

# Haryana State Biodiversity Strategy and Action Plan

Coordinating Agency: Directorate of Environment, Chandigarh

1. Haryana is amongst the smaller states of the Indian Union. The state has 1.3% of the total area of the country supporting 2% of its population. About 75% of the state population lives in rural areas and about the same percentage of the population depends directly upon agriculture. 77% of the land under agriculture is irrigated. Presently canal water irrigates 54% of the area and the ground water the remaining 46%. The state contributes about 6% to the total food production of the country. The per capita income of the state as recorded in 1996-97 at 1980-81 prices was Rs. 4029 and the state stood at 4<sup>th</sup> position in the list of states and Union Territories in this regard. As per 2001 census (provisional), there were 861 females per 1000 males as against 865 in 1991. The literacy rate is 68.59% (excluding the children between 0-6 years).

## 2. Natural Resources

About 83% of the land is put to agricultural use. The land under forests is barely 3.8%. Of the total forest area, about 50% is along the rail, road and canals in strips which are mainly man made plantations. The natural forests are mainly confined the Shiwaliks on the northern border along Himachal Pradesh and Uttaranchal. The natural vegetation on the Aravalli Hills in the south is in degraded state.

2.1. Although the extent of wild resource is very limited yet the state is quite rich in ecological diversity. The state has Shiwaliks and outer Himalayas, a substantial part under the Gangetic plains, the north-eastern tail ending in Delhi of the Aravalli Hill system and a considerable area under the arid desertic conditions on the border of the Thar deserts. Each of these regions support flora and fauna of its own kind.

2.2. The central Gangetic plains are flat and accumulate water in depressions especially during the monsoon which harbour aquatic flora and fauna, and a plethora of migratory birds in the winter.

2.3. There is only one river, Yamuna, which is perennial and flows along the border with Uttar Pradesh. The other smaller rivers are seasonal.

## 3. The State BSAP

3.1. This strategy and action plan deals with the state of Haryana within the overall frame work of the National Biodiversity Strategy and Action Plan and attempts to deal with the issues of conservation and sustainable utilisation of the biodiversity in a holistic manner.

3.2.1. The strategy and action plans for the conservation of biodiversity were obtained from the departments dealing with the corresponding natural resource. In the process, the state departments of Agriculture, Forests, Animal Husbandry, Wildlife, Horticulture, Fisheries were involved. Inputs were also obtained from the National Dairy Research Institute, Karnal, CCS Haryana Agriculture University, Hisar, Department of Zoology, and Botany, Punjab University and Institute of Microbial Technology.

3.2.2. To get the views of people, two workshops were organised at Yamunanagar and Gurgaon. To get the perceptions of all the categories of rural population survey was conducted in 98 villages in Gurgaon, Mahendergarh and Rewari. Two public hearings were also organised. One was organised in the Chicken village in the Shivalik foothills of Yamuna Nagar district and another was organised at village Bodla in the fertile gangetic plains of Kurukshetra district.

3.2.3. The contributions obtained from the volunteers have also been incorporated in the report.

3.3. This report contains the strategy and action plans for the sectors separately. It is felt that this scheme of writing separate chapters for different sectors will be helpful and easy especially from the comprehension and implementation point of view.

## 4. Reasons for Loss of Biodiversity

4.1 One of the most important reasons for the loss of biodiversity which manifests in different forms is the increasing human population. The waste lands which met the fuel and fodder requirement of the local community gradually were diverted for various

developmental activities which resulted into the increased pressure on the natural resources. The increased human population is responsible for the encroachment of forest lands or utilisation of forestry resource and hunting of wild animals beyond the sustainable limits. In the last 30 years the lands where domestic animal could graze decreased by 43%. The decrease in the available wastelands resulted into consequent pressure on the natural resources.

The Sukhomajri experiment has clearly indicated that the biological resource conservation in a developing country like ours is possible only with the joint efforts of the government and the local community especially those who depend most on these resources. Adequate care, therefore, has been taken to involve the local community in the conservation efforts suggested in this plan.

4.2. With increased population, the land holding decreased considerably. The formation of new state, Haryana, saw the taking up of large scale developmental. This coincided with the beginning of green revolution. These factors resulted into the conversion of wastelands for agriculture purpose, and the decrease of the fallow lands resulting into increasing pressure on wild natural resources. With the need for the increasing the agricultural productivity newer hybrid varieties were developed. The agricultural crop varieties which had evolved over centuries of human efforts were replaced by newer varieties. These new varieties produced more and so they removed more nutrients from the soil. The enhanced use of pesticides and fungicides disrupted the plant insect/pathogen association. The improved agriculture prosperity resulted into the loss of agricultural crop varieties and the destruction of floral and faunal composition of the agricultural field ecosystem.

4.3. The development resulted into the levelling of large number of wet lands affecting the aquatic fauna of the state. The increased pesticides also resulted into the decreased avian population, the most important of which, observed recently, is the mortality of peacock in the state.

4.4. To produce more wood to meet the local fuel wood requirements large scale afforestation of the community waste lands was done. Mono-culture was raised with high density of trees which did not allow the growth of other plants. Thus, even the afforestation activities have been responsible to some extent for the reduction of biodiversity in the areas out side forests. These plantations however indirectly reduced the pressure on the natural forests elsewhere and thus helped the protection of biodiversity of the natural forest areas.

## **5.0 Strategies**

The following paragraphs summarise the strategies and action plans of the various sectors:

### **5.1. Forests**

5.1.1. Creation of preservation plots in various vegetation types and ecosystems represented in the state is recommended.

5.1.2 Standardisation of nursery techniques of 100 lesser known species is proposed to be taken up. To reduce the pressure on the natural forests promotion of agro-forestry on farmers fields, promotion of silvi-pasture practice on community lands with very low tree density, and taking up of income generating activities for the population depending on the forests resources have been proposed.

5.1.3. For the conservation of the species and improvement of the habitat, soil and moisture conservation works and fire protection measures have been provided for.

5.1.4. To know and monitor the status of various species, it is necessary to have base line survey. This would also help in calculating the sustainable productivity potential of the various species (NTFPs). The preparation of biodiversity registers with the involvement of the local community especially the women has been included in the report.

5.1.5. The state is one of the pioneers in the field of Joint Forest Management (JFM) in the country, having evolved and successfully implemented the JFM rules. To further strengthen the people's participation in the management of natural resource throughout the state, provisions to this effect have been incorporated in the report.

### **5.2 Wildlife**

5.2.1. For the conservation of the wild biodiversity and other vertebrate and invertebrate faunal diversity of the state, eight pronged strategies both short term and long term, has been stressed. Improvement of the habitat in the forested ecosystem by plantation of fruit species and making water available in the protected areas, provisions of water to the threatened wet lands and

to protect the wild life out side the forest areas amendments to the Panchayat act to keep 25-30% of community lands under tree cover (very low density tree crop) have been suggested.

5.2.2. For creating the awareness amongst the people at large, nature education and conservation programmes, and to wean the communities involved in wildlife offences away, the provision of income generating activities have been suggested.

5.2.3. To help and monitor the status of various species at a later date, base line survey including the preparation of biodiversity registers of all life forms and local traditions and knowledge have been incorporated in the report.

5.2.4. To conserve the biodiversity of the north western Himalayan region and also of the state, strengthening of the protection mechanism has been provided for in the report.

### **5.3. Agriculture**

5.3.1. For the conservation of the varieties of various agricultural crops, improvement of soil and restoration of the earlier plant animal association through the use of farmyard manure and bio pesticides has been suggested. Although it is difficult to conserve all that we have lost yet it is hoped that this strategy will make a beginning to that effect.

5.3.2. Cryo preservation of various strains and genetic material has been suggested as an *ex situ* conservation method.

5.3.3. During the process of development, the agricultural crop diversity as also of varietal diversity has greatly shrunk. This is proposed to be restored through extension and integrated crop management practices.

5.3.4. There are large number of medicinal plant species which are used for ailments. The CCS HAU, Hisar has proposed to take up a detailed survey of medicinal plants in the state, the study of their bio-chemical composition and also the pharmacology of various ingredients. The University has already formulated a project to that effect. The project also envisages holding of workshop to elicit the local knowledge of the people about various plant and animal species. The preparation of the biodiversity registers with the involvement of the local community has been suggested.

### **5.4. Horticulture**

Surveying and documentation of existing horticultural diversity by various means and various *ex situ* and *in situ* conservation methods have been suggested over a period of 20 years. The preparation of the register of local biodiversity is incorporated.

### **5.5 Fish and Aquatic Fauna**

5.5.1. There are 77 species of fish of 41 genera found in the state. The list of endangered species of the fish has been mentioned. Rapid industrialisation, pollution of water resource have direct bearing on aquatic ecosystem. Siltation of ponds and levelling of the depressions have led to depletion in the fish diversity.

5.5.2. The base line survey of the existing fish and aquatic fauna in the state already exists. However, a monitoring mechanism which is needed, has been incorporated in the report. The preparation register of biodiversity and local knowledge is also suggested.

5.5.3. For *in situ* conservation of the aquatic flora and fauna, some stretches of Yamuna river and some other canal systems is proposed to be declared as "Fish Sanctuary".

5.5.4. To reduce the pollution in the aquatic systems especially in the Yamuna river, setting up of the sewage treatment plants in major towns has been recommended. It has also been proposed to create bigger ponds in the Yamuna river bed for the conservation of the aquatic fauna.

### **5.6 Animal Husbandry**

5.6.1. The state is gifted with the presence of some of the very good cattle and buffalo breeds of the world. Murrah buffalo is world known. The Hariana breed of cattle is being cross bred with the high yielding European breeds. The Karan Fries and Karan Swiss breeds developed at NDRI, Karnal by cross breeding of Holstine Frisian and Brown Swiss have received wide acceptance amongst the farmers in the state.

5.6.2. The *in situ* and *ex situ* conservation measures have been proposed. Formation of breeder association and progressive farmers club is encouraged to be formed to adopt multi-pronged strategy including provision for keeping biodiversity intact. Preparation of biodiversity registers and local knowledge and traditions has also been provided for.

5.6.3. Genetic mapping of the wilder relatives of the domesticated animals has been suggested over a period of next 15 years.

### 5.7 Financial requirements

The tentative requirements of the funds for the implementation of various action plans over 5-20 years' period as worked out for various sectors is given below:

<i>*(Rs. in lakhs)</i>			
<b>Sectors</b>	<b>5 year</b>	<b>5-10 year</b>	<b>10+ year</b>
1. Forests and plant life	1921	1076.5	13779
2. Wildlife and animal life	50	1710	1233
3. Agriculture and medicinal plants	150	1500	23000
4. Horticulture	Up to 10 year	1000	
5. Fish and aquatic fauna	400	3200	1800
6. Animal husbandry	4000	2000	4000

*\* These financial requirements are based on very rough estimates and are likely to vary greatly.*

# Himachal Pradesh State Biodiversity Strategy and Action Plan

Coordinating Agency: State Council for Science, Technology and Environment, Shimla

## Introduction

Himachal Pradesh, the land of beautiful landscape, lush green forests, bubbling streams, emerald meadows, enchanting lakes, eternal snows, ethnic communities and colorful people, is located in the North Western Himalayas. Himachal Pradesh like any other mountainous region is a vast repository of plants and animal ecosystems embodying profuse variation in intra and inter-species levels. Out of total 45,000 plant species found in the country, as many as 3245 species (7.32%) are reported in Himachal Pradesh and out of 77,450 species of animals Himachal Pradesh harbors 5,721 species; amounting to about 7.4% of Indian fauna. This shows richness of faunal resources of the state considering its small geographical area, which is only about 1.7% of the country. Invertebrates constitute 88.4% (5,055 species) and vertebrates 11.6% (666 species) of the Himachal fauna.

Himachal Pradesh is bestowed with distinctive fauna having aesthetic, cultural, commercial and genetic values. Beautiful birds like Himalayan Monal, Koklas, and Tragopan Pheasants, Red billed blue Magpie, Paradise flycatcher, Himalayan Snowcock and different types of butterflies are of great aesthetic values. Infact, they have enriched the aesthetic life of the hill people and are admired for adding liveliness to nature. The unique colour shades and design of butterflies and birds have caught the imaginations of poets, naturalists and fashion designers and collectors etc.

Domesticated animal biodiversity in Himachal Pradesh is also very rich. There are a number of breeds of sheep, goats and ponies, which are also able to withstand hazards of mountainous areas. Some of these are; Bhadarwah (Gaddi), Rampur Bushairi, Biangi, Mewati and Khand, among sheep; Chamba, Gaddi, Pashmina and Chegu, among goats; Spiti and Chummarti among ponies.

Many species of plants and animals are considered as threatened species in Himachal Pradesh. The percentage of threatened mammals in this highly fragile area is comparatively much higher. All species of pheasants occurring in Himachal Pradesh are at risk because of habitat loss and hunting. Freshwater and soil fauna are under tremendous stress due to inorganic and chemical pollution of ponds, streams and wetlands. The situation is fast deteriorating due to indiscriminate spray of highly toxic insecticides in orchards and agricultural fields. Intentional and unintentional introduction of exotic species has also threatened the existence of certain soil and aquatic species; thereby disturbing various ecosystems in the State.

The document on Biodiversity Strategy and Action Plan of the State of HP has been prepared through an interactive process by incorporating views of academicians technocrats, bureaucrats and the general public and was participatory in nature involving stakeholders from all walks of life for planning for future strategies and actions for conservation of biodiversity which have emerged on the basis of the issues/problems(gaps) found on various themes pertaining to Biodiversity in the State of Himachal Pradesh.

The objectives of BSAP are to assess the existing status of biodiversity of Himachal Pradesh and identify the causes of its depletion or deterioration and to promote conservation and sustainable use of biological resources of the State. Major issues and gaps in the field of biodiversity have been identified and measures are proposed to fill the gaps in the form of Strategy and Actions.

## Main Issues of Biodiversity in the State

- The effective valuation of the biodiversity especially agro-biodiversity needs proper understanding of traditional farming practices.
- No information base of traditional ecosystem in marginalized/remote areas is available.
- People are totally ignorant of the values of genetic resources available for them in the State.
- Forest fires create havocs, but no fire fighting system/fireproof system is available for prevention and control of fire.
- Lack of initiatives for eradication, rehabilitation and alternate use of exotic weeds namely; *Lantana camara*, *Ageratum*, *Eupatorium* and *Parthenium* in the State.
- Over grazing, soil erosion, exploitation and unlawful activities by intruders are leading to degradation of the biological resources of the State.

- Advancement of development, Cement Projects, hydroelectric power projects, posing a big threat to the biodiversity.
- Increase in pollution, population, use of toxic pesticides, chemical fertilizer and changing weather conditions are affecting biodiversity.
- Lack of Awareness programmes for the conservation of the biological resources in the State.
- Illegal hunting and poaching is one of the main causes for the loss and decline of wildlife biodiversity.
- Habitat destruction, wrong and erratic use of natural habitats, change in climatic conditions and imbalance in natural ecosystems are also causing problems to biodiversity in the State.
- Change in food habits leading to cultivation of only a few selected cereals, pulses, oil seeds and other economic plants, is also posing threat to the agriculture.
- Propagation of monoculture practices.
- Introduction of the exotic species of flora and fauna adversely affecting the indigenous species in the State.
- Glaciers outbursts and cloudbursts resulting in the release of a large volume of water often destroys existing biodiversity.
- Due importance has not been given to biodiversity in the co-curricular activities of the school, colleges and training institutes.
- People are unaware of the importance and dangerous consequences of the loss of the biodiversity.
- Efforts for the conservation of biodiversity in the State are not optimum.
- Lack of R&D and transfer of R&D activities related to biodiversity.
- Increased sedimentation by deforestation and mining and unauthorized and indiscriminate fishing using destructive fishing methods viz. poisoning, electrocuting, dynamiting etc. is threatening aquatic biodiversity
- Biodiversity education is not an integral part of both formal and non-formal education in the State.
- Poor co-ordination amongst developmental plans, executing bodies, local communities, research and academic institutions.
- Poor control on contractors of medicinal herbs/plants contractors and collection by outsiders is often done without the knowledge of local people.

### **Ongoing Biodiversity Measures**

- The Government of Himachal Pradesh has adopted National Forest Policy, National Conservation Strategy and National Wildlife Action Plan to tackle various biodiversity related issues. The state government has also imposed a complete ban on hunting of wild animals and a moratorium on felling of trees in all Protected Areas.
- The State Government has taken measures for the propagation and conservation of wild biodiversity. The Dept. of Forest has designated a full fledged post of Principal Chief Conservator of Forest (Wildlife) and *in situ* animal biodiversity conservation programme in Himachal Pradesh is being carried out in the Wildlife Sanctuaries (WLS) and National Parks (NP).
- The Wildlife wing of H.P. Forest Department has undertaken integrated eco-development projects in some Wildlife Sanctuaries and National Parks.
- The Forest Department has embarked upon an extensive programme for restoring degraded habitats of wild animals through large-scale plantation of different species of trees under various schemes, including social and participatory forestry.
- The Pong dam wetland is being managed by the Forest Department under centrally assisted Intensive Management Plan for the improvement and creation of suitable habitats, and nesting and roosting sites for several species of birds. The Government of Himachal Pradesh has also undertaken ecological improvement and restoration of Renuka and Riwalasar wetlands for conservation and propagation their biotic resources.
- The Department of Agriculture is implementing various schemes relating to soil and water conservation of agriculture land in different parts of the state. The departments of Agriculture, Horticulture, Animal Husbandry, Forest and Rural Development have undertaken integrated water shed development programmes in the State.
- Agriculture Department is presently laying emphasis on the use of chemical fertilizers and other chemicals for management of diseases and weeds and introducing high yielding varieties.
- Horticulture Department is popularizing horticulture as profession in the State. Besides, Apple cultivation off-season ornamental plants and cultivation of medicinal and aromatic herbs/plants being encouraged.
- In Animal Husbandry the initiatives include providing veterinary health services, improving low milk yielding cows and buffaloes breeds at Block and Panchayat level and introduction of improved breeds such as Jersey cows, Murrah buffaloes, Marino wool sheep and Angora wool rabbits.
- To improve commercial use of fishery the fishermen have taken initiatives for reservoir harvests from Gobindsagar, Chamera and Pong Dam lakes through promotion of trout farming and through development of aquaculture in the running water for which Fish farmer Development Agency has been constituted

### **Strategies and Actions for Conservation of Biodiversity**

Major issues and gaps in the field of biodiversity have been identified and measures are proposed to fill the gaps by outlining Strategies and Actions related to various themes, which are as follows:

<b>1. Wild Floral and Faunal Diversity</b>					
<b>S. No.</b>	<b>Issues/Gaps</b>	<b>Strategies</b>	<b>Action</b>	<b>Responsibility</b>	<b>Time Frame</b>
1.	Lack of adequate information/data regarding status of biodiversity in the state	<ul style="list-style-type: none"> <li>• Develop databases and make available in the public domain</li> <li>• Establishment of biodiversity sample plots/areas for long term monitoring and data collection</li> </ul>	<ul style="list-style-type: none"> <li>• All concerned departments to compile available information and make available on-line</li> </ul>	<ul style="list-style-type: none"> <li>• SCSTE</li> <li>• HPFD</li> <li>• AD</li> <li>• HD</li> <li>• Fisheries Deptt.</li> <li>• Universities/Institutes</li> </ul>	5 years
2.	Lack of adequate coordination and cross-sectoral exchange of information and data concerning biodiversity	<ul style="list-style-type: none"> <li>• Ensure that data concerns and action regarding biodiversity conservation are available to all agencies and key actors/sectors</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a nodal agency for collection, compilation and dissemination of all biodiversity related data/information</li> </ul>	<ul style="list-style-type: none"> <li>• SCSTE</li> <li>• HPFD</li> <li>• Universities</li> </ul>	Ongoing
3.	There is a general lack of expertise within the state for identification of wild flora and fauna	<ul style="list-style-type: none"> <li>• Develop capacity within scientists and researchers in state to take up taxonomic study/research related to wild biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Strengthen taxonomy departments in Universities/Research Institutes</li> <li>• Sponsor taxonomic research on wild biodiversity</li> <li>• Support scholars taking up animal and plant taxonomy in Universities/Institutes</li> </ul>	<ul style="list-style-type: none"> <li>• SCSTE</li> <li>• ED</li> <li>• HPFD</li> <li>• AD</li> <li>• HD</li> <li>• Fisheries Deptt.</li> <li>• AH Deptt.</li> <li>• Universities/Institutes</li> </ul>	5 years
4.	Current conservation efforts focus only on macro flora and fauna – lower animals and plants are ignored	<ul style="list-style-type: none"> <li>• Extend focus to lower animals and plants as also to micro flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>• Initiate studies on status and vulnerability of lower animals and plants and draw up plans for their conservation</li> </ul>	<ul style="list-style-type: none"> <li>• SCSTE</li> <li>• Universities</li> <li>• ZSI</li> <li>• BSI</li> </ul>	5 years
5.	Inadequate provision of funds for conservation of undomesticated biodiversity	<ul style="list-style-type: none"> <li>• Acknowledge biodiversity conservation as a priority sector and earmark a specific percentage of budget for such schemes</li> </ul>	<ul style="list-style-type: none"> <li>• Departments engaged in land based activities to include schemes for biodiversity conservation in their plans and seek state/CSS funding</li> <li>• State to earmark adequate budget for biodiversity conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Planning Deptt.</li> <li>• Finance Deptt.</li> <li>• HPFD</li> <li>• AD</li> <li>• HD</li> <li>• Fisheries Deptt.</li> <li>• AH Deptt.</li> <li>• Universities/Institutes</li> </ul>	Ongoing
6.	Inadequate involvement of stakeholders while	<ul style="list-style-type: none"> <li>• Inform, train and encourage local communities to voice</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of stakeholders</li> <li>• Hold awareness/</li> </ul>	<ul style="list-style-type: none"> <li>• HPFD</li> <li>• Planning Deptt.</li> <li>• Land Use Board</li> </ul>	Ongoing

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
	formulating policies and legislations relevant to biological diversity	their concerns and actively participate in planning and strategy formulation	training workshops at various levels ● Adopt PFM process in all planning and policy formulation activities		
7.	Education and awareness programmes regarding biodiversity are restricted to schools, colleges and Institutions in urban areas only	<ul style="list-style-type: none"> <li>● Extend such programmes to all communities, particularly in rural areas</li> <li>● Include chapters on biodiversity in school curricula</li> </ul>	<ul style="list-style-type: none"> <li>● Revise curricula to include chapters on importance of biodiversity</li> <li>● Hold workshops, seminars, meetings on regular basis at panchayat and block level</li> <li>● Train stakeholders to adopt measures for conservation of local biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>● ED</li> <li>● HPFD</li> <li>● SCERT</li> </ul>	5 years
8.	Human -Wildlife conflict resolution	<ul style="list-style-type: none"> <li>● Extend education and awareness amongst villagers regarding importance of wildlife conservation and how to avoid conflict</li> </ul>	<ul style="list-style-type: none"> <li>● Formulate clear cut policy and guidelines related to extension of human activities in forest/wildlife habitats</li> <li>● Initiate studies on modified wild animal behaviour</li> <li>● Review existing policies relating to management of wildlife populations in the state</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> </ul>	5 years
9.	Need for identification and maintenance of biodiversity 'hotspots' and heritage sites in the state	<ul style="list-style-type: none"> <li>● Wetlands, grasslands, special habitats to be identified and declared nature heritage sites</li> </ul>	<ul style="list-style-type: none"> <li>● Identify 'hotspots'</li> <li>● Carry out status surveys</li> <li>● Amend existing legislation, if necessary, to protect such areas for posterity</li> </ul>	<ul style="list-style-type: none"> <li>● Planning Deptt.</li> <li>● SCSTE</li> <li>● HPFD</li> </ul>	5 years
10.	Lack of adequate facilities for <i>ex situ</i> propagation and reintroduction of fast depleting wild flora and fauna in the state	<ul style="list-style-type: none"> <li>● Create/strengthen facilities for <i>ex situ</i> conservation and reintroduction of endangered flora and fauna</li> </ul>	<ul style="list-style-type: none"> <li>● Create nurseries/ captive breeding facilities in various agro-climatic and ecozones in the state</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> <li>● A D</li> <li>● HD</li> <li>● Universities/Institutes</li> <li>● NBPGR</li> <li>● NBAGR</li> </ul>	Ongoing
11.	No information available on impact of developmental projects on floral and faunal diversity and also their tolerance to various pollutants	<ul style="list-style-type: none"> <li>● Such studies to form essential component of impact assessment prior to approval for establishment of industries in the state</li> </ul>	<ul style="list-style-type: none"> <li>● Take up scientific studies on these aspects</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● SPCB</li> <li>● Universities</li> </ul>	Ongoing



<b>2. Farming and Biodiversity</b>					
<b>S. No.</b>	<b>Issues/Gaps</b>	<b>Strategies</b>	<b>Action</b>	<b>Responsibility</b>	<b>Time Frame</b>
1.	Lack of understanding of traditional farming practices leading to erosion of agro-biodiversity in all agro-climatic zones	<ul style="list-style-type: none"> <li>● To sensitize farmers, planners/ administrators and extension workers</li> <li>● Stakeholders should participate in the planning process</li> </ul>	<ul style="list-style-type: none"> <li>● Documentation of traditional farming practices and indigenous knowledge related to agro-biodiversity</li> <li>● Creation of awareness through workshops, group meetings and trainings</li> <li>● Encourage on farm conservation of traditional crops</li> <li>● Maintain gene banks of traditional agro-biodiversity on Govt. farms</li> <li>● Economic evaluation of agro-biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>● NBPGR</li> <li>● SAUs</li> <li>● NGOs</li> <li>● PRIs</li> <li>● Local Communities</li> </ul>	Within 5 years
2.	Intangible values do not figure in the planning process	<ul style="list-style-type: none"> <li>● Economic values of biodiversity, tangible and intangible, should form an integral part of all planning processes</li> </ul>	<ul style="list-style-type: none"> <li>● Listing of all the values</li> <li>● Economic assessment of the values</li> <li>● Integration into project/programme process</li> </ul>	<ul style="list-style-type: none"> <li>● NBPGR</li> <li>● SAUs</li> <li>● AD</li> </ul>	Ongoing
3.	Lack of adequate information on the vulnerability of communities to biodiversity change	<ul style="list-style-type: none"> <li>● To assess the impact of biodiversity change</li> <li>● Develop an index of community sensitivity to biodiversity change</li> </ul>	<ul style="list-style-type: none"> <li>● To identify communities that are most vulnerable to biodiversity loss/change.</li> <li>● Classify them as per the community sensitivity index</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● SAUs</li> <li>● NGOs</li> </ul>	Within 5 years
4.	Lack of incentives for the conservation of on farm biodiversity	<ul style="list-style-type: none"> <li>● Provide policy/legal provisions to encourage conservation of on farm biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>● Evaluation of existing legal framework</li> <li>● Lay down policy/legal guidelines</li> <li>● Provide incentives/disincentives</li> </ul>	<ul style="list-style-type: none"> <li>● DoE</li> <li>● SCSTE</li> <li>● ADs</li> </ul>	5 years
5.	Lack of policies for compensation for loss of agro-biodiversity due to development activities viz. roads, dams, industries etc	<ul style="list-style-type: none"> <li>● Develop policy and guidelines for users to compensate for loss of biodiversity on Govt. as well as private lands</li> <li>● Lack of policies on disincentives to those who damage/pollute biodiversity directly or indirectly</li> </ul>	<ul style="list-style-type: none"> <li>● Impact assessment and valuation of diversity-diversity loss</li> <li>● Standardization of norms for fixing compensation</li> </ul>	<ul style="list-style-type: none"> <li>● All Deptts.</li> </ul>	Ongoing

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
6.	Lack of effective market mechanism for diverse agriculture produce	<ul style="list-style-type: none"> <li>● Develop local markets for traditional produce (local crops)</li> </ul>	<ul style="list-style-type: none"> <li>● Strengthen co-operative mechanism for production and marketing</li> <li>● Create facilities for procurement of traditional farm produce</li> <li>● State level PDS should procure and distribute the produce</li> </ul>	<ul style="list-style-type: none"> <li>● Univ.</li> <li>● AD</li> <li>● HD</li> <li>● Civil Supplies</li> </ul>	
7.	Inadequate exploitation of available water resources for irrigation	<ul style="list-style-type: none"> <li>● To improve irrigation facilities</li> </ul>	<ul style="list-style-type: none"> <li>● Develop technologies for rain harvesting</li> <li>● Provide trainings to farmers</li> <li>● Evolve a scheme for rain water harvesting</li> </ul>	<ul style="list-style-type: none"> <li>● IPH,</li> <li>● AD</li> <li>● HD</li> </ul>	5 years
8.	Lack of grazing policy	<ul style="list-style-type: none"> <li>● Grazing policy should be enunciated with involvement of stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>● Study existing grazing practices and pressures and also the problems</li> <li>● Initiate consultation process with stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> <li>● SAUs</li> <li>● AH</li> </ul>	5 years
9.	Exotic weeds, namely Lantana camara, Ageratum, Eupatorium and Parthenium are spreading rapidly in agriculture lands	<ul style="list-style-type: none"> <li>● Create awareness amongst the stakeholders</li> <li>● Develop and demonstrate technology for control of the weeds</li> <li>● Explore use of the weeds for income generation</li> </ul>	<ul style="list-style-type: none"> <li>● Organise group meetings, workshops for the stakeholders</li> <li>● Prepare education/publicity material for use of common stakeholders</li> <li>● Provide training to the stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>● AD</li> <li>● SAUs</li> <li>● UHF</li> <li>● AH</li> <li>● PRIs</li> <li>● NGOs</li> <li>● Mahila Mandals</li> </ul>	10 Years
10	Agro-biodiversity based cottage/small industries not receiving state recognition	<ul style="list-style-type: none"> <li>● Recognition of agro-based cottage Industries by the govt.</li> <li>● Frame policy for agro-based cottage industries/jobs</li> <li>● Inventory of agro-based cottage small industries in the state</li> </ul>	<ul style="list-style-type: none"> <li>● Initiate formulation of policy for recognition and popularisation of environment friendly agro-based cottage/small industries</li> <li>● Prepare an inventory for establishment of agro-based cottage/small industries</li> </ul>	<ul style="list-style-type: none"> <li>● AD</li> <li>● Ind. Deptt.</li> </ul>	Ongoing
11.	Genetic erosion/loss of traditional crops/varieties/old land races of various agri-	Conservation ( <i>Ex situ</i> and <i>In situ</i> ) of traditional crops/varieties/old land races	<ul style="list-style-type: none"> <li>● Collection</li> <li>● Ex situ i.e. conservation in the National Gene Bank</li> </ul>	<ul style="list-style-type: none"> <li>● NBPGR</li> <li>● AD</li> <li>● HD</li> <li>● SAUs</li> </ul>	Five years

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
	horticultural crops in the state	for diversification and food and nutritional security	<ul style="list-style-type: none"> <li>● On-farm conservation (cultivation) at farmers fields</li> <li>● Creation of Gene Parks in farms of SAUs and Departments</li> <li>● Value addition</li> <li>● Awareness generation on food and agriculture value</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● PRIs and Mahila Mandals</li> <li>● HPMC</li> <li>● Dept. of Tourism</li> <li>● GBPIHED</li> <li>● NGOs</li> </ul>	
12.	Inadequate information on useful wild edible food and fruit plants	Inventorisation and evaluation (nutritional and medicinal) of useful wild edible food and fruits	<ul style="list-style-type: none"> <li>● Collection of ethno-botanical information</li> <li>● Preparation of inventory</li> <li>● Chemical evaluation for food and nutritional properties</li> <li>● Generation of literature on awareness (particularly in local language)</li> <li>● Development of museums and herbaria for knowledge of a common man</li> </ul>	<ul style="list-style-type: none"> <li>● AD</li> <li>● HD</li> <li>● SAUs</li> <li>● NBPGR</li> <li>● Education Institutions</li> <li>● PRIs and Mahila Mandals</li> <li>● NGO's</li> </ul>	Ongoing
13.	Changes in Land use pattern and traditional farming systems	Optimization of traditional and modern agriculture	<ul style="list-style-type: none"> <li>● Bio-fertilizer use to be popularized</li> <li>● Optimum use of chemical in agriculture and horticulture</li> <li>● Organic farming to be encouraged</li> <li>● Orientation of farmers through extension agencies</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● SCSTE</li> <li>● AD</li> <li>● HD</li> <li>● ICAR institutes</li> <li>● NGOs</li> </ul>	On-going
14.	Farmers inclination for monoculture	Diversification of agri-horticultural crops base in order to achieve sustainability	<ul style="list-style-type: none"> <li>● Revival of traditional crops</li> <li>● Commercialization of lesser known economic plants</li> <li>● Introduction of new crops and varieties</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● AD</li> <li>● HD</li> <li>● NBPGR</li> <li>● IHBT</li> </ul>	Five years
15.	Inadequate information on wild relatives of crop plants	<ul style="list-style-type: none"> <li>● Documentation and bio-mapping of wild species of crop plants</li> <li>● Conservation of wild species</li> <li>● Utilization of wild species in research programmes</li> </ul>	<ul style="list-style-type: none"> <li>● Survey and collection</li> <li>● Preparation of inventory and bio-mapping</li> <li>● Multiplication and evaluation</li> <li>● <i>Ex situ</i> and <i>in situ</i> conservation</li> <li>● Utilization of wild species in crop improvement programmes</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● NBPGR</li> <li>● IARI</li> <li>● ICAR</li> <li>● PRIs</li> <li>● FD</li> <li>● GBPIHED</li> </ul>	Five years

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
16.	Inadequate information on traditional food recipes	Documentation of food practices and traditional recipes	<ul style="list-style-type: none"> <li>• Documentation of information on preparation and use local recipes</li> <li>• Commercialization through value addition</li> <li>• Patenting of traditional recipes</li> </ul>	<ul style="list-style-type: none"> <li>• SAUs</li> <li>• SCSTE</li> <li>• IGRMS, Bhopal</li> <li>• Health Deptt</li> <li>• Dept of Ayurveda</li> <li>• NGO's</li> <li>• Mahila Mandals</li> <li>• Tourism</li> </ul>	Five years
<b>3. Aquatic Biodiversity</b>					
S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Inadequate data on aquatic life (macro and micro organisms) and rare and unique species in temperate lakes and streams	<ul style="list-style-type: none"> <li>• Initiate studies to document and catalogue rare and unique species in temperate lakes and streams</li> </ul>	<ul style="list-style-type: none"> <li>• Formulate research projects.</li> <li>• Carry out studies to identify existing variegated aquatic forms in the state</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries Deptt.</li> <li>• HPKVV</li> <li>• HPU</li> <li>• SCSTE</li> </ul>	5 years
2.	Danger to aquatic resources due to Developmental activities	<ul style="list-style-type: none"> <li>• Policy on development should be in consonance with conservation of aquatic life</li> </ul>	<ul style="list-style-type: none"> <li>• Review of existing legal framework</li> <li>• Evolve policy, legal guidelines</li> <li>• Identify sensitive areas for taking up remedial measures</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries Deptt.</li> <li>• SCSTE</li> <li>• HPU</li> <li>• MPP and Power</li> <li>• HPFD</li> </ul>	Ongoing
3.	Ineffective implementation of laws relating to aquatic pollution	<ul style="list-style-type: none"> <li>• Strengthening/ Establishment of effective mechanism for enforcement of legal provisions</li> </ul>	<ul style="list-style-type: none"> <li>• Creation of awareness</li> <li>• Creation of multi-disciplinary task force</li> <li>• Strict enforcement of laws</li> <li>• Regular monitoring</li> <li>• Streamline legal framework</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries Deptt.</li> <li>• SCSTE</li> </ul>	Ongoing
4	Illegal and/or unscientific fishing practices	<ul style="list-style-type: none"> <li>• Create awareness amongst the stakeholders</li> <li>• Enforce existing laws strictly</li> </ul>	<ul style="list-style-type: none"> <li>• Production of literature for creating awareness</li> <li>• Strengthening legal framework and implementation mechanism</li> <li>• Creation of awareness among stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Fisheries Deptt.</li> <li>• HPU</li> <li>• SCSTE</li> <li>• PRIs</li> <li>• NGOs</li> </ul>	Ongoing
5	Danger to existing indigenous fauna and aquatic ecosystem due to the introduction of numerous exotic species	<ul style="list-style-type: none"> <li>• Develop policy guidelines on introduction of exotics in aquatic systems in the state</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct impact evaluation studies on introduced species vis-à-vis indigenous fauna</li> <li>• Develop issue guidelines</li> </ul>	<ul style="list-style-type: none"> <li>• HPU</li> <li>• Fisheries Deptt.</li> </ul>	Ongoing

<b>4. Health and Biodiversity</b>					
<b>S. No.</b>	<b>Issues/Gaps</b>	<b>Strategies</b>	<b>Action</b>	<b>Responsibility</b>	<b>Time Frame</b>
1.	Inadequate information regarding relationship between health and biodiversity, and its status	<ul style="list-style-type: none"> <li>● Agro-climatic zones base survey, assessment and publicize biodiversity resources related to health</li> </ul>	<ul style="list-style-type: none"> <li>● Develop IEC education activities/ programmes</li> <li>● Train personal on IEC</li> <li>● Develop publicity/ education material</li> <li>● Create bio-resource database</li> </ul>	<ul style="list-style-type: none"> <li>● Ayurveda Deptt.</li> <li>● UHF</li> <li>● IHBT</li> <li>● NGOs</li> <li>● PRIs</li> </ul>	5 years
2.	Inadequate co-ordination and adoption of appropriate technologies for propagation and conservation of health related bioresources	<ul style="list-style-type: none"> <li>● Popularize cultivation of plants/ herbs related to health</li> <li>● Standardization of package of practices for farming</li> <li>● Identification of nodal agencies for coordination</li> </ul>	<ul style="list-style-type: none"> <li>● Establish herbal gardens/ demonstration plots/ farms/nurseries</li> <li>● Develop package of practice on medicinal plants</li> <li>● Declare Medicinal Plant Board as Nodal Agency for coordinated action plan</li> </ul>	<ul style="list-style-type: none"> <li>● IHBT</li> <li>● UHF</li> <li>● R&amp;D Institutions</li> <li>● NGOs</li> <li>● Ayurveda Deptt.</li> </ul>	Ongoing
3.	Lack of adequate genuine planting material, R&D activities and extension in the field	<ul style="list-style-type: none"> <li>● Encourage mass production of germplasm</li> <li>● Strengthen R&amp;D on biodiversity related to health.</li> </ul>	<ul style="list-style-type: none"> <li>● Train farmers in nursery practices, maintenance and mass production of medicinal plants</li> <li>● Involve R&amp;D sectors of different Institutions</li> </ul>	<ul style="list-style-type: none"> <li>● UHF</li> <li>● Ayurveda Dept.</li> <li>● IHBT</li> </ul>	Ongoing
4.	Lack of incentives for cultivation of medicinal herbs/plants	<ul style="list-style-type: none"> <li>● Provide financial and marketing support to growers</li> </ul>	<ul style="list-style-type: none"> <li>● Making arrangement for easy financing</li> <li>● Provide subsidized inputs to farmers</li> </ul>	<ul style="list-style-type: none"> <li>● Ayurveda Dept.</li> <li>● SAU</li> <li>● UHF</li> </ul>	Ongoing
5.	Inadequate drug standardization and quality control	<ul style="list-style-type: none"> <li>● Standardize and assure quality control of medicines and food products based on biological resources</li> </ul>	<ul style="list-style-type: none"> <li>● Develop standards for extraction, manufacturing procedure/practices and value addition</li> <li>● Assure genuineness and purity of biological raw material</li> <li>● Strengthen R&amp;D institutions and Ayurvedic pharmacies at Jogindernagar and Majra</li> <li>● Implement GMP and GLP</li> </ul>	<ul style="list-style-type: none"> <li>● UHF</li> <li>● IHBT</li> <li>● Ayurveda Dept.</li> <li>● HPU</li> </ul>	Ongoing
6.	Inadequate markets for cultivated biological resources	<ul style="list-style-type: none"> <li>● To assess the actual and future demand of bio-resources (Domestic as well as Global)</li> <li>● To establish and strengthen buy back arrangement.</li> </ul>	<ul style="list-style-type: none"> <li>● Identify demand pattern of Drug Industries (Domestic as well as Global)</li> <li>● Develop extraction, semi-processing, value addition, manufacturing processes of medicines and food supplements based on biological resources</li> </ul>	<ul style="list-style-type: none"> <li>● MPB</li> <li>● NGOs</li> <li>● SAUs</li> </ul>	Ongoing

<b>5. Livelihoods, Culture, Economic Valuation, Awareness and Biodiversity</b>					
<b>Economic Valuation</b>					
<b>S. No.</b>	<b>Issues/Gaps</b>	<b>Strategies</b>	<b>Action</b>	<b>Responsibility</b>	<b>Time Frame</b>
1.	There is no proper understanding of traditional farming systems	<ul style="list-style-type: none"> <li>Understand and assess the temporal and spatial movement of genes and varieties into and out of the cropping system</li> </ul>	<ul style="list-style-type: none"> <li>Initiate studies on traditional farming systems of high altitude regions/ mountains</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>NGOs</li> <li>Local communities</li> </ul>	5 years
2.	No information base of traditional ecosystems in marginalized tribal/ remote areas	<ul style="list-style-type: none"> <li>Create understanding of biological resources and the human use of agro-biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Study and document traditional practices in marginalized/remote tribal area for integrating social, cultural and economic aspects including the food habits, climate and available crop plant species</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>HPU</li> <li>SCSTE</li> </ul>	5 years
3.	People are totally ignorant of the value of genetic resources available with them	<ul style="list-style-type: none"> <li>Create awareness among farmers and potential industrial users of the genetic resources about the economic importance of biodiversity and genetic resources conservation</li> </ul>	<ul style="list-style-type: none"> <li>Launch an extensive awareness programme at the block level about the economic importance of genetic resources, and their conservation</li> </ul>	<ul style="list-style-type: none"> <li>AD</li> <li>HD</li> <li>HPFD</li> <li>AH Deptt.</li> <li>SAUs/</li> <li>Research Institutes</li> <li>SCSTE</li> <li>NGOs</li> </ul>	On going
4.	Limited documentation of traditional wisdom	<ul style="list-style-type: none"> <li>Recognise and document traditional ethos and wisdom</li> </ul>	<ul style="list-style-type: none"> <li>Field surveys</li> <li>Documentation and publication of indigenous knowledge</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>Ayurveda Dept.</li> <li>CSIR</li> <li>SCSTE</li> </ul>	5 years
5.	No weightage given to regional assessment and time horizons as important considerations for biodiversity valuation	<ul style="list-style-type: none"> <li>Provide for comprehensive, adequate and representative system of biodiversity valuation through regional assessments</li> <li>Recognition to ethnically diverse mountain societies through economic assessment</li> </ul>	<ul style="list-style-type: none"> <li>Conduct regional assessments</li> <li>Conduct ethnically diverse community based assessments</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>SCSTE</li> <li>NGOs</li> <li>Mahila Mandals</li> <li>Local communities</li> </ul>	5 years
6.	Lack of peoples participation in understanding the valuation process	<ul style="list-style-type: none"> <li>Involve small farmers, nomadic graziers, pastoralists/ progressive farmers, etc. having different interests in effective valuation of mountain biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Document views of specific communities, groups, individuals and other custodians of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>SCSTE</li> <li>NGOs</li> <li>Agri Deptt.</li> <li>Horti. Deptt.</li> <li>HPFD</li> <li>AH Deptt.</li> </ul>	On going

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
7.	Lack of valuation of impact of development projects on biodiversity	<ul style="list-style-type: none"> <li>● Include value of the biodiversity threatened due to the development activities in the project cost and assess the loss in terms of their impact</li> </ul>	<ul style="list-style-type: none"> <li>● Studies to be conducted on threatened plant and animal diversity, unique sites/habitats which are driven to extinction by public projects</li> <li>● Develop norms for valuing such losses</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> <li>● SCSTE</li> <li>● PCB</li> <li>● SAUs</li> <li>● FRI</li> </ul>	On going
8.	<p>Social expectations and needs from the forest ecosystems are not clearly identified.</p> <p>Traditional forestry and biodiversity conservation has focus on economic objectives only.</p>	<ul style="list-style-type: none"> <li>● Consider wider range of values and needs like commodity, amenity, environment quality, ecological, public use, spiritual and health heritage</li> </ul>	<ul style="list-style-type: none"> <li>● List social expectations from forests</li> <li>● Set priorities based on recognized ecological realities and expectations of all stake holders</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> <li>● SAUs</li> <li>● NGOs</li> <li>● Local bodies</li> </ul>	5 years
9.	Limited information on the community sensitivity/vulnerability to changing biodiversity	<ul style="list-style-type: none"> <li>● Seek to develop an index of community sensitivity to change based on social indicator analysis</li> </ul>	<ul style="list-style-type: none"> <li>● Identify communities that are more vulnerable to change in biodiversity due to their close linkages</li> <li>● Develop an index of community sensitivity to change based on social indicator analysis</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● AD</li> <li>● HD</li> <li>● HPFD</li> <li>● AH Deptt.</li> </ul>	5 years
10.	Absence of effective legal and regulatory framework along with provision of incentives for biodiversity valuation	<ul style="list-style-type: none"> <li>● Integrate social, economical and environmental factors for the effective implementation of the legal and regulatory framework</li> </ul>	<ul style="list-style-type: none"> <li>● Develop effective and implementable legal and regulatory framework</li> </ul>	<ul style="list-style-type: none"> <li>● HPU</li> <li>● Law Deptt.</li> <li>● SCSTE</li> </ul>	5 years

### Livelihood and lifestyle

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Limited emphasis on biodiversity based livelihood issues of nomadic graziers	<ul style="list-style-type: none"> <li>● Forest policies to consider livelihood issues of nomadic graziers</li> </ul>	<ul style="list-style-type: none"> <li>● Reformulation of state grazing policies</li> <li>● Protection of rights of nomadic graziers</li> </ul>	<ul style="list-style-type: none"> <li>● HPFD</li> <li>● Revenue Deptt.</li> <li>● SCSTE</li> </ul>	5 years
2.	Excessive exploitation of biodiversity for increased commercial benefits	<ul style="list-style-type: none"> <li>● Policy intervention for rational harvesting and conservation</li> </ul>	<ul style="list-style-type: none"> <li>● Reformulation of policies for rationalizing commercial benefits from biological resources</li> <li>● Public awareness for sustained resource availability</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● HPFD</li> <li>● SAUs</li> <li>● NGOs</li> </ul>	On going

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
3.	Limited recognition to biodiversity based cottage and small-scale industries	<ul style="list-style-type: none"> <li>● Policies needed to promote biodiversity and biodiversity based cottage/small industries</li> </ul>	<ul style="list-style-type: none"> <li>● Policy formulations</li> <li>● Establishment of small-scale biodiversity based industries</li> <li>● Public awareness</li> </ul>	<ul style="list-style-type: none"> <li>● Ind. Deptt.</li> <li>● DBT</li> <li>● SCSTE</li> <li>● SAUs</li> </ul>	5 years
4.	Limited documentation of biodiversity based livelihood activities  Villagers unaware of the need for conservation of biodiversity for sustained livelihood	<ul style="list-style-type: none"> <li>● Documentation of biodiversity based livelihood issues for creating awareness amongst people for conservation of biotic resources</li> </ul>	<ul style="list-style-type: none"> <li>● Inventory of livelihood issues at local level</li> <li>● Creation of awareness regarding need for conservation</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● AD</li> <li>● HD</li> <li>● HPFD</li> <li>● AH Deptt.</li> </ul>	8 years
<b>Culture and biodiversity</b>					
S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Limited information on linkages between culture and biodiversity  Biodiversity and culture studied separately	<ul style="list-style-type: none"> <li>● Integration of biodiversity conservation with underlying cultural entities</li> </ul>	<ul style="list-style-type: none"> <li>● Documentation of information on links between culture and biodiversity</li> <li>● Identification and codification of animal and plant species related to culture</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● SCSTE</li> <li>● Art, Lang. and Culture</li> <li>● NGOs</li> </ul>	8 years
2.	Existing educational curricula lack information on cultural and biodiversity linkages	<ul style="list-style-type: none"> <li>● Cultural and biodiversity linkages to be incorporated in curriculum of schools/ colleges/Universities</li> </ul>	<ul style="list-style-type: none"> <li>● Formulation of policies and provisions to incorporate biodiversity activities in education system</li> <li>● Addition of culture and biodiversity topic in existing curriculum through policy and administrative provisions</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● HPU</li> <li>● SCSTE</li> <li>● ED</li> <li>● SCERT</li> <li>● NCERT</li> </ul>	3 years
3.	Lack of experts and resource persons in the field of culture and biodiversity	<ul style="list-style-type: none"> <li>● Increased participation of ethnic communities in studies and research on the subject</li> </ul>	<ul style="list-style-type: none"> <li>● Identification of ethnic communities with hereditary knowledge of culture and biodiversity linkages</li> <li>● Spread awareness about cultural heritage and biodiversity conservation linkages</li> </ul>	<ul style="list-style-type: none"> <li>● Senior citizens</li> <li>● Cultural organizations</li> <li>● Youth clubs</li> <li>● NGOs</li> <li>● Women's organizations</li> <li>● SCSTE</li> <li>● SAUs</li> </ul>	
4.	Limited efforts for setting up of new sacred groves	<ul style="list-style-type: none"> <li>● Sacred groves to be maintained as sites for conservation of culture related biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>● Identification of sacred groves and biological component</li> <li>● Development of sacred groves through policy interventions</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● HPFD</li> <li>● NGOs</li> <li>● Women Organization</li> <li>● SCSTE</li> </ul>	On going



S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
5.	Inadequate information, awareness and education about the agro-based culture in the State	<ul style="list-style-type: none"> <li>● Create awareness/ understanding among people of importance of traditional agro-based culture</li> </ul>	<ul style="list-style-type: none"> <li>● Sensitization of stakeholders</li> <li>● Documentation of the practices related to agro-based culture</li> <li>● Prepare registers/ directories and maintain them at community/panchayat level</li> </ul>	<ul style="list-style-type: none"> <li>● A D</li> <li>● Art, Lang. and Culture</li> </ul>	5 Years
6.	Traditional knowledge of communities is not utilized	<ul style="list-style-type: none"> <li>● Document and disseminate/promote traditional knowledge</li> </ul>	<ul style="list-style-type: none"> <li>● Identify communities practicing traditional techniques</li> <li>● Document the traditional knowledge</li> <li>● Publicise and propagate the skill/ knowledge amongst other stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>● SAUs</li> <li>● Art, Lang. and Culture</li> </ul>	5 Years
7.	Inadequate documentation/ recognition of sacred groves	<ul style="list-style-type: none"> <li>● Recognize importance of sacred groves in the culture of the people and enunciate a policy for their upkeep</li> </ul>	<ul style="list-style-type: none"> <li>● Prepare inventory of existing Sacred Groves</li> <li>● Encourage establishment of new sacred groves around the places of worship in the villages</li> <li>● Recognise and reward the communities/villages maintaining sacred groves</li> </ul>	<ul style="list-style-type: none"> <li>● FD</li> </ul>	5 Years
8.	Inadequate knowledge about existing systems, folklore and religious beliefs promoting biodiversity conservation	<ul style="list-style-type: none"> <li>● Investigate, document and publicise existing systems, folklore and religious beliefs promoting biodiversity conservation</li> </ul>	<ul style="list-style-type: none"> <li>● Initiate research and documentation</li> <li>● Publicise through newsletters/journals</li> </ul>	<ul style="list-style-type: none"> <li>● Art, Lang. and Culture</li> </ul>	Ongoing

### 6. Policies, Laws and Institutions

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Existing laws and policies in the state are merely ad hoc responses to emerging biodiversity problems	<ul style="list-style-type: none"> <li>● State Biodiversity Policy to be formulated</li> </ul>	<ul style="list-style-type: none"> <li>● Formulate a comprehensive policy aimed at resource conservation, development, sustainable use and benefit sharing</li> </ul>	<ul style="list-style-type: none"> <li>● SCSTE</li> <li>● Planning Deptt.</li> </ul>	5 years

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
2.	Lack of an effective central administrative mechanism at state level to deal with various aspects of bio-resource management and conservation	<ul style="list-style-type: none"> <li>Establish a group of experts to evolve and implement a strategy for biodiversity valuation, management and conservation</li> </ul>	<ul style="list-style-type: none"> <li>Constitute a State Biodiversity Board and local biodiversity committees to ensure conservation of biological resources</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> </ul>	5 years
3.	Inadequate documentation of indigenous knowledge and local traditions related to conservation and use of biodiversity	<ul style="list-style-type: none"> <li>Take up documentation of local customs, traditions and knowledge related to conservation and use of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Conduct surveys and compile information on traditional customs and knowledge</li> <li>Provide legislation to protect indigenous knowledge and recompensate traditional practitioners for its sharing</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> <li>Universities/Institutes</li> <li>ED</li> <li>Ayurveda Dept.</li> <li>Lang., Art and Culture</li> </ul>	5 years
4.	Inadequacy of facilities available for collaborative research on biodiversity matters in the state	<ul style="list-style-type: none"> <li>Develop facilities and encourage biodiversity related research in existing Universities and R&amp;D institutions</li> </ul>	<ul style="list-style-type: none"> <li>Actively encourage collaborative research projects</li> <li>Provide institutional support for such research</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> <li>Universities</li> <li>ZSI</li> <li>BSI</li> </ul>	On going
5.	Policy of protecting wild animals needs review	<ul style="list-style-type: none"> <li>Policy that takes into account avoidance of human-animal conflict to be formulated</li> </ul>	<ul style="list-style-type: none"> <li>Formulate clear cut policy and guidelines related to extension of human activities in forest/wildlife habitats</li> <li>Review existing policies relating to management of wildlife populations in the state</li> </ul>	<ul style="list-style-type: none"> <li>HPFD</li> </ul>	5 years
6.	Stakeholders are not involved while formulating policies and legislations relevant to biological diversity	<ul style="list-style-type: none"> <li>Inform, train and encourage local communities to voice their concerns and actively participate in planning and strategy formulation</li> </ul>	<ul style="list-style-type: none"> <li>Hold awareness/ training workshops at various levels</li> <li>Adopt PFM process in all planning and policy formulation processes</li> </ul>	<ul style="list-style-type: none"> <li>HPFD</li> <li>Planning Deptt.</li> <li>Land Use Board</li> </ul>	On going
7.	Existing laws relating to damage to biodiversity not stringent enough	<ul style="list-style-type: none"> <li>Provide more stringent penalties for causing damage to or loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Review existing laws on the subject</li> <li>Amend laws where necessary</li> <li>Set up mechanism for speedy disposal of violations relating to biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> </ul>	5 years

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
8.	Trade in some plant species is regulated but other lesser known or unknown species also need attention	<ul style="list-style-type: none"> <li>Formulate rules under existing acts to regulate exploitation and trade in all plant and animal species</li> </ul>	<ul style="list-style-type: none"> <li>Review existing laws and rules on the subject</li> <li>Draft new rules where necessary</li> </ul>	<ul style="list-style-type: none"> <li>HPFD</li> </ul>	5 years

### 7. Education, Awareness and Training

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Teachers at primary and secondary level lack requisite skills to relate the existing relevant content of the textbooks with the biodiversity issues	<ul style="list-style-type: none"> <li>Incorporate a module on biodiversity importance and conservation in teacher training programmes</li> </ul>	<ul style="list-style-type: none"> <li>Organize the in-service programmes for the teachers in the teaching methodology with emphasis on biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>ED</li> <li>SCSTE</li> <li>SCERT</li> </ul>	3 years
2.	Inadequate integration of biodiversity with existing botanical information in high school text books	<ul style="list-style-type: none"> <li>Incorporate biodiversity concerns</li> </ul>	<ul style="list-style-type: none"> <li>Integrate biodiversity component in existing high school course curricula</li> </ul>	<ul style="list-style-type: none"> <li>ED</li> <li>SCSTE</li> <li>SCERT</li> </ul>	3 years
3.	Lack of biodiversity theme in co-curricular activities like debates, quiz, essay writing, painting competitions etc.	<ul style="list-style-type: none"> <li>Integrate biodiversity concerns with the co-curricular activities conducted in the schools and colleges</li> </ul>	<ul style="list-style-type: none"> <li>Motivate students by giving incentives to include themes related to biodiversity in their co-curricular activities</li> </ul>	<ul style="list-style-type: none"> <li>ED</li> <li>SCSTE</li> </ul>	5 years
4.	School/College magazines have little information on biodiversity	<ul style="list-style-type: none"> <li>Encourage students to contribute articles in school/college magazines</li> </ul>	<ul style="list-style-type: none"> <li>Conduct awareness campaigns among students</li> <li>Award prizes for best articles</li> </ul>	<ul style="list-style-type: none"> <li>ED</li> <li>SCSTE</li> <li>SAUs</li> <li>HPU</li> </ul>	On going
5.	Non-formal education lacks the contents of biodiversity conservation	<ul style="list-style-type: none"> <li>Encourage maximum community participation in the discussions regarding local flora and fauna</li> <li>Promote community action to protect and enrich biodiversity as a part of the continuing education programme</li> </ul>	<ul style="list-style-type: none"> <li>Develop skills of literacy instructors in initiating community discussions on the biodiversity concerns and integrating them with continuing education</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>SCSTE</li> <li>Gyan Vigyan Samiti</li> </ul>	On going
6.	Limited environmental awareness campaign with emphasis on biodiversity	<ul style="list-style-type: none"> <li>Development of structured publicity programmes</li> </ul>	<ul style="list-style-type: none"> <li>Public awareness campaigns through audio-visual and print media</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> </ul>	On going
7.	Lack of coordination among various organizations undertaking research and extension on biodiversity	<ul style="list-style-type: none"> <li>Coordinate efforts to achieve common objective of biodiversity conservation and use</li> </ul>	<ul style="list-style-type: none"> <li>Organise seminars/workshops at organizational/institution level to share research on biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>SCSTE</li> </ul>	On going

S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
8.	Limited interaction of children with nature	<ul style="list-style-type: none"> <li>Facilitate interaction of children with different forms of life</li> </ul>	<ul style="list-style-type: none"> <li>Field trips to natural surrounding</li> <li>Production of field guides</li> </ul>	<ul style="list-style-type: none"> <li>ED</li> <li>SCSTE</li> <li>HPFD</li> </ul>	On going
<b>8. Animal Husbandry</b>					
S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Loss of local animal genetic resources	Conservation and economic valuation	<ul style="list-style-type: none"> <li>Economic valuation of all the local animal genetic resources</li> <li>On-farm conservation</li> </ul>	<ul style="list-style-type: none"> <li>HPKV</li> <li>Dept. of Animal Husbandry</li> <li>ICAR Institutes</li> <li>NGO's</li> <li>PRIs and CBO</li> </ul>	5 years
2.	Low productivity of local breeds leading to replacement of local strains	Improvement of existing husbandry practices	<ul style="list-style-type: none"> <li>Documentation of reason of low productivity</li> <li>Research and extension of improved practices</li> </ul>	<ul style="list-style-type: none"> <li>HPKV Palampur</li> <li>Dept. of Animal Husbandry</li> <li>ICAR Institutes</li> <li>NGO's</li> </ul>	On going
3.	Vulnerability of wild fauna to communicable diseases from domesticated animals	Effective health management	<ul style="list-style-type: none"> <li>Disease surveillance</li> <li>Veterinary dispensaries at Panchyat level</li> <li>Application of ethno-veterinary knowledge</li> <li>Mandatory vaccination of all live stocks entering forests</li> </ul>	<ul style="list-style-type: none"> <li>Dept. of animal Husbandry</li> <li>NGOs</li> <li>HPKV</li> <li>MoEF</li> <li>SCSTE</li> </ul>	5 years
4.	Low utilization of animal biodiversity for commercial purposes	Promotion of animal produce based industry viz. dairying, poultry, wool, meat, apiary, fishery, piggery, sericulture etc.	<ul style="list-style-type: none"> <li>Encourage cooperative management</li> <li>Imparting technical know-how</li> <li>Financial support</li> <li>Linking of production with market</li> </ul>	<ul style="list-style-type: none"> <li>Dept. of animal Husbandry</li> <li>Financial institution</li> <li>Dept of rural development</li> <li>PRIs</li> <li>Dept. of Industry</li> <li>Marketing boards etc.</li> </ul>	5 years
<b>9. Microbial diversity</b>					
S. No.	Issues/Gaps	Strategies	Action	Responsibility	Time Frame
1.	Inadequate information on microbial diversity	Documentation of microbial diversity in different ecosystems	<ul style="list-style-type: none"> <li>Survey and identification</li> <li>Documentation on fungi, bacterial, algae, virus etc.</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>HPU</li> <li>IHBT</li> </ul>	5 years
2.	Limited knowledge of beneficial microbes	Listing/Evaluation of beneficial microbial diversity	<ul style="list-style-type: none"> <li>Screening and documentation</li> <li>Development of suitable technologies for propagation and utilization</li> </ul>	<ul style="list-style-type: none"> <li>SAUs</li> <li>HPU</li> <li>IHBT</li> <li>SCSTE</li> <li>GBPIHED</li> <li>NBAIM</li> <li>ICFRE</li> </ul>	On going

# Jammu and Kashmir State Biodiversity Strategy and Action Plan

Coordinating Agency: Directorate of Environment and Remote Sensing, Srinagar

Nature's each manifestation is purposeful. Nothing exists without purpose. Nature took millions of years to weave the present day web of life. The variety of climates, soils and habitats have made the existence of different life-forms possible and any change in the basic factors shall jeopardize the existence of Biodiversity i.e. the Diversity of genes, species and ecosystems in the days to come.

Present day pressures of increasing human and livestock population, increasing use of various forms of energy in the industrial and transport sector, overexploitation of bio-resources for the economic gains without caring for their future existence in nature, increasing consumerism and materialistic life-styles are all threatening the existence of Nature's web of life upon which the survival of man depends.

The convention of Biological Diversity which came into force in 1993, makes it mandatory for all the signatory countries to conserve their Biodiversity including the life-support systems under their jurisdiction by preparing and formulating strategies and action plans for the conservation of biodiversity at the national level. As a follow-up of these guidelines, the process of preparation of National Biodiversity Strategy Action Plan (NBSAP) was undertaken by Government of India in 2000. It envisaged the preparation of strategies and Action Plans for all the states and Union territories, Eco-regions, sub-state sites for their ultimate inclusion in the National level NBSAP Document.

The present document encompasses the strategies and Action Plans at the level of state of Jammu and Kashmir. It has established a general framework for the state's policy for conservation and sustainable use of its Biological resources including the management of their life-support systems. The document presents the current status of wild and domesticated biodiversity, identifies the problems and processes leading to the deterioration of biodiversity support systems and their components and formulates guidelines and specific programmes for future action in the field of Biodiversity Conservation. This document is expected to act as a bridge between National level Biodiversity Strategy Action Plan (NBSAP) and state level measures and actions to be adopted by the state government.

The State Biodiversity Strategy Action Plan (SBSAP) document covers both wild and domesticated ecosystems and attempts to collect and present available information on wild and domesticated components of flora and fauna including lower life forms. The document focuses on the issue of conservation and sustainable use of State's Biodiversity and to achieve this, it advocates creation of awareness among all the stakeholders including Governmental departments, Non-Governmental agencies, common masses and tribals, enhancement of a co-operation between various stakeholders at the level of policy formulation and implementation of conservation action plans and creation of mechanisms required to implement Biodiversity Conservation plans for the long-term management and conservation of Bio-resources. The strategy is guided by the cross-sectoral concepts of conservation and sustainable use, participation and co-ordination among all stake holders, gender and equity, planning, education, training and research and economic, legal ethical and cultural issues in relation to conservation of Bio-resources.

A multi-pronged approach as envisaged under the guidelines issued by the Government of India, was adopted for the preparation of this document. The Primary data was collected through interactions, discussions and interviews conducted with various stakeholders including NGO's and academic institutions. The secondary data was collected from M. Phil and Ph. D Thesis of Research Scholars, Research papers and Journals of the Research and Academic Institutions including the published reports of the Government Departments and Agricultural Universities. The document deals with Geographical socio-economic and Political-cum-administrative profile of the state in the Chapter-I. The state of Jammu and Kashmir is hilly and mountainous with three distinct regions of Jammu, Kashmir and Ladakh. The climate, Land use, water-resources and soils vary in all the three regions. The tract lying between River Ravi and Tawi experiences sub-tropical climate whereas the hilly districts of Jammu and almost whole of Kashmir region experiences temperate type of climate. The Ladakh has cold-desert type of climate with scanty rainfall and snowfall.

Ecological profile for both cropland and forest land ecosystems including wetlands and protected areas stands dealt with in Chapter-II. The vegetation of Jammu region varies from sub-tropical to temperate alpine type; that of Kashmir is moist temperate

and moist alpine whereas that of Ladakh is of cold desert type having unique diversity of plants and animals not seen elsewhere in the state.

Out of total geographical area of 222235 sq. kms. Recorded forest area is 20230 sq. kms. and actual forest area is 20433 sq. kms. as revealed in the Digest of Forest Statistics 1996 and Forest Survey of India, 1995. Per capita forest area in three regions of Jammu, Kashmir and Ladakh is about 0.20, 0.34 and 0.02 hectares. Total revenue realized from forest is more than 6000 lakh rupees. Major area under forests fall in the category of Himalayan Moist temperate (44%) and Alpine (28%) forests whereas Himalayan Dry temperate (7%) and sub-tropical dry deciduous (4%) forests cover the least area. Sub-tropical evergreen forests occupy (3%) of the forests and sub-tropical pine forests are (14%). The area under pastures in the region of Jammu and Kashmir is 0.038 ha, 0.086 ha respectively and is almost negligible in Ladakh region. Major wetlands which support unique elements of aquatic flora and fauna are Dal lake, Wular lake, Naranbagh, Anchar lake, Nagin lake, Mansbal lake, Mirgund lake, Shallabugh lake, Haigam lake, Hokersar (in Kashmir), Suriansar, Mansar (in Jammu) Fangong Tso, Tso Marori and Tso kar (in Ladakh). Out of these, Wular lake and Tso-morori lake stand given the status of Ramsar site. Many other Wetlands fall under the Protected areas network.

To protect the existing biodiversity, the state of Jammu and Kashmir has established a network of 3 national parks (one each in the region of Jammu, Kashmir and Ladakh) 14 wildlife sanctuaries (5 in Jammu, 7 in Kashmir and 2 in Ladakh), 13 wildlife reserves (4 in Jammu, 6 in Kashmir and 3 in Ladakh) and 12 wetland reserves (5 in Jammu, 6 in Kashmir and 1 in Ladakh) constituting an area of 15781 sq. kms. which is about 7% of the total geographical area in the state.

For *ex situ* conservation of Biodiversity, few Botanical Gardens, Herbal gardens and Floricultural parks and Green belts have been set up where in addition to various exotic ornamental varieties of plants, many indigenous wild plants of ornamental and medicinal value stand introduced. Mughal Gardens of Kashmir has a unique assemblage of some of the rare-introductions.

Group wise status of various components of Biodiversity stand described under the IV Chapter. Various taxa of plants and animals reported from the state are new to science. Many species like Hangul, Mountain Goats and Sheep are endemic to the state and have no parallel elsewhere in the country.

The analysis of the various components of state's physical and biological environment reveals that major factors contributing towards degradation of Biodiversity and its life support systems are intensive agriculture with over exploitation of soils, construction of roads and Hydroelectric projects, illegal trade in the animal and plant products, increased urbanization and industrialization have adversely affected the natural habitats and their bio-resources. Although no systemic studies have been carried out on extent of degradation of ecological habitats and the number of species facing threat of immediate extinction if no remedial measures are taken but stray attempts to know the extent of damage reveals the situation is quite alarming. It is estimated that about 80 plant taxa and about 70 animal taxa have already reached the endangered category and many are in the vulnerable status category. Realizing the seriousness, Govt. of Jammu and Kashmir has recently drastically amended the Wildlife Protection Act, Forest Conservation Act and has also passed Forest Protection Act.

The introduction of modern agricultural inputs like hybrid varieties, fertilizers, pesticides, etc. have brought a considerable change in the cropping pattern of various crops under cultivation. Available statistics indicate that area under rice has increased from 196 thousand hectares (1955-56) to 275 thousand hectares (1997-98) which however got decreased to 250 thousand hectares in 1999-2000; area under wheat has increased from 150 thousand ha. (1955-56) to 245 thousand ha. (1999-2000) area under Maize showed increase from 203 thousand ha. (1955-56) to 317 thousand ha. (1999-2000). The area under Jowar cultivation has decreased from 1.00 thousand ha. to 0.006 thousand ha. whereas area under Bajra cultivation showed decrease from 19 thousand ha. to 13.90 thousand ha; 44 to 29.27 thousand ha. respectively but the area under oil seeds has increased from 37 to 75.92 thousand ha. in the corresponding period. Prior to 1975, there existed 14 indigenous varieties of rice, 6 local varieties of wheat, 11 local varieties of maize, 2 local varieties of Bajra, 2 local varieties of sugarcane, 4 local varieties of pulses, 7 local varieties of oil seeds, 13 local varieties of vegetables and 9 local varieties of fruits but presently their cultivation is almost non-existent and much of local germplasm stands lost for ever. Due to impact of modern agricultural practices, traditional varieties were neglected and they got replaced by high yielding varieties. Further, population of domesticated livestock has increased from 3.742 lakh in 1956 to 7.878 lakh in 1997. The native breeds of cattle particularly Goat and Sheep are on the verge of extinction and need to be protected. Double-humped camel of Nobra and Zanskari horse are also facing threat of extinction

The major factors which have contributed towards erosion of wild and domesticated Biodiversity in the state are introduction of hybrid varieties of crops, vegetables and fruits, hybrid breeds of cattle, sheep and goat, indiscriminate use of agrochemicals, promotion of mono-culture cropping and monoculture forestry plantations; large scale urbanization, increase of industrial activity, construction of hydro-electric projects, construction of roads, dams and buildings increase of industrial and vehicular pollution;

increasing consumerism, focus on increasing yield and productivity, lack of people's participation in planning and implementation of development projects.

The Department of Forestry and Wildlife, Agriculture, Horticulture, Animal Husbandry, Fisheries, Industry, Irrigation, Science and Technology, Environment and Remote Sensing, Department of Soil Conservation, State Pollution Control Board, etc. are the major departments which need to shoulder the major responsibility of Biodiversity Conservation in the state. Besides Government Departments, Academic Institutions at the level of university and colleges, Agricultural Universities of Jammu and Kashmir, Non-Governmental Agencies, Industry and Transport Section all religious and ethnic groups particularly the tribal communities dependent directly on forestry resources all need to sensitize about the urgency of Biodiversity Conservation and the role they can play in getting action plans for conservation implemented at the Ground level. The initiatives taken by some Government Departments and NGO's need to further strengthened by getting social, political economical and legal support.

As per available information many gaps exist with regard to inventorisation of Bioresources, documentation of people's indigenous knowledge, implementation of legal provisions of various laws and acts, policy regarding exploitation and management of natural resources like minerals, water resources, medicinal plants, timber, wild life and local threatened germplasm found in Jammu and Kashmir. Many gaps exist with regard to institutional and human capacities for undertaking survey and documentation of local germplasm, implementation of Biodiversity Conservation plans for the priority species and priority areas in all three regions of the state. As on today, there exists lot of inadequacies in information on reproductive Biology of rare and threatened species of plants and animals analysis of problems and pressures which are leading to drastic change in species composition, erosion of rare and threatened taxa, degradation of ecological habitats, economic criteria for evaluation of Bioresources, development of resource efficient technologies, data on going research initiatives and dissemination of biodiversity related data. The proposed strategies to remove the above mentioned gaps regarding of bioresources assessment, conservation and exploitation on a sustainable basis include an inventorisation of existing wild and domesticated biodiversity, fixing criteria for economic evaluation of resources, linking the issues and problems of biodiversity conservation with the developmental plans, developing resource-efficient technologies, formulating sustainable schemes for resource utilization, minimizing the use of agrochemicals, encouraging the cultivation and domestication of local varieties and breeds of plants and animals among farmers and pastoralists, phasing out of exotic varieties and breeds and devising incentives and disincentives for promoting the cause of Biodiversity Conservation. Efforts need to be made to restore the original ecosystems of forests and wetlands and improve their carrying capacity for sustainable utilization of their resources. Critically endangered taxa of flora and fauna need to be preserved in an *ex situ* and *in situ* way of conservation by laying down the necessary infrastructures and making available trained staff with the concerned departments and Research Institutions. Further, to minimize the ill effects of using agrochemicals in our agricultural lands, Integrated Pest Management Schemes involving use of Bio-control agents need to be popularized among the farmers. Cultivation of traditional varieties of cereals, fruits and vegetables alongwith local eco-friendly agricultural practices need to be revived by giving appropriate incentives and devising a social security system by extending insurance to several other crops and vegetables. The problem of excessive production of some crops and almost negligible production of others need to be balanced.

For putting the above mentioned strategies on rails, appropriate action plans need to be drawn and implemented by major Government departments and other stakeholder groups. Inter-departmental co-ordination needs to be strengthened by establishing a Biodiversity Conservation Monitoring Agency under the Department of Forests and Wildlife or Department of Science and Technology. Department of Finance need to provide top priority to Bio-conservation plans in the state. Each developmental plan must have a sizeable amount of funds kept aside for redressing the issues and problems of Biodiversity Conservation. A state level database for existing Biodiversity and available indigenous knowledge need to be prepared and the awareness regarding the Biodiversity issues need to be disseminated with actual data and findings. Mere rituals for celebrating environmental Days, Forestry Days, World Arbour Days, Van-Mohotsavas, Wetland Days can not bring any change at the grass root level, such celebrations need to transform into full-fledged movements where all stake-holders should pool their resources and make these movements result-oriented. Further the guidelines for use and management of Bio-resources and other natural resources including restoration of habitat ecology, *in situ* and *ex situ* conservation for rare and threatened taxa, assessment of Biotic interference on the forests, ways of conserving local germplasm, assessment of unsustainable farming practices, reduction in use of agrochemicals incentives for conservation and promotion of use of Bio-resources on a sustainable basis need to be formulated and implemented without any further delay Institutional, legislative and economic reforms need to be accomplished in response to issue of Biodiversity Conservation in the state. A State Biodiversity Development Authority need to be set-up which can co-ordinate the activities of various departments and other stakeholders for achieving the ultimate goals of Biodiversity Conservation.

For operational implementation of the action plans, it is desirable that each department or stakeholder agency establishes a Biodiversity Unit or Biodiversity Conservation Cell for drawing up the details of these action plans, so that they can be implemented on the ground with full participation of the local people and other concerned agencies.

# Karnataka State Biodiversity Strategy and Action Plan

Coordinating Agency: Chief Secretary, Government of Karnataka, Bangalore through Centre for Ecological Sciences, Indian Institute of Science, Bangalore

## Key Concerns

- Need to focus not just on flagship species, but the entire spectrum of biodiversity
- Need to focus not just on Protected Areas, but the entire landscape and waterscape
- Need to devise a variety of policy instruments, over and beyond regulatory measures
- Need to ensure that biodiversity focussed efforts contribute to the enhancement of quality of life of the broader masses of people, especially including women and the weaker segments of the population - through empowerment; participation in planning, implementation and monitoring; through social recognition; through promoting sustainable livelihoods, through economic incentives
- Need to combine conservation and sustainable use approaches
- Need to ensure cross-sectoral co-ordination
- Need to mainstream biodiversity concerns in the developmental process
- Need to operationalize the "Precautionary Principle"
- Need to operationalize the "Polluter Pays Principle"
- Need to deal with newly emerging challenges such as Intellectual Property Rights(IPR) issues and Genetically Modified Organisms(GMO)

## Strategy and Action Plans

### Strategy I

#### Expanding and improving knowledge of the characteristics, uses and values of biological diversity

- Current understanding very limited in terms of groups of organisms, localities, people- biodiversity interactions including uses, ongoing changes, forces driving changes
- No mechanisms to bring together scientific and folk knowledge
- No mechanisms to monitor on-going changes
- No mechanisms to tackle newly emerging challenges such as spread of novel genes consequent on the release of genetically modified organisms(GMO)
- Tremendous scope to use modern tools of information technology

### Action Plan I

#### Proposed programmes, projects and activities

#### I. A Biodiversity Inventorying and Monitoring Programme

**Project I.A.1** Compilation of a Scientific Inventory

**Project I.A.2** Inventorying and monitoring GMOs

**Project I.A.3** Compilation of Community Based Inventories

**Project I.A.4** Documentation of folk and other public domain knowledge of uses of biodiversity

**Project I.A.5** Identification and Inventory of Biodiversity Indicators of Pollution

**Project I.A.6** Identification and Inventory of Biodiversity Indicators of Habitat Quality

**Project I.A.7** Identification, Inventory and Monitoring of Exotic Invasive Species

**Project I.A.8** Establishment of Herbaria, Museums and Electronic Data Bases

#### I. B Ecosystems Mapping

**Project I.B.1** Satellite imagery based mapping of forest habitats

**Project I.B.2** Satellite imagery based mapping of aquatic habitats

**Project I.B.3** Establishment of a Geographical Information System for ecological habitats

**Project I.B.4** Inter-habitat connectivity studies



### **I. C Socio-Economic Studies Program**

**Project 1.C.1** Documentation of traditional conservation- sustainable use practices

**Project 1.C.2** Studies on social motivation for continuation- revival- forces promoting dissolution of traditional conservation- sustainable use practices

**Project 1.C.3** Documentation of traditional systems of management of knowledge of uses of biodiversity

**Project 1.C.4** Studies on livelihood implications of biodiversity loss

**Project 1.C.5** Studies on health implications of biodiversity loss

**Project 1.C.6** Studies on implications of tenurial arrangements for biodiversity loss

**Project 1.C.7** Documentation of response of people to newly emerging challenges such as IPRs and GMOs

### **I. D.Trends and Forces Driving Biodiversity Change**

**Project 1.D.1.** Documentation of major changes taking place over time and forces driving such changes in the major ecosystems, namely forests, grasslands, arable fields, orchards and plantations, streams and rivers, tanks and lakes, rural and urban habitation

**Project 1.D.2.** Documentation of major changes taking place over time and forces driving such changes in the major biodiversity resources such as medicinal plants, timber and non-timber forest produce, fish and shellfish, waterfowl, larger mammals

## **Strategy II**

### **Enhancing and integrating existing and planned in situ and ex situ biodiversity conservation efforts**

- Current limited coverage of protected areas
- Need to broaden focus to private and revenue lands, to much smaller sites
- Need to focus on all forms of aquatic habitats, fresh-water, estuarine, coastal and open sea
- Need to focus on agro- biodiversity
- Need to focus on micro-organisms

## **Action Plan II**

### **Proposed programmes, projects and activities**

### **II. A. In situ Conservation Programme**

**Project II.A.1** Establishment of supplementary conservation sites in low rainfall tracts

**Project II.A.2** Conservation of Sahyadri Ecologically Sensitive Area

**Project II.A.3** Establishment of conservation sites protecting special habitats

**Project II.A.4** Establishment of marine protected areas

**Project II.A.5** Establishment of estuarine protected areas

**Project II.A.6** Establishment of turtle breeding beaches conservation sites

**Project II.A.7** Establishment of sea bird breeding colonies conservation sites

**Project II.A.8** Establishment of irrigation tanks biodiversity conservation sites

**Project II.A.9** Establishment of Gunduthope tree genetic diversity conservation sites

**Project II.A.10** Establishment of fruit tree genetic diversity conservation sites

**Project II.A.11** Development of medicinal plants conservation areas

**Project II.A.12** Establishment of heronaries conservation sites

**Project II.A.13** Establishment of bat colonies conservation sites

**Project II.A.14** Establishment of on-farm crop genetic diversity conservation sites

**Project II.A.15** Conservation of Sacred Groves

**Project II.A.16** Conservation of Sacred Ponds

**Project II.A.17** Conservation of Sacred Stream and River Stretches

**Project II.A.18** Conservation of Sacred Trees

**Project II.A.19** Conservation of Special Security Areas

**Project II.A.20** Conservation of urban biodiversity

**Project II.A.21** Biodiversity-friendly management of community controlled sustainable use area such as village forests and grasslands

**Project II.A.22** Biodiversity-friendly management of privately controlled woodlands such as soppinabetta, kumki and hadi lands

**Project II.A.23** Control of Exotic Invasive Species

### **II. B Ex situ Conservation Programme**

**Project II.B.1** Establishment of medicinal plants genetic resources centres in degraded forest areas and as avenue plantations

**Project II.B.2** Establishment of medicinal plants genetic resources centres in irrigation tank catchment areas

**Project II.B.3** Establishment of medicinal plants genetic resources development centres

**Project II.B.4** Establishment of Honge (*Pongamia pinnata*) and Neem genetic resources centres;

**Project II.B.5** Conservation of Ficus tree resources through avenue plantations

**Project II.B.6** Upgrading Botanical Gardens, Zoos and Safari Parks

**Project II.B.7** Establishment of fish and shell-fish gene banks

**Project II.B.8** Establishment of cultivated plants genetic resources centres

**Project II.B.9** Biodiversity- oriented urban forestry programmes

**Project II.B.10** Breeding of indigenous livestock, poultry and pet breeds to maintain the animal genetic resources and to make them available to people

### **Strategy III**

#### **Promoting sustainable use of biodiversity resources**

- Need to promote sustainable use of biodiversity resources in the production landscapes and waterscapes
- Need to promote biodiversity friendly management on state and community controlled lands and waters

### **Action Plan III**

#### **Proposed programmes, projects and activities**

- Need to focus on ensuring sustainable and biodiversity friendly patterns of use of living resources such as medicinal plants, timber and non-timber forest produce, fresh water and marine fishes and shell-fishes
- Need to co-ordinate relevant actions pertaining to knowledge base, *in situ* and *ex situ* conservation, policy and legislation, capacity building, education, awareness and communication outlined in various components of the Strategy and Action Plan

**Project III.1** Promoting sustainable utilization of natural populations of medicinal plants

**Project III.2** Promoting sustainable utilization of timber resources

**Project III.3** Promoting sustainable utilization of non-timber forest produce

**Project III.4** Promoting sustainable utilization of fresh-water fish and shell-fish populations

**Project III.5** Promoting sustainable utilization of marine fish and shell-fish populations

### **Strategy IV**

#### **Formulating an integrated policy and legislative framework for the conservation, sustainable use, and equitable sharing of benefits of biological diversity**

- Need to broaden biodiversity conservation efforts, to link them to sustainable use and equitable sharing of benefits

### **Action Plan IV**

#### **Proposed programmes, projects and activities**

**Project IV.1** Injecting biodiversity concerns in the functioning of civic bodies

**Project IV.2** Establishment of State - District - Panchayat level Biodiversity Management Institutions

**Project IV.3** Development of a Realistic System of Economic Instruments such as: Access Fees, Incentives to encourage prudent and Penalties to discourage non-sustainable Utilization of Biological Resources and Biodiversity

**Project IV.4** Incorporating considerations of habitat connectivity and broader spectrum of biodiversity issues in Environmental Impact Assessments

**Project IV.5** Creation of a policy and regulatory framework for the protection of fresh-water biodiversity

**Project IV.6** Creation of a policy and regulatory framework for the protection of coastal and marine biodiversity

**Project IV.7** Creation of a policy, incentives and regulatory framework for the protection of biodiversity on private, community and other non- forest lands and waters

**Project IV.8** Creation of a policy and regulatory framework for joint management in biodiversity rich forest areas and in protected areas

**Project IV.9** Creation of a policy and regulatory framework for management of biodiversity in forest areas

**Project IV.10** Creation of a policy and regulatory framework for *in situ* protection of agro- biodiversity

**Activity IV.1** Policy Advocacy

**Activity IV.2** Formulation of Guidelines on Compensatory Activities to offset Biodiversity Loss

**Activity IV.3** Land Use Planning and Biodiversity Conservation and Integration thereof in the Plans of Concerned Agencies

### **Strategy V**

#### **Strengthening capacities for integrating and institutionalizing biodiversity conservation and management**

- New perspectives and new activities require development of new institutional and human capacities

**Action Plan V****Proposed programmes, projects and activities****V. A Institutional Capacity Programme**

**Project V.A.1** Institutional capacity development for Civic Bodies

**Project V.A.2** Creation of a Geographical Information System data base on boundaries of forest and revenue land holdings

**Project V.A.3** Creation of a satellite imagery based data base on boundaries of Protected Areas

**Project V.A.4** Creation of a satellite imagery based data base on boundaries of wetlands

**Project V.A.5** Creation of a satellite imagery based data base on the coastal zone

**Project V.A.6** Establishment of State and District level Biodiversity Information Systems

**Project V.A.7** Building the capacity to handle IPR issues

**Project V.A.8** Building the capacity of Coast Guards for protection of marine biodiversity resources

**Project V.A.9** Promotion of NGO role in enhancing the quality of functioning of biodiversity management institutions at various levels

**Project V.A.10** Enhancing the quality of Environmental Impact Assessment

**Project V.A.11** Promotion of NGO role in enhancing the quality of Environmental Impact Assessment Exercises

**Project V.A.12** Promotion of NGO role in enhancing the quality of monitoring of pollution Impacts on

biodiversity

**V.B Human Resources Development**

**Project V.B.1** Development of Capacity on Biodiversity Planning: I. Private Sector Stakeholders

**Project V.B.2** Development of Capacity on Biodiversity Planning: II. Government Decision Makers at State, district and village panchayat levels

**Project V.B.3** Development of Capacity on Biodiversity Inventorying and Monitoring: School and College Teachers

**Project V.B.4** Development of Capacity on Biodiversity Inventorying and Monitoring: Government agency personnel

**Project V.B.5** Development of Capacity on Biodiversity Inventorying and Monitoring: Folk ecologists

**Activity V.B.1** Formation of a committee to develop curricula and educational material

**Strategy VI****Mobilizing an integrated information, education and communication system for biodiversity conservation**

- Need to promote biodiversity management as a broad based, participatory activity grounded in a sound base of information; an activity appropriate for the modern biotechnology and information technology age

**Action Plan VI****Proposed programmes, projects and activities****VI.A Biodiversity Conservation Awareness and Information Programme for Local Communities**

**Project VI.A.1** Biodiversity Inventory and Monitoring educational material and training programmes for School and College Teachers and Students

**Project VI.A.2** Community Organizing and Biodiversity Conservation Training for Local Stakeholders

**VI.B Community-Based Biodiversity Conservation Education and Research Program**

**Project VI.B.1** Technical Competency Training on Biodiversity Research and Management Information System

**Project VI.B.2** Establishment of a Pilot Village Biodiversity Research and Management for Biodiversity Information system

**Project VI.B.3** Community Based Development and Management for Biodiversity Education for local Communities

**VI.C Value Added Products and Alternative Sustainable Livelihood Development for Bioresources Dependent Communities**

**Project VI.C.1** Local Capability Building for Development and Management of Biodiversity based Enterprises such as ecotourism

**Project VI.C.2** Local Capability Building for Development and Management of Biodiversity based Enterprises such as collection, cultivation and value addition to medicinal plants

Kbsap.summary of 9th October 2002.

# Kerala State Biodiversity Strategy and Action Plan

Coordinating Agency: Kerala Forest Research Institute, Peechi

## Background

This document on State Biodiversity Strategy and Action Plan (SBSAP) is based on inputs received from several persons including subject experts, members of the Steering Committee and Thematic Working Groups during workshops/meetings/public hearings.

There are **six main Chapters** in the SBSAP.

- The **first** Chapter on Introduction deals with background, scope, objectives, methodology and format of the Report.
- The **second** Chapter provides information on Kerala State's history, physiography, climate, agroclimatic zones, soils, agriculture, irrigation, landuse patterns, developmental programmes, industrial, socio-economic, political fields in relation to biodiversity.
- The **third** Chapter deals with domesticated and wild biodiversity of Kerala State.
- The **fourth** Chapter deals with the causes for the loss of wild and domesticated biodiversity as well as an overview on effectiveness of biodiversity related laws in preventing biodiversity loss.
- The **fifth** Chapter discusses and highlights major initiatives and key actors involved in the conservation of wild and domesticated biodiversity.
- The **sixth** Chapter deals with various strategies and actions under separate issues required for conservation, sustainable use and equitable access and sharing of benefits for both wild and domesticated biodiversity under each Thematic Group.

## Chapter 1. Introduction

This Chapter provides a background including context, scope and approach to the process of SBSAP for Kerala. It covers constitution of a (i) State Steering Committee to provide overall guidance for the whole process and (ii) Formulation of 12 Thematic Working Groups to focus on broad thematic areas of biodiversity so as to play an important role in collecting and synthesizing information, and drawing up draft strategy and action plans.

The information related to the above was gathered through a series of participatory process, involving announcements in media, organizing workshops, meetings, and public hearings in different parts of the State. Information was also gathered through invited articles on specific topics written by experts and eminent personalities. The Chapter also describes the format of the SBSAP. References and annexures referred to in the text are provided of the end.

## Chapter 2. Kerala State – A Profile

The Chapter 2 provides an insight into Kerala's history, physiography, climate, agriculture and land/water use patterns, socio-economics and various developmental activities taken up as influenced by its unique location on the West Coast of peninsular India amidst biodiversity rich Western Ghats. Kerala's typical special geographical position has helped to ensure, to some extent, its political and cultural isolation from the rest of the country and has also facilitated establishment of strong contacts with various foreign countries.

## Chapter 3. Biodiversity Profile of Kerala

This Chapter profiles Kerala's rich biodiversity in six Sections. The first Section (3.1) takes a look at natural ecosystems. Details are provided on the extent of area under various ecosystems and distribution of biodiversity in natural forests, fresh water swamps, mangroves, sacred groves and non-wood resources in natural forests. Various components of wild plant diversity such as marine algae, fungi, flowering plants and mangroves are discussed in Section 3.2. highlighting the immense diversity with each of these groups.

In the Section 3.3. on wild animal diversity, a detailed review on the current status of wild animal diversity in Kerala is given. The subsections 3.3.1. covers wild animals and sections 3.3.2, 3.3.3, 3.3.4 and 3.3.5. on various aquatic biodiversity such as marine biodiversity, inland fishes, biodiversity of bivalves and sponge biodiversity. Agricultural ecosystems and domesticated plant species and varieties are described in Section 3.4.

## Chapter 4. Loss of Biodiversity

Due to degradation of ecosystems due to human population pressure, both the wild and domesticated diversity of Kerala have been adversely affected. This Chapter analyzes the causes for the loss of wild and domesticated diversity in the Sub sections 4.1.1. and 4.1.2. Unsustainable harvesting of forest produce, diversion of forest land for non-forestry purposes, inappropriate management operations, incidence of fire, invasion of exotic weeds, soil erosion and poor regeneration have been identified as the major causes of forest degradation.

Subsections 4.1.1.9. and 4.1.1.10 deal with factors responsible for the loss of biodiversity in wild animals and aquatic ecosystems (better covering both plants and animals) Section 4.1.2. analyzes the loss of domesticated biodiversity both for plants and animals. The major causes for loss of plants biodiversity were conversion of paddy fields for house construction, introduction of plantation crops, invasion of exotic weeds, introduction of hybrids and high yielding varieties which replaced low yielding traditional varieties and mechanized farming and excessive use of synthetic fertilizers, pesticides, weedicides, etc. The loss of domestic animal diversity is ascribed to introduction of exotic high yielding domesticated animals and shift in consumer preference of other animals.

## Chapter 5. Past and Ongoing Initiatives and their Major Actors

Several institutions in Kerala have been carrying out research on various aspects of biodiversity in different ecosystems. This Chapter provides details of some of the major studies/initiatives by these organizations for the sustainable utilization and conservation of wild and domesticated biodiversity. The major organizations involved in this process are Kerala Forests and Wildlife Department, Kerala Agricultural University and five R&D Centres under Kerala State Council for Science, Technology and Environment (KSCSTE). These R&D Centres, which have been conducting excellent research on various aspects of biodiversity could unravel the richness in plant and animal biodiversity especially protected areas for which has been vegetation mapped and floristic inventories have been made. Research highlights/achievements of these organizations clearly indicate past and ongoing initiatives taken by them in understanding the biodiversity of the State.

## Chapter 6. Strategies and Actions

This chapter provides details of strategies and actions required for the sustainable use of conservation and biodiversity which are the main objectives of SBSAP.

There are 12 sections under this chapter each dealing with a Thematic Group. Each section contains a set of broad strategies with specific actions that are required for addressing each issue. In order to implement the programme, indications on possible funding agencies and indicators have been identified. In all, a total of 75 strategies and 190 actions are recommended under 12 Thematic Groups as listed below.

1. Economics and biodiversity: 2 strategies and 5 actions
2. Culture, lifestyles, livelihood, tribals and intellectual property rights: 9 strategies and 37 actions.
3. Health and biodiversity: 14 strategies and 21 actions.
4. Domesticated biodiversity: 6 strategies and 13 actions.
5. Wild animal diversity: 11 strategies and 9 actions.
6. Wild plant diversity: 6 strategies and 18 actions.
7. Micro-organism diversity: 2 strategies and 6 actions.
8. Natural terrestrial ecosystem: 7 strategies and 18 actions
9. Natural aquatic ecosystem: 4 strategies and 11 actions.
10. Policy, laws and institutions: 2 strategies and 14 actions.
11. Education, awareness, training and research: 4 strategies and 29 actions
12. Technology, industry and biodiversity: 8 strategies and 9 actions.

### 6.1. Economics and Biodiversity

#### 6.1.1. Over-exploitation and Degradation of Natural Ecosystems

##### Strategy

1. Generate bio resource accounts and incorporate the environmental value of depletion of bio resources into the national income accounts.

##### Actions

1. Develop simple methodology for valuation.

2. Create awareness among the policy makers and common people regarding prospective value of natural resources through workshops and training programmes.
3. Carry out studies on the market and non-market benefits of the natural resources.

### **6.1.2. Scarce Studies/Research on Biodiversity Valuation**

#### **Strategy**

1. Set up and strengthen appropriate agencies/institutions for promoting biodiversity valuation studies.

#### **Actions**

1. Set up State level committees to work out biodiversity valuation.
2. Set up a district level co-ordination committee of the officers and scientists of concerned departments and Institutions involving of local Panchayats in the biodiversity conservation programme.

## **6.2 Culture, Lifestyles, Livelihood, Tribals and Intellectual Property Rights**

### **6.2.1. Depletion and Degradation of Wild Biodiversity Resources**

#### **Strategies**

1. Identify political, social and economic aspects responsible for the replacement of natural vegetation through unconventional land uses and work out strategies to address them.
2. Recognition of biodiversity conservation as a national objective.
3. Develop a credible plan for economic and fire prevention and management through proper discussion, by expert groups.

#### **Actions**

1. Research on the underlying causes that lead to loss of biodiversity and provide suitable incentives to consent biodiversity.
2. Develop a mechanism for monitoring biodiversity of protected areas and adjacent areas through participatory approach.
3. Implementation of a national biodiversity conservation policy by all ministries, Govt. departments, agencies and institutions including those in the private sector and to integrate biodiversity conservation with natural resource management programmes.
4. Amend town, urban and rural plans so as to ensure natural vegetation along the rivers of streams. No construction should be permitted within a specified distance from the waters edge.
5. Availability of social science research studies, media debates and discussion among stakeholders on ways to reverse depletion and degradation of biodiversity resources.
6. Policy decision to enlarge the area under natural vegetation while strictly conserving the remaining natural forests and wild vegetation.
7. Involve independent agencies at the local, national and international level to actively monitor the threats and actual changes in area under natural vegetation.
8. Documenting all fire incidences in forest areas after proper investigation and prosecute to offenders. Step up initiatives for awareness creation within the community.
9. Effective eradication of weeds through biological and mechanical means after a thorough research on the biology and ecology.
10. Genetic awareness on biodiversity conservation through regular school curriculum, activities of state agricultural department, R&D organizations, agricultural universities, etc. and encourage to practice it in home gardens and farmlands. Commodity boards like rubber, coconut, coffee, spices etc. should be sensitised and reoriented to help promote biodiversity conservation in farmlands.
11. Promote activities of nature clubs particularly in all educational institutions, Government offices, industrial establishments and community organizations. For this, the existing NSS, VSS and NGC may be strengthened. Promote bird watching to convey the message that old trees and hedges permit birds to thrive, which in turn suppress crop pests. Promote awareness regarding biodiversity, environmental conservation, hazards of pollution, etc.
12. A programme to revive the quality of the water bodies such as ponds, streams, rivers, wetlands and their banks. Waste disposal into water bodies to be stopped.

### **6.2.2. Decline in income and status of people depending on biodiversity resources**

#### **Strategy**

1. Participatory research on how best support mechanisms can be provided/created to ensure sustainable utilization of resources and sustainable lifestyles for the population depending on them. Based on the findings, modify current policies and formulate appropriate packages for achieving the above.

**Actions**

1. Sponsor research programmes on the utilization biological resources pattern in relation to the lifestyle of various committees depending on explore means to uplift livelihood of communities dependent on biodiversity.
2. Research on criteria and indicators of sustainable levels of resource use that may not threaten the long-term viability of the resource base.
3. Research on mechanism to provide incentives for sustainable use and effective systems to ensure equitable benefit sharing.
4. Tribal VSS (forest protection committees) to be charged with the responsibility of NWFP collection and management. They must be empowered to make local rules for resource conservation. Programmes for value addition to NWFP to benefit those depending on the resource.
5. Monitor and carry out research on sustainable management of NWFP resources by regulating harvest schedule and by leaving areas for regeneration.
6. Employment creation in rural areas around forests in agriculture and infrastructure development to mitigate the unemployment problem around forests.
7. Enhanced investment in education and health care in rural areas adjoining forests and protected areas to improve awareness of biodiversity conservation and improve employment opportunities and the quality of life of the people.

**6.2.3. Decline in Diversity in Food, Agriculture, Traditional Resource Sharing Systems****Strategy**

1. Traditional knowledge in food, medicine, agriculture, handicrafts, folk arts, traditional resource and information sharing system etc. to be documented and popularized as an alternative and ethnic life style, as a survival tool box, as a window to past and a tourism resource.

**Actions**

1. Legislation to protect the intellectual property rights of indigenous knowledge. For this encourage documentation of tribal medicines and validate claims of effectiveness to get IPR protection. In the present system the national board as a custodian of IPR render benefits inaccessible to the tribals especially in cases of litigation. For this, a state authority would be more appropriate.
2. Biodiversity registers should be prepared and the local community should be given the right to market indigenous items.
3. Documentation and popularization of traditional diversity in lifestyles, food, medicines, handicrafts, folk arts etc.
4. Enhanced funding for documentation and promotion of traditional diversity in culture and lifestyles.
5. Promote of self-help groups and community development initiatives. Support resource and information sharing programmes.
6. Recognize tribal medicine as a branch of indigenous medicine by Government of India. The State government should promote dispensaries of tribal medicine in tribal areas.
7. Introduce legislation to ensure benefits of research in tribal medicine to be used for the uplift to this community. Tribal medical practitioners should be recognized and appointed as teachers to train new generation of practitioners.
8. Artisans and crafts men living on biodiversity resources such as bamboo, reeds, canes, etc. should be supported by marketing this products, providing information on design and through welfare schemes and organization support.
9. In order to protect the livelihood of traditional fishing communities conservation of the fish resource from decline should be attempted.
10. Ensure equitable sharing of benefits arising from the use of resources managed or developed by community.

**6.2.4. Bio Piracy and Commercialization of Traditional Knowledge Including Product Development, Technology and Benefit Sharing****Strategies**

1. Create an awareness among people about the provision of CBD for protecting IPR and also provide awareness on documenting/safeguarding the traditional knowledge.
2. Framing laws and rules for recognizing and rewarding the IPR of local and indigenous communities subject to the proposed biodiversity Act 1999 and protection of plant varieties and farmers right bill 1999.
3. Introducing different kinds of benefit sharing mechanism right from the disclosure of the knowledge to the product development, technology transfer and commercialization.
4. Protection of traditional knowledge by introducing new *sui generis* system.

**Actions**

1. Documenting traditional knowledge in a standard format with safeguarding facilities.

2. Preparation of biodiversity register at Panchayat level.
3. Scientific validation of traditional practices/knowledge.
4. Establishment of digital libraries for disclosing knowledge to the users with a provision for benefit sharing.
5. To introduce benefit sharing mechanism at different levels right i.e., from the time of disclosure of safeguarded knowledge, product development technology transfer and marketing.
6. To standardize all transactions including raw material including its trade and enact legislation to prevent bio piracy by selling live preserved plant and animal materials to unknown outside agencies.
7. List out endemic plants that can be protected through the geographical indicators.
8. Prepare DNA fingerprints of endemic plant species.

### **6.3. Health and biodiversity.**

#### **6.3.1. Scarcity of Raw Drugs for Indian Systems of Medicine and Folklore Medicines**

##### **Strategies**

1. Generate data on annual requirement of raw drugs for Indian and Folklore Systems of Medicine
2. Encourage research on sustainable harvesting and post harvest storage
3. Encourage studies to standardise cultivation practices of medicinal plants, their habitat requirements and marketing
4. Establishment of gene banks of medicinal plants at village level popularising good conservation practice.
5. Introduction of good collection and storage practice for medicinal plants

##### **Actions**

1. Preparation of resource inventory of raw drugs
2. Make it mandatory for the medicine manufacturing units to declare their annual raw drugs requirement
3. Assess the resource, which have become rare or fast depleting.
4. Promote cultivation of medicinal plants in wastelands, homesteads, government lands, forest plantations, etc.
5. Include medicinal plants in "Smirithivanams" raised in memory of National leaders
6. Permit the user agencies to go in for captive breeding of animals of medicinal importance subject to rules and regulation
7. Lack of standardisation of raw drugs and prepared medicines in Indian systems of medicine

#### **6.3.2. Lack of Standardisation of Raw Drugs and Prepared Medicines in Indian Systems of Medicine.**

##### **Strategies**

1. Generate data on raw drugs, which are being substituted.
2. Create awareness among practitioners and public.
3. Encourage raising of medicinal plants plantations by medicine manufacturing units in private lands.
4. Effective implementation of good manufacturing practices
5. Ensure the therapeutic efficacy of raw drugs through pharmacological and clinical studies adopting both principles of traditional systems of medicine and modern methodology

##### **Actions**

1. Establish the correct botanical identity of raw drugs and their phytochemical characterisation.
2. Formulate rules/laws so that only genuine raw drugs can be sold by raw drugs dealers and sellers.
3. Promote pharmacognostic studies of raw drugs

#### **6.3.3 Biopiracy and Commercialisation of Traditional Knowledge**

##### **Strategies**

1. Create awareness among the people about the provisions of convention on Biological Diversity for protecting IPR and the need for documenting traditional knowledge
2. Formulation of laws relating to IPRs and provision of CBD on benefit sharing

##### **Actions**

1. Documenting traditional knowledge in a standardised format
2. Evaluate traditional practices and test their usefulness
3. Preparation of biodiversity register at Panchayat levels



4. Preparation of a Digital Library on traditional knowledge
5. Decline on the use of traditional systems of medicine and food resource among the people

#### **6.3.4 Decline on the use of Traditional Systems of Medicine and Food Resource Among the People**

##### **Strategies**

1. Promotion of traditional food resources among people and their conservation.
2. Introduce and popularise an holistic approach with regard to primary health care linking biodiversity and indigenous knowledge.

##### **Actions**

1. Create awareness among people on traditional systems of medicine and food resources and their importance.
2. Create awareness among the people on the significance of home remedies in primary health care, by providing training on the preparation and use of home remedies
3. Create awareness on pros and cons of GM foods as compared to traditional foods
4. *Ex situ* conservation of traditional food resources
5. Generate data on food resource from communities, which mainly depends on traditional sources.
6. Research to improve cultivation, processing and manufacturing of traditional foods.

### **6.4. Domesticated Biodiversity**

#### **6.4.1. Lack of a comprehensive inventory of domesticated biodiversity**

##### **Strategies**

1. Generate information, at the grass root level on existing as well as extinct breeds and landraces in that particular area/locality/region
2. Collate the information available with different agencies

##### **Actions**

1. Provide required research input to generate new information
2. Agency (ies) to be identified to collate the scattered information

#### **6.4.2. Loss/Near Extinction of Domesticated Biodiversity**

##### **Strategies**

1. Provide incentives to farmers for promoting the use of traditional varieties/breeds
2. Preservation of germplasm of indigenous/traditional varieties/breeds, etc. and conduct studies on them.

##### **Actions**

1. Conduct awareness programmes among school children, farmers, etc. on the significance of conservation of domesticated biodiversity.
2. Demonstration of local traditional agricultural practices in relation to sustainability and conservation of traditional varieties/breeds, etc. at farmers' level.
3. Promote trade of traditional varieties through value addition, thereby creating demand which will balance between HYVs and local land races in terms of sustainable use
4. Provide incentives to farmers for growing traditional varieties/breeds, etc.
5. Sourcing the availability of traditional varieties/breeds, etc.
6. Seeds of rare varieties of plant/native animals to be made available to farmers.
7. Promote both on farm and *ex situ* conservation.

#### **6.4.3. Intensive Monoculture of Selected Crops/Breeds of Animals**

##### **Strategies**

1. Encourage traditional crops with crop/variety combinations along with livestock/fish etc. suited to the different needs of the farmer
2. Any undisturbed natural habitat including sacred groves available around the household to be conserved.

### **Actions**

1. Carry out detailed analysis of the merits of the homesteads in the effective conservation, sustainable management and efficient utilisation of biological resources.
2. Evolve typical homestead type models that are more specific to culture, lifestyle, food habit, resource availability etc.
3. Strengthen efforts to rationally integrate and conserve each component of these systems.
4. Adoption of a farming system incorporating all associated components for conservation, sustainable management and utilisation of all components of these systems.

## **6.5. Wild Animal Diversity**

### **6.5.1. Lack of Adequate and Comprehensive Information on Wild Animals**

#### **Strategies**

1. Generate sufficient information as wild animal diversity at Panchayat/Block/District/State levels.
2. Encourage taxonomic research so as to develop expertise in various animal groups to determine the correct identity of animal species.
3. Inclusion of 'biodiversity' education in the curriculum at school/college/University levels.

#### **Actions**

1. There is an urgent need to prepare inventories on different animal groups.
2. Establish centers of taxonomic studies for various groups of animals.

### **6.5.2. Man-wildlife Conflicts in and Around Protected Areas (PAs)**

#### **Strategies**

1. Create public awareness to avoid human encroachment in wildlife areas.
2. Encourage conservation activities through people's participation to prevent habitat degradation.
3. Adoption of co-ordinated approach to solve controversial problems with representatives of local people/local bodies/forest officials/NGOs.

#### **Actions**

1. Conduct periodic meetings, workshops etc. to increase the awareness of people and to reduce tense situations in vulnerable areas.
2. Further improvement in habitat management of core areas for the survival/feeding of wild animals, so as to reduce their movement to marginal areas in search of food.
3. Sustainable utilization of animal resources as mentioned in the case of wild boar.

### **6.5.3. Lack of Conservation Efforts Outside Protected Areas Such as Revenue Land/Private Land**

#### **Strategies**

1. Motivate the stakeholders by providing adequate incentives to conserve the wild animal biodiversity outside the PAs
2. Establish biodiversity parks/museums with help from local bodies/educational/research institutions
3. Frame or modify laws so as to bring these areas also under the purview of protected areas.

#### **Actions**

1. Bring about better interaction amongst the various governmental departments such as revenue, forests etc.
2. Create public awareness on biodiversity conservation and encourage the local bodies to prepare biodiversity registers of such areas.

### **6.5.4. More Animal Species Becoming Threatened or Endangered**

#### **Strategies**

1. Take adequate measures to improve the habitat
2. Discourage introduction of exotics

#### **Actions**

1. Maintain habitat continuity
2. Detailed studies on impact of exotics on native species

## 6.6. Wild Plant Diversity

### 6.6.1. Lack of Comprehensive Information on Wild Plant Diversity

#### Strategy

1. Prepare a comprehensive inventory of wild plant diversity along with details on species, that need protection

#### Actions

1. Exhaustive surveys, involving population assessment and biological studies, especially for imperfectly known wild plant groups.
2. Consolidation of all available data on wild plant species of the State.
3. Generate details on rare and endangered species with information on the causes of rarity.

### 6.6.2. Loss of Plant Diversity Due to Excessive Exploitation from the Wild

#### Strategy

1. Regulating unsustainable exploitation of wild plant species and their products

#### Actions

1. Gathering details on the availability and growing stock of excessively exploited species.
2. Generating data on natural populations of extremely rare species.
3. Regulations to be framed and executed effectively to check further depletion of natural populations
4. Promoting regeneration, sustainable utilization and research for alternate source species through bio-prospecting

### 6.6.3. Loss of Species and Their Ecosystems

#### Strategy

1. Implementation of species and ecosystem conservation programmes.

#### Actions

1. Identification of wild plant species and their habitats, which require conservation actions.
2. Identification of causes of depletion and strategies to mitigate such negative impacts.
3. Standardization of protocols for the conservation of endangered species and their natural habitats.
4. Execution of effective education programmes to conserve the wild plant diversity of the State, especially on species which deserve protection from people, domestic animals, etc.

### 6.6.4. Loss of Fragile Ecosystems and Specialized Habitats

#### Strategy

1. Execution of micro-level action programmes to save wild plant diversity in specialized habitats like mangroves, strand flora, fresh water lakes, sacred groves, *Myristica* swamps and so on.

#### Actions

1. Generate data on the wild plant contents of fragile ecosystems and develop methodologies to protect them.
2. Initiate location-specific action plans with the involvement of voluntary groups, student community and local plan implementing bodies.
3. Involve researchers as resource persons for the execution of various protection activities.

### 6.6.5. Need for Documentation and Protection of Wild Relatives of Useful Plants

#### Strategy

1. Collection and documentation of data on wild relatives of useful plants

#### Actions

1. Survey and detailed documentation of wild relatives of useful plants.
2. Implementation of suitable conservation programmes to protect them.

### **6.6.6. Lack of Exhaustive and Interactive Information Exchange Mechanism**

#### **Strategy**

1. Organization of a complete, interactive and dynamic database.

#### **Actions**

1. Establishment of a centralized data base on biodiversity under the auspices of State Biodiversity Board.
2. Seek active involvement of research institutions, universities and colleges to provide necessary data and assistance in the region.

### **6.7. Micro-organism Diversity**

#### **6.7.1. Inadequate Information on Micro-organism Diversity in Different Ecosystems**

#### **Strategy**

1. Development of human resources and infra-structure.

#### **Actions**

1. Intensify research on microorganism diversity and develop a database.
2. Establish research centres for studying microorganism diversity and develop expertise in microbial taxonomy
3. Establish national repositories for microbial germplasm

#### **6.7.2. Micro-organism Diversity Under Threat**

#### **Strategy**

1. Protection of environment

#### **Action**

1. Generate basic information on biological and functional diversity of microorganisms.
2. Enhance the knowledge on their ecology, geographical distribution and status.
3. Provide coverage of legal protection to the microorganisms in industry, medicine and agriculture

### **6.8. Natural Terrestrial Ecosystem**

#### **6.8.1. Land Degradation**

#### **Strategy**

1. Development of appropriate land management practices so as to reduce/minimize land degradation.

#### **Actions**

1. Generate information on site-specific landuse planning
2. Create awareness regarding sustainable use of land resources
3. Increase vegetation cover and initiate action for reduction of soil erosion

#### **6.8.2. Degradation of River Basin**

#### **Strategy**

1. Scientific management of river basins.

#### **Actions**

1. Reduce catchment degradation due to uncontrolled and improper landuse, deforestation, grazing, etc.
2. Control of river pollution
3. Regulation of mining activities along river and its environs (sand/clay)
4. Weed control
5. Introduced watershed management practices

### **6.8.3. Issues Related to Ground Water**

#### **Strategy**

1. Sustainable utilization of ground water resources

#### **Actions**

1. Proper and continuous qualitative and quantitative ground water resources evaluation
2. Evolving proper management strategies

### **6.8.4. Pollution**

#### **Strategy**

1. Reduction of environmental pollution by proper management of terrestrial ecosystem

#### **Actions**

1. Create awareness among the public, administrators and planning officials.
2. Enforcement of law against agencies causing pollution.
3. Implement technologies for cleaning up.

### **6.8.5. Coastal Erosion**

#### **Strategy**

1. Coastal zone management

#### **Action**

1. Develop and implement a coastal zone management plan.

### **6.8.6. Unplanned Tourism Development**

#### **Strategy**

1. Promotion of planned tourism

#### **Actions**

1. Develop site-specific tourism policy based on carrying capacity assessment
2. Create public awareness

### **6.8.7. Adverse Impacts of Surface Transport Network**

#### **Strategy**

1. Development of transportation facilities with least adverse impacts

#### **Actions**

1. Long term planning based on systematic terrain evaluation.
2. Alternate transportation systems

## **6.9. Natural Aquatic Ecosystems**

### **6.9.1. Lack of Adequate Knowledge on Freshwater and Marine Biodiversity**

#### **Strategy**

1. To generate and document the required information

#### **Actions**

1. Continuous monitoring of the health status of fauna and flora of the estuarine, marine and freshwater ecosystems
2. Inventory surveys.

### **6.9.2. Loss of Marine and Freshwater Biodiversity**

#### **Strategies**

1. Conserve marine and freshwater biodiversity
2. Mangrove ecosystem should be brought under Protected Area category

#### **Actions**

1. Reclamation of the wetlands should be banned.
2. Develop and implement effective legal measures to prevent wetland reclamation.
3. Stop indiscriminate capture of fish spawners during monsoon.
4. Captive breeding and re-stocking of threatened species.
5. Give top priority to endemic species in aquaculture practices and give appropriate incentives to promote this.
6. Declare mangroves for using as Protected Areas and authorise local bodies for their restoration and management.
7. Ban introduction of exotic aquatic species.
8. Declare bar-mouth areas as no-fishing zones.

### **6.9.3 Inter-State/Eco-regional Problems**

#### **Strategy**

1. Activities/(eco) developmental projects/forestry operations should be viewed on the ground of the ecological disaster/impact on ecosystems that are contiguous in the neighbouring States.

#### **Action**

1. Set up a panel of experts from neighbouring States to advise and to monitor the eco-regional issues.

## **6.10. Policy, Laws and Institutions**

### **6.10.1. Loss in Biodiversity**

#### **Strategy**

1. Strengthen the present legal machinery (laws, enactments etc.) with an emphasis on biodiversity and provide new, wherever necessary in conservation of biodiversity and also implementation at the lower level.

#### **Actions**

1. Amend forest acts and laws to suite the present conditions and demands (Revision of Indian Forest Act of 1927).
2. Activate the present forest tribunals and establish more if necessary.
3. Stop issuing tenure rights and pattas in forest area.
4. Repeal the land ceiling laws.
5. Conduct detailed EIA and more transparent and sensitised public hearing.
6. Consistent Environmental Policy
7. Identify indicators to monitor loss of biodiversity
8. Maintenance/enhancement of ecosystem functions

### **6.10.2. Lack of Adequate Legal Literacy on Biodiversity at the Panchayat and People levels**

#### **Strategy**

1. Develop a mechanism for imparting legal literacy.

#### **Actions**

1. Establish legal literacy missions
2. Translate documents into the local language
3. Provide advisory clinics for local institutions and affected persons.
4. Create Lawyer's Forums for environmental awareness.
5. Popularise the existing remedies available at local level.
6. Facilitate education, awareness, training and research

## **6.11. Education, Awareness, Training and Research**

### **6.11.1. Inadequate Emphasis on Biodiversity in Educational Curricula**

#### **Strategy**

1. Promote introduction of biodiversity and its conservation as an integral component in the educational curricula of Schools and Colleges.

#### **Actions**

1. Creation of awareness among educationists and decision makers regarding the need for introducing biodiversity related topics in the curricula at various levels in Schools and Colleges.
2. Identification of topics on biodiversity to be included in the educational curricula of Schools and Colleges.
3. Evaluation of existing curriculae at various levels (primary, high school, college etc.) with regard to the adequacy of biodiversity related topics.
4. Introduction of biodiversity related topics in the syllabus of schools and colleges to the extent required.
5. Preparation of books and other teaching materials with adequate emphasis on biodiversity
6. Provide training at various levels to teachers on different aspects of biodiversity and its conservation.
7. Motivation and incentives to the teachers depending on requirement.
8. Monitoring the implementation of the above activities and adoption of measures to rectify any defects identified.

### **6.11.2. Lack of Awareness on Biodiversity Related Issues**

#### **Strategy**

1. Create awareness about the significance of biodiversity and its conservation among all sections of society - politicians, planners, administrators, media, academia, judiciary, industrialists and businessmen, farmers, students and the general public at large.

#### **Actions**

1. Highlight the importance of biodiversity conservation as a State policy through appropriate forums – among intellectuals, politicians, administrators, policy planners, social workers, academia and other decision makers
2. Organize Seminars and Workshops on biodiversity for different professional groups such as media, judiciary, medical, engineers, industrialists, managers and traders.
3. Proactive campaigns through varied forms of media such as national and regional (including vernacular) newspapers/magazines, TV, radio and cable networks on the significance of biodiversity on immediate and long-term quality of life of the people.
4. The potential of Information Technology should be fully utilized.
5. Create awareness among the public on biodiversity culture links and emphasize on ecofriendly activities such as waste recycling, rain water harvesting, organic farming, sustainable agricultural practices, traditional food processing and eating habits, traditional first aid measures, as well as folklore and their linkage to biodiversity conservation.
6. Involve various non-governmental and governmental agencies in promoting awareness to the maximum extent possible.
7. Involve people such as teachers, extension workers, social workers, gram sevaks, health workers, anganwadis and Kudumbasree units on biodiversity related issues.
8. Promote development of adequate publicity materials, literature, TV programs, documentaries and computer software highlighting the relevance of biodiversity and its conservation.

### **6.11.3. Lack of Adequate Training Among Different Sections of the Society about Various Aspects Pertaining to Biodiversity Conservation**

#### **Strategy**

1. To provide practical training to the people belonging to different sections of the society on various aspects of biodiversity conservation, bring positive attitudinal change and equip them for sustainable use of resources.

#### **Actions**

1. Identify the agencies and institutions capable of providing training on different aspects related to biodiversity conservation to different sections of the people.
2. Identify multilevel target groups to be trained by these organizations/agencies.
3. Identify the aspects on biodiversity to be covered and the approaches to be followed while providing training to different target groups.

4. Develop training materials suitable for different target groups.
5. Organize multi-level Trainers' Training Programs to provide sufficient resource persons for imparting training on various aspects of biodiversity conservation to different sections of the society.
6. Organize continuous training programs for various target groups on different aspects that are directly or indirectly connected with biodiversity conservation.
7. Make the training on conservation and sustainable use of resources as an integral component of various other related training programs and educational activities targeted to different sections of the society.

#### **6.11.4. Lack of Adequate Research on Different Aspects Pertaining to Biodiversity and its Conservation**

##### **Strategy**

1. To develop adequate infrastructure, conduct research on priority areas and transfer the findings on a time bound basis.

##### **Actions**

1. Increase the awareness among decision-makers on science policy about the importance of biodiversity and its conservation.
2. Identify areas on biodiversity and its conservation requiring research and prioritise them with the active involvement and participation of various specialist groups and stakeholders.
3. Mobilise resources, manpower and infrastructure facilities for undertaking research on prioritised areas in a time bound manner.
4. Prepare research programs on priority areas and conduct research on a timebound basis.
5. Effective monitoring regarding the progress of research and implementation of corrective measures wherever required.
6. Timely transfer of research findings for field application.

### **6.12. Technology, Industry and Biodiversity**

#### **6.12.1. Over Exploitation by the Industry Leading to Depletion of Biodiversity**

##### **Strategies**

1. Research efforts to be encouraged for efficient, sustainable use of biodiversity, value addition and conservation of biodiversity using modern technologies including biotechnology.
2. Pharmacognosy standards to be developed for authentic raw material and finished products in herbal drugs. Enforcement of such standards and certification also is essential.
3. Promotion of cultivation of plant species that are overexploited in wild and ensuring appropriate marketing avenues and remuneration for cultivators, incentives to manufacturers for products made from raw materials raised in plantations
4. Promotion of technologies more suited for the topography and climate of the State and the highly literate manpower available eg., Eco-tourism, Biotechnology, Information technology, Floriculture including explorations on the potential of local ornamental flora and fauna.

##### **Actions**

1. Brainstorming meetings to be held with experts, policy makers and stakeholders on specific issues in sustainable utilization of biodiversity, value addition (preprocessing, storage), research needs and application of available technology.
2. Sponsored research projects aimed at sustainable use of biodiversity, value addition, development of pharmacognosy standards by improved amalgamation of modern analytical tools and digital documentation
3. Drawing up of schemes with involvement of the stakeholders to promote cultivation of the wild plants of interest to the industry and in short supply and regulating collection from wild resources.
4. Research projects focused on alternative technologies, bioprospecting.

#### **6.12.2. Pollution and Inefficient Waste Disposal Affecting Biodiversity**

##### **Strategies**

1. Strengthening of existing laws concerning utilization of biodiversity and environmental pollution and their urgent implementation.
2. Segregation of severely polluting industries from non-polluting ones and relocation from thickly populated or ecologically sensitive areas (in a phased manner), to take advantage of centralized pollution control systems, disaster management units etc.
3. Equipping statutory bodies like pollution control authorities with infrastructure for information dissemination and transfer of technology by linking with research Institutes, NGO's.
4. Adaptation of eco-friendly technologies for packaging materials using plant products or biodegradable polymers.



**Actions**

1. Sensitization of policy, law making and implementing bodies, industry, local governments through dissemination of information, interaction with experts, NGO's etc.
2. Identification of industrial belts; the nature of their pollution; their effect on biodiversity; segregation of polluting units as well as potential mechanism for their relocation.
3. Regular monitoring of air and water quality and pollutants throughout the State and study their impact on flora, fauna and human health and suggest remedial action with the help of statutory bodies and NGO's.
4. Building up the infrastructure and software for effective dissemination of eco friendly technologies and state of the art pollution control measures to the industry and local governments by links between statutory bodies, research Institutes and NGO's.
5. Utilization of alternate eco-friendly technologies and sponsorship of research for development of newer technologies.

# Lakshadweep Biodiversity Strategy and Action Plan

Coordinating Agency: Department of Environment and Forests, Kavaratti

## Introduction

The National Biodiversity Strategy and Action Plan (NBSAP) intends to cover all the diverse form of life in our country and the various ecosystems they live in. The diversity of life on Earth and the ecosystem and habitats which sustain them amount for the natural biodiversity of an area. The human beings which occupy an area, the plurality and ethnicity of the culture, their ways of interacting with the natural world, their perceptions about the diverse life forms around them, the agriculture and the seed varieties evolved over time is also taken into account while preparing the Strategy and Action Plan.

The Strategy and Action Plan for Lakshadweep has been prepared keeping as prime focus the fragility, vulnerability, limitations and scope of the island ecosystem. It describes in details the geographical, socio-economic, political, historical and ecological profile of the Union Territory.

Lakshadweep is an archipelago consisting of 12 atolls, three reefs, and five submerged banks. It is located between 80-12013" North latitude and 710-740 East longitude, 220-440 Kms away from the coastal city of Kochi in Kerala. Lakshadweep is a uni-district Union Territory with an area of 32 sq.km. and has 10 inhabited islands. The inhabited islands are Kavaratti, Agatti, Amini, Androth, Kiltan, Kalpeni, Kadamat, Chetlat, Bitra and Minicoy. Androth has the largest land area and Bitra the smallest. The islands are ring-shaped atolls lying along a north-south axis (except Androth) with lagoon on the west and open sea on the east. The islands have a lagoon area of 4,200 sq. kms, territorial waters of 20,000 sq.kms and 4 lakhs sq.kms of economic zone.

## Major Biodiversity Related Issues

### The Coral Reef

The marine biodiversity of the Islands is predominantly and directly related to the diversity of the coral reefs. Coral reefs and the islands that are formed due to the accretionary process are vital both in the economic and ecological sense. Coral reefs are considered to be the most productive ecosystem in the world with annual production amounting to 2000-5000 g C/m<sup>2</sup>. The coral diversity of Lakshadweep is second to that of Andaman and Nicobar islands. Coral genera like *Montipora*, *Pavona*, *Porites*, *Favia*, *Favites*, *Goniastrea*, *Platygyra*, *Hydnophora* and *Symphillia* are common here. Some subgenera like *Psammocora* (*Plesioseris*) and *Psammocora* (*Stephanaria*) are found only in Lakshadweep. On lagoon shoals and windward and leeward sides of the reefs genera like *Pocillopora*, *Acropora*, *Porites*, *Goniastrea* among the scleractinians and the blue coral *Heliopora* are found. Scleractinian corals divided among 31 genera are hitherto reported from Lakshadweep. Out of these 27 genera with a total of 69 species are hermatypes and the rest 4 genera with 9 species are ahermatypes. The changing demographic pattern and life style, coupled with resource harvest from the reefs at more than sustenance levels have created atmosphere of stress in the islands.

### The Lagoon

The extensive lagoon around the western side of each island in Lakshadweep has an area of 4200 sq. km. The lagoon in Lakshadweep has abundant growth of independent coral associations. It also abounds in and is home to a variety of flora and fauna. The calm waters of the lagoon which serves as a lake is home to and nursery for a large number of fishes, molluscs, echinoderms and larger species. Adjacent to the beaches, most of the islands have extensive growth of sea grass. *Thalassia hemprichii* and *Cymodocea isoetifolia* are the two major plants constituting the sea grass beds. The sea grass beds prevent erosion and also movement of beach sediments. It is also a major feeding ground for turtles and other organisms. The lagoon and atolls of Lakshadweep also abound in a variety of marine macrophyte or algae. They belong to Chlorophyta (Green Algae), Phaeophyta (Brown algae) and Rhodophyta (Red algae). The sea grass community of the lagoon contributes to the benthic plant biomass of islands. The predominant sea weeds observed are *Enteromorpha*, *Ulva*, *Codium*, *Laminaria*, *Turbinaria*, *Sargassum*, *Padina*, *Gelidium*, *Gracilaria*, *Hypena* and *Ceramium*. The lagoon, its pristine waters and the biota are threatened by a variety of factors. These may be natural and anthropogenic. Global factors like Green House effect, sea level rise and global warming may be also indirectly effecting the health of the lagoon.

### The Soil

The soil is formed by the dead, disintegrated and weathered skeletons of corals. It is estimated to contain 95% calcium carbonate in the form of aragonite. The PH of the soil is neutral, the index ranging from 6-8. Lakshadweep soils are rich in phosphorus and calcium, though deficient in nitrogen and potash. In Chetlat, Kiltan and Kalpeni phosphatic soil is found with 11 - 24% P<sub>2</sub>O<sub>5</sub>. The thick layer of bird guano accumulated in many islands has a high phosphate value.

### The Water

The islands which are 1-2 metres above sea level has a very thin lens of fresh water floating over the sea water. This is actually rainwater collected and percolated through the porous calcareous soils of the islands. In some islands the depth of this lens may be 0.5 metre whereas in others it could be 2 metres. In some islands, the deepest portion of this lens would be in the middle, in other islands it could be at the northern or southern end of the island. The quality and quantity of the fresh water lens also varies with the fluctuating tides

### The Flora

There is no marked zonation for the vegetation in Lakshadweep since the land area is small and there is homogeneity in topography and soil content. Plant species collected from all over the islands reveal a total of more than 290 species of plants. Most of them (230) belong to the Angiosperm category. The rest are freshwater (in tanks) and marine algae, ferns and moss. Coconut is the commonest plant of these islands, which is most extensively cultivated and forms the great bulk of the vegetation. There are a few bread fruit trees, banyans and tamarinds on all the islands. Other trees that are fairly common are the puvarasu (*Thespesia populnea*), the Punna (*Calophyllum inophyllum*) the wild almond (*Terminalia catappa*) and the Horse Radish tree, (*Moringa pterygosperma*) along with Custard apple, drumstick, Indian Coral Tree, and wild cotton.

### The Fauna:

There are no indigenous mammals on the islands. The only representative of the family Carnivora is the common domesticated cat. The only wild mammal on the island is the genus *Mus* that must have got introduced through ships and cargo. Wall lizards, garden lizards, skinks and snake (Rat snake) are the reptiles on land. Rat snake has been reported from Androth. The common frog (*Rana tigrina*) has been reported from Minicoy. The insects commonly found are roaches (*Periplanata* species), the Rhinoceros beetle (*Oryctes rhinoceros* common pest of coconut). Mosquitoes are found in all islands due to stagnant waters and coconut husk curing. There are a few butterflies in all islands, the most common noted being Plain Tiger.

### The Birds

The birds which are not waterbirds but found on land are-the Grey Heron, the Little Green Heron, the Crow, the Crab Plover, the Koel, the white breasted water hen, the common teal, the black naped tern, the sooty tern, the white eye, the turtle dove, the Brown Rock Pippit and Yellow wagtail.

### The Mangrove

The mangrove patch found on the south eastern portion of Minicoy has special biodiversity value. It spreads over an area of 2500 sq. m. There is also a unique loamy soil accumulation (over the sandy coral sand) so essential for mangrove growth 3 species of mangroves are found here, the most common being *Bruegiera parviflora*. *Cerriops candolleana* and *Clerodendron inerme* are the other species. Associated with this, coastal species like *Dodonia viscosa* and *Pandanus odorattissimus* also grows here. The mangroves of Minicoy deserve special attention and protection.

### The Open Ocean

The Lakshadweep islands are enclosed in the Arabian Sea with Territorial waters extending to 20,000 sq. kms and an exclusive economic zone (EEZ) of 40,000 sq kms. The main factors, which determine and control the diversity of these seas, include temperature, currents, tides, chemical composition including salinity, nutrient upwellings and sinking. The open sea/deep sea of Lakshadweep abounds in a variety of creatures, which are distributed in the zonation typical of ocean ecosystems. The flying fishes occupy the top most photic zone, which extends up to 150 metres. Occasional sightings of mammals like whales/dolphins (Cuvic's beaked whale), tuna shoals, sharks and some other species of fishes are seen in the upper layers. But these species generally occupy the zone upto 150m. There is also a wide variety of plankton occupying this zone, which is spread, over a large area. The middle zone in the area from 150 metres - 1000 metres is occupied by a variety of creatures which are not really permanently residing here but which travel into the light zone. This zone is usually packed with nutrients, which comes up as upwellings and also those that sink in the form of residues of organisms from the photic zone. Dolphins, whales and sharks travel to this area. There are some squid species together with octopuses and prawns, which occupy this zone. The abyssal zone is occupied by a variety of organisms but no clear study has been done so far.

### The Culture

The indigenous population of Lakshadweep is Muslim, belonging to the Shafi school of the Sunni sect. The population of the islands

is 60,595 (2001 Census) with male numbering 31,118 and female 29,477. The literacy rate is male 93.15% and female 81.56%. Malayalam is spoken in all the islands except Minicoy where people speaks Mahl. The entire indigenous people of this Union Territory are classified as Scheduled Tribes. The main occupation of the islanders are fishing and coconut growing. The new Panchayats Regulation implies the formation of a two tier system of Panchayats in Lakshadweep. There are Village (Dweep) Panchayats and District Panchayats. The general administration of the islands was carried out under the customary laws prevailing in the islands till 1965. Most of the folklore of the people in Lakshadweep revolves around the sea and there is hardly any tale or song which does not refer to the sea and odams. The tale of 'Puganna Kevi', Omana Pu, Bi kunhi and the sea-ghost 'Valuvan' are still recounted today. The numerous games also reflect upon another way of perceiving the environment. The games-Bellachachullaka, Anthekulichomeenpayo, Seelacheela, Kavadikali, Chattal Chadal, etc. are common in the islands.

## Ongoing Biodiversity Related Initiatives

### Laws Pertaining to Resource Use and Conservation of Biodiversity (Environment)

There are laws which pertain to land use, use of the lagoon and reef, protection of corals and other species. All of these are connected to the general law as being passed in the mainland. The implementing agency may be different in the islands. Numerous notifications have also been passed by the Lakshadweep Administration to enhance and enforce conservation measures in the islands. The information and Publicity Units, the local newspaper 'Lakshadweep Times' and the All India Radio are instrumental in propagating these laws and regulations. Given below is a table showing the various laws.

Time	Laws
1959	1. Laccadive Islands and Minicoy Regulation 2. Laccadive Islands and Minicoy Regulation Rules 3. Survey and Boundary Regulations
1965	The Laccadive, Minicoy and Amindivi Islands Land Revenue and Tenancy Regulation.
1969	Laccadive, Minicoy and Amindivi Islands Land Revenue and Tenancy Rules.
1973	Laccadive, Minicoy and Amindivi Islands (Alternation of name) Act - Lakshadweep.
1979	Survey and Boundary Regulations Supplementary Rules
1972	The WildLife (Protection) Act, 1972
1973	The Wild Life (Transactions and Taxidermy) Lakshadweep wild life (stock declaration) Rules
1991	The Coastal Zone Regulation Rules
1996	The Coastal Zone Management Plan for U.T of Lakshadweep
1994	Notification of Administrator preventing extraction of sea cucumbers.
1994-95	Notification from Minicoy Information and Publicity unit preventing killing of migrant birds. Notification preventing killing of Dolphins and Whales
1998	Lakshadweep Protection of corals. Bye-laws Lakshadweep Protection of corals. (Amendments) Bye-Laws
1998	Lakshadweep Sanitation Conservancy Bye-Laws
2000	The Lakshadweep Marine Fishing Regulation
2001	The Lakshadweep Marine Fishing Regulation and Rules
2001	Notification (Amendment) to Wild life (Protection) Act 1973.

Inclusion and insertion of certain Fishes, coelenterates Molluses and Echinodermata to the list. The Biodiversity conservation laws are implemented by the Department of Environment and Forests, U.T. of Lakshadweep.

The Central Marine Fisheries Research Institute has done detailed research on biodiversity potential of many of the islands. The National Institute of Oceanography Goa has done studies on biodiversity and productivity in the oceanic waters around the island. Global Coral Reef Monitoring Network (GCRMN) has conducted pilot biophysical and socio-economic monitoring in the islands of Lakshadweep. Both of these initiatives would be clubbed together to form a comprehensive plan for sustained, participatory management and protection of the reefs. The Lakshadweep Coral Reef Monitoring Network (LCRMN) is co-ordinating the biophysical monitoring in the area. This is in association with National Institute of Oceanography, Goa.

### Gap Analysis

Lakshadweep group of islands is unique not only in terms of the coral reef ecosystem, but also of the fact that it is one of the most studied areas in India. There is actually an information glut but this is not available at the right place at the right time in the right proportion. Hence there is always a gap between information, identification of problem, practical solutions and implementation.

### **Gaps in Information**

There is a wealth of information about the natural systems in the islands together with social and economic assessments of the community. But this is not doing the required benefit due to 3 reasons.

1. It is not in a collated, easily available form.
2. It is in a form which is very alien to the real stakeholders or beneficiaries.
3. Traditional and time tested knowledge systems are not taken into consideration or even valued. This creates an unbridgeable gap and the sources of information are often not the best available. The traditional methods of community management of reef resources are completely overlooked.

### **Gaps in Vision**

There has been a lot of gap created due to the short-term unviable approach especially in the case of development of the islands. Most of the planning processes have overlooked the basic fact that islands are fragile and resources limited. There is no localized, broad and ethnic framework to the vision behind Island development. The ethical need to conserve the bio-resources so inherent in the island culture has been overlooked. The above said gaps in information have added to this short-term effect.

### **Gaps in Policy and Legal structure**

There are many gaps in this area also. The Department of Science and Technology previously and now the Department of Environment and Forests is vested with the power to enforce laws and notifications of concern to conserving various fragile species (Coral, Sea cucumber) and also polluting the environment (Plastics). But there is very little implementing power or real enforcement status in this field. This creates ambiguity regarding enforcement even for the officers in charge.

### **Gaps in Institutional and Human Capacity**

There are certain gaps in this regard also, but not of prime importance. The institutes, which are in direct charge of biodiversity conservation should have learned and wise traditional persons in it. Or there should be a platform for exchange of ideas and views. Since the conservation of biodiversity is of prime significance to every islander, it cannot be looked upon as the responsibility of one institute or department. The programme has to be participatory. The decentralized, participatory approach has to be there so that empowerment of local community takes place.

### **Major Strategies and Action Plan**

The Strategies and Action Plan are grouped into 7 major categories and most important actions are as proposed below.

#### **1. Destruction of Coral Reefs**

- i. There has to be constant awareness programmes, which will instill the need for conservation of the reef
- ii. The activities of the Building Materials Board have to be speeded up so that building materials at subsidized rates are available for the public.
- iii. The Dept. of Environment and Forests and the Police Department have to work together for the enforcement of law, which prohibits the destruction of coral reefs.

#### **2. Destruction of the Lagoon**

- i. There has to be a strict ban on the disposal of non-biodegradable toxic materials like plastics and batteries into the lagoon.
- ii. There has to be a high power committee in each island with statutory powers that will survey and suggest methods of conserving the lagoon.
- iii. The Fisheries Department, the Dept. of Environment and Forests and people should work together and restore the status of the lagoon to the 1960 state.

#### **3. Vegetation Cover**

- i. There has to be laws preventing the indiscriminate cutting of trees.
- ii. The Dept. of Environment and Forests and the Agricultural Department has to work jointly and provide people with saplings and bio-fertilizers.
- iii. A botanical garden has to be set up in each island with a special corner for medicinal plants.
- iv. People has to be made aware of the need to protect medicinal plants and also given the knowledge to use traditional means of curing.

#### **4. The Non-availability of Freshwater**

- i. The Public Works Department and Village Dweep Panchayat should make a comprehensive study of areas within each island that require immediate supply of fresh water.

- ii. There has to be a control and regulation on the use of pump sets for drawing fresh water.
- iii. Desalination Plants could be installed in all island so as to ensure supply of good quality waters for drinking and cooking.

#### **5. Sea Erosion**

- i. The Public Works Department and the Harbour Works Department have to work together for an effective solution to the problem. There has to be a complete rethinking and reevaluation of the effectiveness of tetrapods.
- ii. There should be attempt to go in for cheaper time tested and locally suitable methods of preventing the impact of waves on the shore. The traditional method of cordoning of the shore with stones and retaining water for retting of coconut husks used to be a natural sea wall. This system has completely disappeared from the islands.
- iii. The Dept. of Environment and Forests has to take action on a war footing to create green belt along the shore and maintain them with public support and participation.

#### **6. Fishing**

- i. The modern facilities of Doplar radar system and satellite data, which would enhance and improve fishing has to reach the fisherman. This has to be combined with supply of oil and other essential items.
- ii. The Lakshadweep Development Corporation Ltd. and the Govt. Marketing Federation have to find a global market for Tuna.
- iii. The Port Department and Police Departments of Lakshadweep should be provided with speed vessels and other monitoring devices for regular patrolling to prevent the intrusion of outside trawlers for poaching fishery resources from territorial waters of Lakshadweep.

#### **7. Pollution**

- i. The location of the existing Power Plants in the densely populated part of every island causes problems. This has to be shifted to less populated areas after construction of concrete platforms for storing the drums.
- ii. The ban on Plastic carry bags should be enforced without compromise.

#### **Conclusion**

The Lakshadweep Biodiversity Strategy and Action Plan is but an attempt in starting a process whereby the local communities realize and reinforce their stake in decision-making and also conservation of resources. This is but a beginning. Yet the process has made clear the limitless opportunities that still exists for the judiciary, law enforcers and the people to work together. The capacity and scope for such small geographically distinct unit like the islands to show models, which can be extrapolated, replicated and emulated, is obvious. The EIA done by Department of Science and Technology is a good attempt at bringing together all such complex factors. There has to be a rethinking, reevaluation and remodelling of all developmental processes in the islands so that the harmony of human-nature interaction remains intact. The constant education, awareness building, participation and non - formal approaches to implementation have to be exercised. The LBSAP is perhaps the trend-setter in a major shift in governance.