biodiversity conservation
- Provide legal training to frontline staff
- Develop special courts for forests and biodiversity
- Minimise procedural delays in court cases
- Equip central and state forensic sciences laboratories as well as WII with the skills of identification of wildlife and its products.
- Special focus needs to be given to un-represented/minimally represented cases

13. Human Resource Development and Administration

- Provision of incentives (special allowances, etc.)
- Improvement of promotional avenues
- Resolve bans on recruitment-filling of vacant positions while court case is ongoing

- Appointment of forestry personnel along the lines of the Police Departments
- Implementation of HRD study recommendations conducted under Uttaranchal forestry project

14. Financial Support for Biodiversity Conservation

- Increase fund allocation for biodiversity conservation
- Utilisation of all Centrally Sponsored Schemes
- Managers to tap donors and corporate sector
- Government clearance for unconditional funding
- Rewards for successful initiatives to tap funds
- Develop Joint Forest Management and Protected Area Development Agencies along lines of DRDA
- Plough back entry fees for PA management
- Improve efficiency in fund transfer
- Develop working link between FD and MOEF and between FD and Finance department for fast fund flow through the State bureaucracy

15. Information Technology

- Enhance IT capacity, use of GIS
- Preparation of detailed maps for forests, wetlands, PAs, vegetation types, etc.
- Facilitate the flow of information, mainstream use of IT and increase the availability to users of key reference data through an FMIS
- Decision support system (DSS) by generating thematic maps etc. using Remote Sensing, GIS and GPS techniques.
- Copy all Government Orders (GO's) on to a CD-ROM with easily retrieval facility.
- Redesign ate the post of CF (Hq) as CF (IT), who shall be the nodal officer responsible for the IT drive in the department

16. Cross Sectoral, Biodiversity Based Development Planning

- Integrate biodiversity considerations in cross-sectoral development plans
- Create a State biodiversity board
- Create a State biodiversity fund
- Creation of biodiversity cells in all departments connected with the management of air, water, land, forests, soil or biodiversity

17. Implementation of the Strategy

- Institutional structure for plan implementation is required
- Funding for plan implementation
- Create awareness through electronic media, newspaper and magazines
- Coordinating through mass media
- Posters and paintings
- Holding goshties and natak
- Utilising the services of Village Development Officer
- Hoardings with a utility
- Public hearings
- Biodiversity festivals and fairs
- Activity schedule for creating public awareness

Methodology

A multi-pronged approach was adopted for the preparation of the document.

Steering Committee

Consequent to the meeting of the National Project Director on 26-8-2000, a *State Level Steering Committee was notified vide State Govt order no. 3462/I. Va. Gra.wi/2001-8(9)/2001, dated 20.7.2001*. The Steering Committee met on 20.10.2001 in which it was decided to adopt the Tata Energy Research Institute report on "*Strategies and Action Plan for Biodiversity conservation in Uttaranchal*" under World Bank Project for State Forest Dept, as base document.

It was further decided to constitute a working group comprising the following:

1. Dr Arun Kumar, Additional Director, Zoological Survey of India _____ **Chairman**
2. Shri Samir Sinha, IFS, Director, Rajaji National Park _____ **Member Secretary**
3. Dr GS Rawat, Head, Ecology and Habitat Division, Wildlife Institute of India_____ **Member**

4. Shri Dhananjay Mohan, IFS, Associate Professor, IGNFA_____ **Member**
5. Dr SK Srivastava, Scientist C, Botanical Survey of India_____ **Member**
6. Shri AK Banerjee, IFS, DFO, Nanda Devi National_____ **Member**
7. Shri Ajay Mahajan, Vividhara and Kalpavriksh, Nahi Kala C/o Bhogpur Post, Dehra Dun_____ **Member**
8. Dr. Dhanwanti Bisht, Reader in Economics, Govt PG College, Uttarkashi_____ **Member**
9. Dr Archana Bahuguna, lecturer, Uttaranchal college of Law and Science, Jakhan, DehraDun_____ **Nodal Scientist**

The mandate of the working group was to prepare an integrated report based on the TERI document under World Bank Forestry Project.

During this process, TERI along with the Forest Departments of U.P. and Uttaranchal conducted six workshops on different themes. Intensive data was collected through various field visits and meeting with forest staff and local people. This document is thus forest based since it was prepared for forest department. Keeping this in view separate process was adopted for SBSAP- Uttaranchal. The working group decided that the gaps in the TERI report would be attempted to be filled up in the present document.

The working group held a series of formal and informal consultations from October 2001 to March 2002 at Zoological Survey of India, Dehra Dun. Other than Dr Dhanwanti Bisht and Shri Ajaya Maharjan, all other members actively participated in the process and contributed their inputs. Dr Archana Bahuguna, Nodal Scientist was assigned the responsibility of consolidating the report with Dr Arun Kumar.

Main emphasis has been given on domesticated biodiversity, agriculture and ethno botanical diversity. The strategies for two UA State sub sites, namely Nahi Kala and Munsiyari are added as annexure.

Uttaranchal has a typical background of the people's participation in conservation. *Chipko movement, Kumaon Grievances Committee, Van Panchayat,* and *Women participation* are the landmarks. They are duly highlighted in the present document. The document covers detailed inventory of flora and fauna, crops, and ethno botanical species with native varieties.

The first draft report was submitted to Shri Ashish Kothari in March 2002. He and Ms. Madhu Sarin of NBSAP duly reviewed the document. Detailed observations were made by both of them. Following this informal meeting of the working group was held at ZSI, Dehra Dun in first week of September. The meeting of the steering committee SBSAP Uttaranchal was convened at IGNFA Dehra Dun on 23.9.2002, with the following members:

1. Principal Secretary and Commissioner, Forests and Rural Development, Govt. of Uttaranchal.
2. Principal Chief Conservator of Forests, Uttaranchal.
3. Addl.Secretary, Forests and Environment, Govt. of Uttranchal.
4. Sh. Bhupal Singh, C/o Vividhara, Village-Nahinkalan, P.O-Sangaon, Via-Bhogpur, Dist- Dehradun.
5. Mr. Emmanuel Theophilus, Foundation of Ecological Security, Munsiary, Pithoragarh
6. Conservator of Forests, Working Plan, Nainital.
7. Director, Corbett Tiger Resrve, Ramnagar.
8. Director, Nanda Devi Biosphere Reserve, Gopeshwar.
9. Director, Rajaji National Park, Dehra Dun.
10. DFO, Nanda Devi National Park, Joshimath
11. Chief Wildlife Warden, Uttranchal.
12. Dr.R.K.Maikhuri, GB Pant Institute of Himalayan Environment and Development, Garhwal Unit. P.O. Box No 92, Sirnagar(Garhwal)- 246174.
13. Dr. Arun Kumar, Addl. Director, ZSI, Dehra Dun.

14. Dr.S.K. Srivastava, Scientist-C, BSI, 192, Kaulagarh Road, Dehra Dun.

15. Shri P.K. Ghosh, President, The Friends of Doon Society, C/o EBD Buisness Centre, 49, Rajpur Road, Dehra Dun.

16. Dr. Hari Har Ram, Professor and Head, Dept. of Vegetable Sicence, G.B.Pant University of Agriculture and Technology, Pantnager-263145.

17. Mr. Dinesh Chandra Tiwari, Coordinator (Research and Advocacy), HARC, 744, Indria Nagar, Phase-II, P.O-New Forest, Dehra Dun.

18. Dr. N.S. Bisht, Head, Resource Survey and Management, Forest Research Institute, PO New Forest, Dehra Dun- 248 006.

19. Dr. G.S. Rawat, Wildlife Institute of India, P.O.Box.NO18, Chandrabani, Dehra Dun.

20. Nominee of CHIRAG, Nainital

21. Shri Vijay Jardhari, Beej Bachao Andolan, Village-Jardhari, P.O. Nagani, District Tehri Garhwal. A prominent social worker associated with "Beej Bachao Andolan".

22. Dr. Vinod Bhatt "Navdanya" Dehra Dun. – A prominent social worker associated with NAVDANYA

23. Dr. Ravi Chelam, Scientist, Wildlife Institute of India, P.O.-Chandrabani, Dehra Dun. – Also in Technical and Policy Core Group of NBSAP

24. Dr. Archana Bahuguna, Media Himalaya, 4 Sirmor Estate, Rajendra Nagar, Dehra Dun - Already working in the working group of NBSAP

Dr. Arun Kumar Chairman Working Group made a detailed presentation before the steering committee. Therein the comments of different members of committee on the first draft were discussed in detail. In the present document, the comments of Ms. Madhu Sarin, Mr. Ashish Kothari and members of the Steering Committee have duly been incorporated as far as possible in the present document.

Resource Material

The present report has heavily depended on a Report by Sethi, P., Bhujanga Rao, DD, Mohan, D., Mohapatra, KK, Upadhyay, S, Hanfee, F. and MA Khalid (2002) "Strategies and action plan for Biodiversity Conservation in Uttaranchal". Report Submitted by Tata Energy Research Institute (TERI) to the Uttaranchal Forest Department.

In addition the following Individuals and Institutions contributed in preparing the present document.

1. Padamshree Shri Sunder Lal Bahuguna, Navjeevan, Tehri Garhwal

2. Shri AS Negi, CWLW, Uttaranchal, Dehra Dun

3. Dr Vinod Bhatt and Hari Raj Singh, Navdanya, Dehra Dun

4. Dr SK Srivastava, Botanical Survey of India, Dehra Dun

5. Dr GS Rawat, WII, Dehra Dun

6. Shri Vijay Jardhari, Beej Bachao Andolan, Hemal Ghati, Tehri

7. Shri Ajai Maharjan, Nahi Kala, Bhogpur, Dehra Dun (pl. correct)

8. Shri Emmanuel Theophilus, Foundation For Ecological Security, PO Munsiyari, Pithoragarh

9. Ms Madhu Sarin, Member TPCG, NBSAP, Chandigarh

10. Shri Dhananjaya Mohan, IGNFA, Dehra Dun

11. Shri Abrar Ahmad, WWF-TRAFFIC India, New Delhi

12. Dr Diwakar Sharma, Wildlife Trust of India, New Delhi
13. Dr Archana Bahuguna, Director, Media Himalaya, Dehra Dun
14. Shri Rajeev Bhartari, WII, Dehra Dun
15. Shri Sameer Sinha, CTR, Ramnagar
16. Shri AK Banerjee, DFO, NDNP, Joshimath
17. Dr Satya Kumar, WII, Dehra Dun
18. Shri Rajeev Nayan Bahuguna, Secretary, Media Himalaya, Dehra Dun
19. Ms. Jyotsana Sitling, Director Nanda Devi Biosphere Reserve
20. Shri B.D. Kandpal, CWLW, Uttaranchal
21. Dr B.C. Tyagi, National Research Centre on Coldwater Fisheries, Bhimtal
22. Dr Arun Kumar and Vinod Khanna, Zoological Survey of India, Dehra Dun
23. Shri DP Uniyal, Zoological Survey of India, Dehra Dun
24. Dr VP Uniyal, WII, Dehra Dun
25. Ecotask Force, Dehra Dun
26. Kunwar Prasoon, Environmentalist and with Beej Bachao Andolan, Garhwal
27. Dr. MA Khalid, TERI, Lucknow
28. Shri Sanjaya Agarwal, Maple Organics, Dehra Dun
29. Shri Arun Kumar Nautiyal, JRF, Zoological Survey of India, Dehra Dun provided the technical assistance.

Uttar Pradesh State Biodiversity Strategy and Action Plan

Coordinating Agency: G.B. Pant Institute of Himalayan Environment and Development, Almora

Although the state of Uttar Pradesh is well endowed with biological resources, the past decades have seen the erosion of the state's natural ecosystems, particularly in the plains. It was therefore, considered timely and necessary to develop a comprehensive plan for the State that would ensure that aspects relating to the conservation and sustainable use of biodiversity are better understood and managed. For this purpose, the development of a State level Biodiversity Strategy and Action Plan was initiated under the World Bank assisted Uttar Pradesh Forestry Project. This Strategy and Action Plan has been prepared through a consultative process involving multiple stakeholders.

Objectives

The issues and objectives relating to the conservation and sustainable use of biodiversity that were identified as being key to the development of such a strategy, and which have been addressed in the Strategy and Action Plan include:

- Identification of ecosystems and habitats important for conservation lying outside Protected Area Network and suggested ways to protect and manage them.
- Assessment of adequacy of conservation and management measures, plans, socio-economic aspects and research and monitoring needs for Protected Areas and Non Protected Areas such as reserved, protected and unclassified forests, fresh water and other wetland systems, avifauna wintering areas, agricultural ecosystems and landscape systems, sites of anthropogenic importance.
- Status and effectiveness of *ex situ* conservation in the state including rehabilitation of endangered and threatened species and captive breeding programmes.
- Biodiversity education, training, awareness, public outreach, skills development and involvement of voluntary sector
- Review of laws, policies, institutions, regulatory structures and procedures including cross-sectoral coordination and cooperation in relation to biodiversity conservation and sustainable use, assessment of effectiveness of wildlife protection in controlling the trade in wildlife products including medicinal plants and law enforcement and coordination between agencies.

Vision and Goals

- Conservation of the natural heritage of the State including the unique, biodiversity rich and fragile ecosystems of the State such as forests, grasslands, wetlands and mountain ecosystems and their species including wild and domesticated biodiversity, genetic resources and ecological and environmental processes.
- Primacy to be given to *in situ* conservation of the State's biological and cultural diversity located both within and outside the State's protected areas,
- The *ex situ* conservation of flora, fauna and flora and faunal genetic resources
- Sustainable use of biodiversity and natural resources
- Development that is compatible with sustainable use of natural resources,
- Biodiversity as integral to human-existence and permeating developmental planning and implementation
- Culturally sensitive conservation and management that recognizes and protects traditional knowledge and resource use
- Pursuit of a landscape and ecosystem approach
- Meeting of the State's forest based needs of timber, etc. from non-forest farms and degraded lands by encouraging afforestation, plantations, etc.
- Focus on developing people oriented sustainable management
- Encouraging and providing incentives for private and public sector investments.
- Creation of a just and equitable society based on sustainable resource use.

The Strategy

1. Identification of Important Ecosystems of Conservation Value

Ecosystems were identified from amongst the forested landscapes, grasslands and wetlands of UP. For the areas identified various

conservation and management strategies are suggested such as creation of community and conservation reserves (based on the proposed amendment of the Wildlife (Protection) Act, 1972 as amended in 1991), wildlife ranges, mini-biodiversity cores and for very exceptional areas, Protected Area status (Laggabagga corridor, Metha reservoir and perhaps the Shivalik division).

Areas identified from the forested and grassland regions include

- Biogeographic Zone 07, Gangetic Plains
- Biogeographic province 07A: Upper Gangetic Plains

a. Yamuna-Sharada sub montane region stretching from the Yamuna in the west to Sharada in the East
   - Shiwalik forest division

b. Terai region east of the Sharda river
   - N. Pilibhit forest division
   - Laggabagga RF area
   - Palia, N. Nighasan, S. Nighasan and Dhaurara ranges of N. Kheri forest division
   - Bhira, Mailani ranges of S. Kheri forest division
   - Khuntar range of Shahjahanpur forest division
   - Motipur and Kadraha ranges of Katerniaghat wildlife division

Biogeographic Zone 06. Deccan Peninsula
Biogeographic Province 6E: Central Highlands
Lalitpur, Gona and Madaura ranges of Lalitpur social forestry division

Biogegraphic Province 6D: Chota Nagpur Plateau
Dudhi, Pipri and parts of Babni range of Renukoot forest division, Sonbhadra

Areas identified from the wetlands include

- Biogeographic Zone 07. Gangetic Plains
- Manjhira impoundment at Girija barrage
- Pyagpur (Bagheltaal) and Sitadwar jheels
- Jheels in the vicinity of Haidergarh
- Dahar and Sauj Jheels
- Wetlands of E. Uttar Pradesh
- Pasgaonva pond, S. Pilibhit, Deoria range, Bilsanda block
- Fatehpur wetlands
- Metha reservoir, Kanpur dehat
- Bhagvanpur dam, Balrampur
- Bifurcation and Shardasagar dam, Pilibhit division
- Up and downstream of the Ganga between Chunar and Chuchakpur, Varanasi
- Sikandra, Kanpur dehat
- Sarsai Nawar Jheel, Etawah
- Thane-ka-tall, Etah
- Kudaiyya wetland near Karhal town, Mainpuri
- Ambarpur marshlands on Karhal-Kishni road, Mainpuri
- Saman Katra area
- Shaikha jheel, Aligarh
- Pili reservoir, Bijnor
- Narora reservoir, Bulandshaahr, Badaun
- Amakhera tank
- Ashpan, Aligarh
- Daupur jheel, Aligarh
- Bijnor barrage, Bahraich
- Dak Pathar, Hardoi
- Harevli dam
- Seohara estate ponds and wetlands
- Wetlands of Basti

Biogeographic Zone 06. Deccan Peninsula

- Mahoba wetlands

2. Landscape Approach to Biodiversity Conservation

Adoption of a landscape approach using watershed approach in the hills and forest continuums in the foothills and plains as indicated below:

Landscapes	PAs	Forest Divisions	Districts	Major Forest Types (Champion and Seth, 1968)
Pilibhit-Dudhwa-Kishanpur-Katarniaghat	Dudhwa NP, Kishanpur WLS, Katarniaghar WLS	Pilibhit, North Kheri, South Kheri, Shahjahanpur	Pilibhit, Lakhimpur Kheri, Bahraich, Shahjahanpur	3,4,5
Bahraich-Shrawasti-Sohelwa, Gorakhpur-Sohagilbarwa	Sohelwa WLS, Sohagibarwa WLS	Bahraich, Shrawasti, Balrampur, Gonda, Siddharthnagar, Gorakhpur, Derala	Bahraich, Shrawasti, Balrampur, Gonda, Siddharthnagar, Gorakhpur, Derala	3,4,5
Kaimur-Chandraprabha-Obra-Sonbhadra-Renukoot	Kaimur WLS, Chandraprabha WLS	Mirzapur, Obra, Sonbhadra, Renukoot	Varanasi, Mirzapur, Sonbhadra	5,6

3. Biodiversity Conservation and Management in Protected Areas and Non-Protected Areas of the State

Protected Area Management (PA Management)

Strengthening management planning on par with Working Plan (WP formulation

- Transfer management of sanctuaries in non-wildlife divisions to territorial/social forestry DFOs
- Create new wildlife divisions
- Complete final notification
- Rationalise PA boundaries
- Multi-stakeholder PA management

Biodiversity Conservation Outside the Protected Areas (PAs)

- Biodiversity concerns in WPs
- Working plan code amendment
- Enlarge scope of wildlife overlapping circles
- Declaration of community and conservation reserves
- Creation of wildlife ranges in territorial/social forestry divisions to be managed by the local territorial/social forestry DFOs
- Creation of mini biodiversity cores in forest divisions
- Management of wildlife populations in the plains
- Policies and strategies for corridors and buffer areas

Wetland Strategy

- Inventory and prioritization
- Wetland management at landscape level
- Conservation of migratory waterfowl
- Wetland research and training
- Waterfowl census
- Integrated water resource management
- Water hyacinth and weed control
- Development of institutional capacity
- Community involvement

- Sarus crane monitoring
- Development of a wetland management code
- Incorporation of EIA for wetland drainage
- Development of Ramsar sites
- River management

4. Measures to Enhance Management of the State's Biodiversity

Habitat Improvement
- Weed Control
- Control of exotics
- Polyculture plantations
- Fire protection and water management

Anti-poaching Strategies
- Implement Subramaniam committee recommendations (GOI, 1994)

Transborder issues
- Inter-State and Inter-country
- Poaching and illegal trade
- Transborder protected areas
- Management of corridors
- Dependence on forest resources

5. Land Use Practices and Their Management

Forestry Considerations
- Plantation forestry
- Agro-forestry and farm forestry
- Non-wood forest products including medicinal plants
- Alternative energy technologies and intervention

Grazing and Fodder Management
- Stall feeding and fodder development schemes
- Silvi-pasture, good animal husbandry, livestock breeding

Agricultural Practices
- Integrated pest management
- Impact of pesticides, fertilizers and regulation in catchment areas

Water Resources
- Soil and water conservation
- Surface and ground water conservation and management
- Catchment area treatment

Impact of Development Projects
- Environmental Impact Assessments (EIAs) essential
- Mitigation and amelioration measures
- Forest department involvement
- Environmental management plans and EIAs to be reviewed by independent evaluation committee
- Water development projects, fishways and fish migration
- Assessment of pre and post project environment impacts

Integrated Land Use Planning and Policy
- Finalize Land Use Policy
- Facilitate degraded land development/regeneration-terai landscapes

- Enforcement through incentives and legislative means

Integration of Rural Development and Biodiversity
- Integration of biodiversity issues in the DRDA governing body meetings
- Chief Development Officers of forest districts and other important ecosystems from Forest Department (FD)
- Route all planned development within 10 km of the forest boundary through the DFO

6. Research and Monitoring
- Identify research priorities and gaps in information
- Conduct gap filling exercises
- Strengthen funding
- Biodiversity information facility
- Participatory research
- Wildlife and biodiversity research in FD
- Strengthening monitoring mechanisms in PAs and forest divisions
- Establish and rejuvenate system of Preservation Plots

7. Training
- Institutionalise induction and in-service training for frontline staff
- Restrict wildlife postings to those trained in this field

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- Ecotourism
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- Target group specific curricula training
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- Training for multiple stakeholders-government departments, army, police, etc.
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- *Ex situ* conservation of plants and plant genetic resources
- Modern tools and techniques for *ex situ* conservation

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- Measures for threatened species
- Enlist threatened species for the State
- Organize State level Conservation Assessment and Management Plan (CAMP) workshops
- Scientific surveys
- Focus on natural habitat management
- Single species management plans with local communities and relevant agencies
- Listing of prioritized species

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- Develop the criteria for diversion of forestland to other purposes beyond what is provided under the Forest Conservation Rules of 1981.
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- Special focus needs to be given to un-represented/minimally represented cases.

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Provision of incentives (special allowances, etc.)

- Improvement of promotional avenues
- Resolve bans on recruitment-filling of vacant positions while court case is ongoing
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- Develop working link between FD and MoEF and between FD and Finance department for fast fund flow through the state bureaucracy

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- Enhance IT capacity, use of GIS
- Preparation of detailed maps for forests, wetlands, PAs, vegetation types, etc.
- Facilitate the flow of information, mainstream use of IT and increase the availability to users of key reference data through an FMIS

- Decision support system (DSS) by generating thematic maps etc., using Remote Sensing, GIS and GPS techniques
- Copy all Government Orders (GOs) on to a CD-ROM with easily retrieval facility
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- Integrate biodiversity considerations in cross sectoral development plans
- Create a State biodiversity board
- Create a State biodiversity fund
- Creation of biodiversity cells in all departments connected with the management of air, water, land, forests, soil or biodiversity

West Bengal State Biodiversity Strategy and Action Plan

Coordinating Agency: Ramakrishna Mission, Lokasikshka Parishad, Narendrapur

Introduction

One must candidly admit that it is a daunting task to summarise the complexity and the expanse of the lesson learnt from the exercise called the Biodiversity Strategy and Action Plan process. Even more difficult is the task of appropriately communicating with the decision-makers and stakeholders.

This is because of three reasons - one must first have a holistic perception of biodiversity, for which one has to grasp its inter-disciplinary nature. This requires a broad timeframe, which is a must for understanding the whole and not just parts of the different inter-related subjects. Lastly, any conservation effort will require effective communication between experts and conservation workers and even the common peoples.

What is biodiversity? Biodiversity means the variability among living organisms from all sources, and the ecological systems of which they are a part; this includes diversity within species, between species and of ecosystems. Biodiversity is our wealth, and a vital means of sustenance. Therefore, it is absolutely imperative to understand that this diversity must be conserved - it is essential characteristic of all life forms, and a critically important attribute of nature.

Information is the cornerstone of conservation effort, which may encounter many hurdles, mainly anthropogenic. To begin with, we need to know the threats faced by biodiversity and prioritise them. There will be gaps in our knowledge that we need to scrutinize and update. Changes in perspective are likely to be effected as a result. Regular stock-taking is important to track the changing biodiversity. Finally, there should be a proper set of strategies and related action plans in place. The summary, after recapitulating the facts that we already knew, broadly follows this threat-gap-desirable action approach.

The Executive Summary is based on the findings of the number of working groups formed to take stock of the ground reality in forest and non-forest areas, coastal zone, wetlands, agriculture, medicinal plants, fisheries, culture and biodiversity links, etc. It attempts to take stock of some of the essential features of our knowledge of biodiversity, dwell on the major threats, and identify the major gaps that have emerged from the separate exercises.

However, directions suggested or inferences made are not necessarily found in the body of the main text. They have in some cases brought out as a synergy of observations that are separately stated under different chapters.

Things We Alreay Know

Situated within 21°38′ - 27°19′ (North) latitudes and 85°50′ - 89°50′ (East) longitude, the state stretches from the Himalayas in the North to the Bay of Bengal in the South. Five states (Sikkim, Assam, Bihar, Jharkhand and Orissa) and three countries (Bhutan, Nepal and Bangladesh) surround West Bengal. Distribution-wise, Sikkim is to the North, Bhutan to the North-East, Assam and Bangladesh to the East, Nepal,, Bihar and Jharkhand to the West and Orissa to the South-West.

With direct access to the sea ad a network of national and international air links, the state's geographic location makes it the gateway to North-East India and adjoining countries. A system of roadways and railways connects West Bengal with all the major centres of activity in the country. The hub of industrial concentration of eastern India, West Bengal also commands an extensive agricultural and industrial hinterland. The total geographic area of the state is 88752 sq km, i.e. 2.7 per cent of the total geographic area of India.

Socio-economic Profile

Owing to favourable agro-climtic condition, West Bengal has always been one of the most populated regions of the country. Birth rate is lower than that of the country as a whole, but this has been compensated by lower death rate and infant mortality. Further, the problem of demographic stress has been aggravated due to huge immigration from East Pakistan, which became Bangladesh since 1971.

The state supports a population of 88.75 million (according to Census 2001), which is 8.6 per cent of the total population of the country. The average population density works out to be 904 per sq. km, with considerable inter-district variations. Nearly 72 per cent of the population resides in rural areas spread over nearly 43,000 villages. Scheduled Casts (SC) and Scheduled Tribes (ST) constitute 23.62 per cent and 5.59 per cent of the population respectively. About 61.55 per cent of the total area is used for agriculture, according to Census 2001. Ninety-five per cent of the rural population is engaged in agriculture. Though West Bengal has only 2.7 per cent of the total geographical area of the country, its density of population standing at 904 per sq km is second only to Kerala.

West Bengal has at least 38 major categories of tribal people. The tribal population includes Santhais, Oraons, Mundas, Koras, Methalis, Lodhas, Malpaharias who have migrated from Santhal Parganas during the 19th century and settled mainly in Medinipur, Puruliya, Bankura and West Dinajpur; while few others viz Bhutias, Lepchas, Mechs, Revas are residents of the hill section of Darjiling and Jalpaiguri. Tribal population of West Bengal shows a steady increase from 38.08 lakh in 1991 to 46.77 lakh in mid-year 2000. Due to increased population and for other obvious reasons, a section of these people have lost right of their traditional land. This has led them to damage the forested tracts that were earlier used by them.

Since 1901, there has been change in the proportion of rural-urban population, but only of little significance except for these 1951 - 61. It has been seen that only 28.46 per cent of the people of the state may be considered as urbanized, against the world average of 45 per cent.

An analysis of the working force on the basis of man activity has found that the highest percentage (52.96 per cent) of the working force is directly related to agriculture either as cultivators or labourers. In many of the activities such as agricultural labour, plantation, household manufacturing etc., percentage of female working force is much higher than male.

Conservation Efforts in West Bengal

Conservation initiatives in West Bengal have mostly been in terms of national parks, wildlife sanctuaries, protected areas and reserve forests and also the Sunderban Biosphere Reserve. Conservation is supported by a host of laws and legislations, which include the Indian Forest Act (1927), the Indian Wildlife Protection Act (1972), the Forest Conservation Act (1980) and the Environment Protection Act (1986). For the list of national parks, sanctuaries and tiger reserves, see the table below:

National Park (NP)	Wild Life Sanctuary (WLS)		Tiger Reserve (TR)
Singalila	Jorepokhri	Ballabhpur	Buxa
Neora Valley	Senchal	Bethuadahari	Sunderbans
Buxa TR (part)	Mahananda	Bibhuti Bhushab	
Gorumara	Chapramari	Ramnabagan	
Sunderbans (part)	Jaldapara	Sajnekhali	
	Buxa TR (part)	Lothian Island	
	Raiganj	Halliday Island	

Biodiversity Losses Must be Accounted for and Stemmed

This report attempts to take stock of the status of biodiversity and emphasize on including biodiversity in planning and development efforts. Biodiversity concerns can be appropriately articulated at the state level. Awareness and sensitization on part of the planners is needed at the state level for an implementable biodiversity management plan.

For tht an information base is essential to begin with, so that we can account for the diversity that is present, as well as that which may have got lost or become critically threatened. This will aid in conservation of some of the most vital natural resources and plant and animal life, ensure a greater degree of stability in nature and positively affect life and livelihood in our state.

Five Major Threats

The findings of the working groups identified a few major areas of threat to biodiversity in West Bengal. These are:

- Habitat loss
- Adverse impact due to lack of biodiversity awareness specially in development initiatives;
- Demographic pressure;
- Preference for monoculture and indiscriminate use of agro-chemicals;
- Unregulated marine fishing and prawn seed collection.

Habitat Loss

Habitat loss has largely taken place due to human intervention and change in land use pattern. Large scale conservation of natural habitats for a variety of purposes have led to shifts in floristic pattern (like in case of weed flora) and also fragmentation and loss of natural corridors for animals, leading to man-animal conflict. After the armed conflict with China in 1962, for example, the Army has been permanently stationed in Binnaguri, which has led to loss of the elephant corridor. Similar is the case of tea gardens in North Bengal, which have also witnessed man-animal conflict after forests were clearfelled. Habitat loss has led to decline in several species, and fauna like otterm Bengal Jackal, pangolin, mongoose, porcupine are among those which are not frequently sighted today. Habitat loss is a grave threat to biodiversity, whose implications are far reaching, since a decline in biodiversity ultimately leads to a degeneration in the quality of human life. Much needs to be studies about the underlying inter-relationship between biodiversity and the anthropogenic element, to clearly establish how harm to flora and fauna as a result of human interference must be stemmed.

Inadequate Awareness

This is the single largest threat. Biodiversity awareness will have to be distinguished from environmental awareness. Biodiversity can be speedily destroyed by ignorance of the people about the ecosystem they inhabit. For example, a recent survey in the Balli Beel Wetlands of the Swarupnagar area of North 24 Parganas by an NGO reveals that at least 22 types of birds of local migratory origin are known to be victim of regular poaching. Among these birds, large whistling teal, locally called papra falls within Schedule I bird list (endangered) and the rest are Schedule IV birds.

Experts may also need to reorient their perspective about traditional knowledge on biodiversity. In many cases, the wisdom and cultural practices of indigenous people who are long-time inhabitants of specific ecosystems, may need closer scrutiny. This will throw light on their ability to incorporate biodiversity concerns in their lifestyle, and indicate their viability in conservation efforts.

Besides, it is also true that planners and decision-makers have not adequately examined the cumulative effect of development on disappearance of species and even cultures. One can understand the correspondingly large damge that biodiversity has had to suffer since the planning process started in our country.

A similar lark of awareness on part of planners has caused immense damage to the Buxa Tiger Reserve, where dolomite mining has led to loss in faunal wealth. Again, it is claimed that due to commissioning of the Farkka Barrage, a great change has taken place in the faunal structure of the downstream rivers in West Bengal. Migration of hilsa fish has been severely affected since fish ladder has not been provided to allow the migratory passage of the hilsa fish further downstream.

Demographic Stress

West Bengal being a border state, saw a massive rise in population due to large-scale immigration from erstwhile East Pakistan after India got independence. The rise in population has put tremendous pressure on the land and the carrying capacities of ecosystems. It has also forced widespread changes in land use.

Need for more food has resulted in more and more forest land being converted for agricultural purposes. Loss of forest and land for building roads, for irrigation, railways, army and hydel and transmission line projects has often led to fragmentation of forests, loss of animal corridor etc. Rising forest fringe population has increased the pressure on the forests. In the hills, fuel needs to plantation workers and the industry has led to loss of valuable species of timber.

Wetlands have also been major sufferers due to an expanding population base. Realtors see them as an easy solution to the problem of habitation. This is true in the case of both rural and urban wetlands, where no account is taken of the long-term damage done to biodiversity or the subsistence value of the families dependent on the wetland ecosystem.

Preference for Monoculture and Indiscriminate use of Agro-chemicals

The largest area of land used in our state is for agriculture. Agricultural land may soon become critically threatened in terms of biodiversity loss. The report has found that increasing crop productivity by popularizing high yielding varieties is the most predominant strategy today. Hence, a diverse varietal base that existed before the onset of the Green Revolution is gradually narrowing. Both biotic and abiotic stresses have wide ranging implications for the biodiversity scenario in agriculture and horticulture.

A study commissioned by the Department of Environment on the diminishing crop varieties in West Bengal whose findings have been incorporated in this report, has revealed that all districts in West Bengal have been largely or at least partially affected by the loss of biodiversity. One of the main reasons for this is the lucrative high-yielding varieties (HYVs), which fetch better returns when cultivated, in contrast with traditional varieties. So the cultivation of many a traditional variety has been replaced by HYV cultivation.

The use of HYV has led to an increase in the number of pests and change in the plant-insect interaction. For example, the Nilaparvata sp was a pest in south India, but not in Bengal. With the introduction of HYVs, however, this species has become a pest. Work needs to be done in this area to find out the change in the nature of occurrence of insects due to the micro-climatic changes induced by the introduction of HYVs.

Over-use of agro-chemicals is an inevitable fallout of HYV cultivation. The yield shoots up initially, but reaches a plateau after a point of time. So farmers intensify the dose without proper recommendation. This leads to manipulation of soil morphology and considerable loss of soil biodiversity. There are serious health implications for those who spray these agro-chemicals i.e. fertilizers and pesticides, as well as those who consume the crops. Besides, it is perceived that the runoff of these chemicals reaching the river systems can have a damaging effect on the fish diversity as well.

Monoculture was not just encouraged in agriculture, but also in forestry. After the first national forest policy which stated that timber production for industry and national purposes like defence and communication are the major objectives of maintaining forests, funds became available for plantations of a few commercially valuable timber species and a limited number of quick growing species in North Bengal. As a result, in North Bengal, which had the most productive forests, monoculture began to be practiced after clear-felling high forests consisting of broad-leaved species mix.

Again, exclusive pisciculture in the wetlands and waterbodies is determined to the health of the ecosystem in the long run and ultimately results in the dwinding of species diversity. The sustainability of the ecosystem is better ensured in case of integrated fish culture in wetlands and water bodies of diverse depth.

Unregulated Marine Fishing

A well-known problem in the coastal area that hosts the unique Sunderbans ecosystem is that of ecological crop loss due to wild harvest of prawn seeds. The Sunderbans have the largest mangrove vegetation in the world, and mangroves are a nursery for all types of fishes. Quest for wild harvest of prawn seed has not onlyharmed the fish population, but also the mangrove vegetation in this region. This has in turn affected the fish population. An investigation done on this problem revealed that about 50 species of fin fish juveniles and 28 species of shell fish juveniles are wasted per net per day.

Unregulated use of coastal waters by foreign fishing vessels also results in rapid destruction of marine fish wealth. One of the reasons for this is the large-scale use of monofilament nylon yarn, an active gear that hunts the fish and in the process nets in all marine creatures right from the sea floor. This type of fishing can damage the benthic community, and result in rapid destruction of biodiversity stock.

In addition to the major threats stated above, there are a few more areas of anticipated concern. However, due to lack of sufficient information they have not been prioritized. These areas of concern include unsustainable exploitation of medicinal plants, impact of pollutants on aquatic biodiversity etc.

Gaps in a Fuller Understanding and Implementation

Having identified the major threats, it is pertinent to seek the gaps in our better appreciation of the fact that biodiversity in West Bengal is indeed in need of serious management care. These gaps are:

- Information is inadequate, sometimes inconsistent;
- Decentralisation of management has a long way to go;
- Participation and leadership of women is not emerging as a prime mover of biodiversity management;
- Cultural practices, livelihood options, ecosystem and biodiversity linkages have not been adequately explored and understood;
- In agriculture, farmers have little incentive to preserve biodiversity;
- Effect of biotechnology on biodiversity stock has been scarcely studied.

Inadequate Information Base

Our information base is inadequate, sometimes unreliable. Biodiversity has so far been spoken of only by specialists and different institutions. Works has often been done in a fragmented manner. Also, there are many changes that have not been studied, like the effect of the crude oil refinery in Haldia, on the aquatic life in rivers Haldi and even Hugli.

Our knowledge of ecosystems has been species-based and not holistic. Understanding has often been partial because we do not have enough knowledge on wild biodiversity. Belief in species-based conservation, without adequate attention to wild biodiversity, may have proved a deterrent to a fuller knowledge of biodiversity.

Besides, there is also lack of monitoring and follow up studies in certain areas. A case in point is that no studies have been carried out on the effects of effluent discharge in the Ganges as a result of the industries in Durgapur and the surrounding areas. There is a need for detailed study of riverine pollution in at least the major rivers of West Bengal.

Efforts to trace loss of crop diversity loss have been inadequate and sporadie. In the enthusiasm for quick money monoculture, long-term utility of preserving biodiversity, especially *in situ* has been a greatly neglected area. Information on lost varieties needs to be regularly updated, as information is the best tool available to avert a biodiversity crisis. Since information base is never static, and policy makers must be continuously informed, it will also be useful to involve local people in the information generating process and then get theur findings cross-checked.

Decentralization of Management has a Long Way to go

Over the year, it has been realised that complete avoidance of human intervention may not entirely be advisable for protecting biodiversity. Therefore, decentralization has emerged as an important factor that is talked about all over the world today by experts. West Bengal has a well established network of protected areas, national parks and sanctuaries which have by far had a good record of management and conservation. Again, it was West Bengal that pioneered the Joint Forest Management initiatives as a example of decentralization and participatory management. But the lesson that has been learnt is that such initiatives, did not have the desirable multiplier effect and the matter needs much more rigour.

In this context, one may examine the participation advocated by Loka Siksha Parishad of Ramakrishna Mission, Narendrapur which has been assisting the Forest Department, Government of West Bengal in implementing its Joint Forest Management (JFM) initiative. The Parishad's attempt is to make the forest fringe people self reliant through optimal utilisation of available resources for livelihood. They must relive their dependence on the forest by conserving rather than destroying it. The Parishad works with 52 forest protection committee (FPCs) spread through Bankura, Medinipur and Puruliya. On the basis of its experience, it has found certain gaps that need to be addressed to make forest management truly participatory. The lesson that the Parishad has drawn from its FPC experience is that the forest-based activities are woven into the entire life and livelihood processes of the fringe people and are adequately preserve forest biodiversity better. For example, if they have a strong infrastructure to market their minor forest produce, and pursue forest-related activities like tassar and lac cultivation and other rural development activities independently, their lives and livelihood will become much more sustainable and stable. This will spur forest protection. It will also need to committees capably sharing management decisions with the Forest Department and sustain the resource management practices effectively.

Women's Role Undermined

Gender division of roles and responsibilities, and women's primary responsibility for household sustenance have made women traditionally play a key role in domestication of wild cultivars, seed selection, storage and management of domesticated biodiversity, often including livestock, for maximizing household food-security. By virtue of this role women in most cultures became rich databases of unique biodiversity knowledge especially agro-biodiversity, which itself is a critical base for meeting various economic and cultural requirements.

This report has not been able to do justice to tis subject and explore women's link to biodiversity. However, there is one analysis of what harm can result out of forcing women to practice activities that destroy biodiversity. In the coastal ecosystem, women play a vital role in agriculture and aquaculture, in many cases when men migrate on a large scale, often to cities, in search of work. Women are largely involved in the lucrative practice of collection of seed of tiger prawn (Penaeus monodon), which requires them to be absent long hours from home, and exposes their children to neglect, hunger, disease and even exploitation. The destruction that takes place is both at the ecological and the family level.

If men and women are present in decision-making for a relating to biodiversity management with equal space to articulate their respective priorities, they may be able to devise a management system equally responsive to their respective priorities through negotiation. This is imperative, considering women's intimate link with forests and lands, as it will yield the dual dividends of improving their status and ensuring biodiversity.

Cultural Practices, Livelihood Options and Biodiversity Linkage

It is vital to explore the linkages between cultural practices, livelihood options, ecosystems and biodiversity. Since West Bengal is a land marked by dramatic contrasts in terrain, history, culture and religious beliefs - an incredible diversity in ecological landscapes has helped human communities evolve an equally diverse mosaic of traditions and cultural practices, rooted in the knowledge of biodiversity wealth. Therefore, each eco-region will have its particular set of livelihood practices.

Exploring the links between local knowledge of diversity, livelihood options connected to them and the ability of such options to

fulfil local needs is necessary for a better idea of sustainable resource use. Scientists, sociologists and anthropologists may need to work together in this area for fruitful knowledge of biodiversity friendly livelihood options, which will both preserve variety and help optimize resource utilisation.

Farmers have Little Incentive to Preserve Biodiversity

The farmer has little incentive to conserve biodiversity. In our rush to grow more food and adopt new agro-technology during the years of the Green Revolution, we paid little attention to the importance of *in situ* conservation of variety. The success of the Grow More Food Campaign was ensured by a single important factor, viz the high returns from high yield, at the expense of biodiversity. At that time, experts gave little thought to the long-term damages caused by HYVs. Since we have a huge population to feed, high volume production is necessity. It is not practicable to ask farmers to preserve low-yielding but diverse crops since they are concerned more with short-term needs than with biodiversity, which is a tool for long-term survival.

But it is essential to maintain variety, which otherwise has the potential to threaten even our short-term survival. In such a scenario, a system of incentives is necessary to preserve on farm both major and minor crops, to prevent the erosion in gene stock and maintain a balance in the ecosystem. In the absence of such incentives, farmers will not be enthused to promote conservation on their fields. Such incentives also need corresponding changes in agricultural marketing methods, without which incentives will be difficult to sustain.

Effect of Biotechnology on Biodiversity Stock needs to be Studied

Biotechnology is the newest agro-technology that promises to revolutionise agriculture. West Bengal has recently declared a biotechnology policy. But here, iut is important to remember that any new technology that is introduced and has the potential to change our farming practices has to be accompanied by proper and rigorous biodiversity impact monitoring. This is essential to understand the ramifications of the introduction of the new technology.

Basic Strategy and Desirable Actions

That ecosystems will have separate problems and strategies specific to them is easily understood. However, what is common to all these ecosystems is the lack of awareness about biodiversity, easily identified as a serious concern in managing biodiversity. This weakness cuts across social, political and economic boundaries. Similarly, the other shortfall, which is also equally glaring, is the inadequacy of people's participation in biodiversity management and insufficient linkage with livelihood options. There are livelihood that adversely affect nature and biodiversity. There are also livelihoods, particularly those of indigenous people, which will need careful preservation. All of them, therefore, will require profound understanding. It is essential to remember that development initiatives, whatever they are, must incorporate concern for biodiversity loss.

Conventional environmental awareness initiatives, inspite of extensive attention that has gone towards them, have fallen short of desirable heights. A closer scrutiny will reveal that most of these awareness programmes did not consider it necessary to understand the level of awareness of those for whom the programmes are drawn. Every individual, group or community has its own perception of the environment that surrounds them. All of them have their own cognitive images of nature. These images and the awareness they possess are highly diverse and can also be rich in content. The designer and implementers of environmental awareness programmes assume a level playing field and produce "Free size" assignments. Not surprisingly, the tutelage remains largely ineffective, a fact borne out by a very recent study in the forest fringe areas of the Sunderbans by a Kolkata based NGO. A leading environmental reformer of the Sunderbans area was exasperated that while more than a million must have been spent on awareness campaigns, the people of this area do not know that they are sustained by one of the richest biodiversity niches. We know that this statement is correct. The designer and the facilitators of the awareness programmes assumed a level playing field while the reality remained otherwise.

In a different corridor, lack of awareness about traditional practices and cultural traits is increasingly discernible amongst the environmental specialists themselves. Not uniformly though not everywhere either, these are the realms where a considerable stock of knowledge is thought to be present and can be helpful in managing biodiversity better. For conservation specialists and thinkers it is imperative to reach out to the masses, understand their knowledge and convert it into mainstream assignments for wider application.

Conceptualised and introduced in Chapter 13 of the main report, this new raodmap that emerges for designing and implementing conservation and management assignments, is best described by a Chinese saying "From the masses back to the masses" and will be the basic strategy for biodiversity management.

The participatory strategy, in brief, has two steps. Firstly, it requires understanding and assessment of the cognitive images of the people about their environment and the way they recognize the presence of nature. Secondly, going back to the same group of

people with a different set of assignments derived from such understanding, which will be suitable to manage the biodiversity stock better. This strategy will hold good for all the ecosystems being studied for the present.

Based on this strategy, a set of ten desirable actions has been prioritized. These are:

- State-level Biodiversity Board to be set up by the Government;
- Information about biodiversity status to be enriched;
- Work in systematics to be encouraged;
- Coastal biodiversity to be protected;
- Protection measures to be stepped up and conservation efforts strengthened in representative biodiversity rich areas like Buxa TR, Neora Valley NP, Singalila NP, Gorumara NP and other major forest areas particularly in North Bengal;
- Balanced agriculture to be actively promoted and ensured; rainwater harvesting and conservation use of the wetlands of the Sunderbans combining these different ecosystem types viz, mangroves, mudflats and estuaries (along with estuarine marshes);
- The problems of non-point source pollution require serious attention;
- Wetlands and waterbodies should be conserved all over the state;
- Commercially attractive and incentive-based consdrvation of medicinal plants and traditional agricultural seeds to be promoted;
- Special attention to conservation of Ayodhya and Panchet hill forests of Puruliya district;
- Passed conversion of existing monoculture of dhupi and teak in Darjiling Himalayas should be ensured.

Biodiversity Board

To bring together the initiatives and facilitate biodiversity management, we need an umbrella body, which will have overall authority to obtain biodiversity related information and spearhead conservation and management initiatives in a sustained manner. Therefore, the need of the hour is to form a Biodiversity Conservation Board at the state headquarters. Powers and functions of the Board are stated in the National Biodiversity Bill, which is waiting for approval by the Parliament. There will be district level committees for managing biodiversity at the lowest administrative level.

Information about Biodiversity Status

Publishing status of biodiversity will be a major task of the Biodiversity Board and will need continuous updates. Information is the most vital input for policy-making and planning. Every change brought about by a plan or policy has its corresponding effects on the ecosystems of a region, and affects the interface between people and biodiversity. So if there are critical changes in the biodiversity of a region due to a host of factors, they will need to be identified and proper management measures will be required. For that, regular information updates are a must.

Publishing the biodiversity status will require knowledge about the parameters and methods to be involved in status assessment, after taking into account what information we require. We need to tap the already existing information base, which are spread throughout the state in a relatively organised manner.

A good place to tap for information will be museums West Bengal has a number of outstanding museums where wealth of information is available. A good amount of information has already been retrieved on oriza sativa (rice) and many more of studies can be taken up. Information about ecological history is an important area what will be particularly useful in protecting IPR rights on grounds of place of origin. In this context, it will also be important to set up DNA fingerprinting facility for the documentation of plant biodiversity, to begin with.

Work in Systematics Should be Encouraged

Systematics is the scientific study of the kinds and diversity of organisms and of any and all relationships among them. Interestingly, the origin of scientific taxonomy lies with folk classification of species. In fact, all human societies have folk taxonomy i.e. traditional classifications of organisms which are often associated with cultural survival and culinary practices. Unfortunately, there is a real dearth of taxonomists and no immediate sign of this gap being filled up.

The result can sometimes be disastrous, like improper scientific names finding place in scientific journals. But taxonomy is an area of vital importance in any work on biodiversity, and without taxonomists, biodiversity status assessment is impossible.

Biodiversity Database for each District Should be Completed

Lowest administrative level at which biodiversity database should be maintained is a district. The district administration will maintain formal biodiversity database which will include flora, fauna, ecosystem and crop variety information.

A good amount of information will be generated in areas least intervened by humans. A number of people's biodiversity registers at the village level is being worked upon. Paschim Banga Bigyan Mancha is active in several districts in preparing such registers. Efforts of this sort will have to be supported and supervised by the district level administration with the help of specialists and scientific institutions.

Coastal Biodiversity Protection

The coastal zone is one of the most densely populated and one of the most threatened zones from the standpoint of biodiversity. Side by side, it is also extremely rich in biodiversity and hosts the unique Sunderbans ecosystem, which is one of the most biologically productive and taxonomically diverse ecosystems of the Indian sub-continent. The sad part is that the sustainable living of the people who reside here faces threats largely due to factors that are linked to the biodiversity of the region. The coastal zone largely includes the Indian part of the Sunderbans.

A good way to work towards a sustainable solution to the problem is disappearing and destroyed biodiversity is to find practical, workable livelihood solutions for the people of the coastal zone, especially the Sunderbans. Appreciating is significance, Sunderban biodiversity has been discussed separately. Another area of serious concern, where we have hardly any record, is the introduction of exotic species into the coastal water through ballast cleaning and washing.

Increased Protection Measures

The protected areas of North Bengal, though lying along the same foothill region, are of different nature and harbour varied combination of biodiversity elements particularly due to altitudinal variation and other geomorphological factors. Each of these reserves has acquired some kind of uniqueness which need to be protected separately. The Pas are already under the shelter of legal protection and are relatively secured. But sill, mostly due to lack of proper implementation of wildlife management practices, inadequate enforcement staff and underdeveloped infrastructure, severe man made problems threaten these biodiversity rich wild habitats of North Bengal. The conservation measures and related activities has to be stepped up to ensure highest level of protection to these existing Pas of Terai and Duars. This will also need a proper review of the existing measures.

Balanced Agriculture

With the introduction of HYVs or hybrid varieties, agriculture in India underwent a tremendous change. A study commissioned by the Department of Environment, Govt. of West Bengal has found that pushing the indigenous varieties of different crops to a backseat has resulted in the slow disappearance of many quality varieties from the field, such as the scented rice varieties. At the same time, farmers feel that higher production is the need of the day as there has been a steady growth of population. For this reason, resorting to cultivation of HYVs has become imperative.

Among certain quarter, there is a belief that organic farming is the way out of health, environmental and biodiversity hazards caused by high-input, chemically intensive, high-yielding agriculture.

Pragmatically, due to the present population growth and the existing perspective of agrarian politic, resorting to organic farming will be a difficult goal to achieve, if not impossible at present. This is specially so with India being a signatory to the General Agreement on Trade and Tariffs (GATT), and a member of the World Trade Organisation (WTO).

Given such circumstances, a balance which is also being advocated by the Department of Agriculture ever since the chemical fertilizers were available, has to be struck. Such a balance, alternatively termed balanced farming will not only take care of providing harmless food to the population, but also take care of the soil health. In fact, balanced farming also includes animal husbandry.

Also, rainwater harvesting and conservation is required for a widespread beneficial effect on wetland and biodiversity conservation and restoration. Most part of West Bengal have copious rainfall. Unfortunately, the optimal use of rainwater, storing it in natural or manmade waterbodies is not a priority programme. In many parts of India, storing rainwater in natural depression wetlands and waterbodies is well known for multiple benefits in addition to preservation and restoration of biodiversity.

Problem of Non-point Source Pollution Needs Serious Attention

In India, the control of point source pollution is taken care of by a number of environmental acts and related regulations. These acts and regulations have been found to be fairly effective in reducing pollution. Unfortunately, there is not a single legislative provision within the fold of the Environmental Protection Act for controlling non-point source pollution. Agricultural chemicals cause a major part of the non-point source pollution.

Wetlands Conservation

Apart from about 54 natural and nine man made wetlands which are more than 100 hectares, there are innumerable small water

bodies including ponds, puddles etc which have not been adequately recorded, but the biodiversity of which helps sustain many rural families. Urban water bodies and peri-urban wetlands are also equally important for sustaining their ecosystem.

Wetlands are also home to a wide variety of fauna, like fish, amphibia, reptiles, waterfowls, and such are of great interest to experts. From a biodiversity point of view, as well as from a livelihood and sustenance point of view, wetlands help to hold together a complex and inter-connected web of life. Besides, wetlands also have a climate control function in the regions where they are found. There are other functions of wetlands that require further understanding.

At the onset, district level records of existing wetlands and water bodies must be completed with the help of satellite images and local land records. All these wetlands should be classified according to their significance and conserved appropriately. Subsequently, there should studies on a number of subjects like the study of the food web in a wetland ecosystem, and the bio-magnification problems of insecticides on the food web.

Preserve the Sunderban Wetlands

The wetlands of the Sunderbans preserve one of the richest biodiversity hotspots of India. At present, conservation initiatives in the Sunderbans are essentially centred around two prime concerns; protection of the mangroves and enhancing livelihood opportunities. A substantial amount of research has been done on the taxonomy of plants and animals. Lately, social survey of loca,l communities are also being taken up. Interestingly, there is no study on the wise use of this large wetland area. Sunderban wetlands can be distinctly separated into three ecosystem types. These are: the mangroves, the mudflats and the estuaries, along with the estuarine marshes. All these types have specific functions and services upon which the local communities depend for their sustenance. (More than 4.2 million people depend upon wetland resources and services, according to Census 1991).

It is crucial, therefore that a management action plan for the conservation and wise use of the Sunderban be drawn up immediately and implemented by a competent authority. It is also important to add that the primary concern for this wetland is the conservation of biodiversity and threatened livelihood of the local people. The implementing authority should be empowered to ensure the legal and regulatory control that will be available through the ensuing promulgation of the Biodiversity.

Commercially Attractive and Incentive-based Conservation

If we think in terms of agriculture, for example, farmers will concentrate on those crops that will fetch them high returns. Also, only institutionalized conservation of biodiversity will mean that such efforts will be limited in nature. Therefore, a wider reach of conservation may be needed, which can be done only if farmers are provided adequate incentives.

Commercially attractive and incentive-based conservation efforts will have to be progressively implemented. Primary emphasis areas will include medicinal plants and traditional seed varieties that are tolerant to adverse climates.

Special Focus on Puruliya

The reserve forest areas of Ayodhya and Panchet Hills of Puruliya represent unique habitat type lying between the southern West Bengal plains and the Chhotanagpur plateau. Both the areas harbour a varied combination of biodiversity components different from other areas of West Bengal. The reserve forest status is barely sufficient to provide basic protection for the region. The flora and fauna of both the areas should be taken to conserve the diversity of these two areas. An appropriate strategy of conservation management will have to be worked out, remembering the limitations of conventional protected area approach.

Phased conservation of North Bengal forests

Existing forest plantation patches of dhupi and teak of lower and middle hills of Darjiling Himalayas should be changed into mixed hardwood (through adoption of appropriate sylvan techniques). This conversion is to be phased, over a period of the next 20 years.

Conclusion

In all there-conservation oriented efforts, the ultimate assumption will be the sustenance of as many varieties as possible. With out limited knowledge of nature's complex ways, the maxims of minimum intervention in natural processes and controlling consumption would be useful starting points.