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**SUB- STATE SITE BIODIVERSITY  
STRATEGY AND ACTION PLAN  
(LAHAUL & SPITI AND KINNAUR)**

**MAY-2002**

**SUBMITTED TO:  
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# CONTENTS

<b>S. No.</b>	<b>Chapter</b>	<b>Pages</b>
1.	Introduction	1-6
2.	Profile of Area	7-16
3.	Current Range and Status of Biodiversity	17-35
4.	Statement of the problems relating to biodiversity	36-38
5.	Major Actors and their current roles relevant to biodiversity	39-40
6.	Ongoing biodiversity- related initiatives (including assessment of their efficacy)	41-46
7.	Gap Analysis	47-48
8.	Major strategies to fill these gaps and to enhance/strengthen ongoing measures	49-51
9.	Required actions to fill gaps, and enhance/strengthen ongoing measures	52-61
10.	Proposed Projects for Implementation of Action Plan	62-74
11.	Comprehensive Note	75-81
12.	Public Hearing	82-86
13.	Synthesis of the Issues/problems	87-96
14.	Bibliography	97-99
	Annexures	

## CHAPTER- 1

# INTRODUCTION

Biodiversity or Biological Diversity is the variability within and between all microorganisms, plants and animals and the ecological system, which they inhabit. It starts with genes and manifests itself as organisms, populations, species and communities, which give life to ecosystems, landscapes and ultimately the biosphere (Swaminathan, 1997).

India in general and Himalayas in particular are the reservoir of genetic wealth ranging from tropical, sub-tropical, sub temperate including dry temperate and cold desert culminating into alpine (both dry and moist) flora and fauna. This genetic resource has also contributed immensely towards agro-diversity in the form of genes from wild relatives and land races of many present day crop plants and livestock. But, this genetic resource is threatened, a process switched on by the exploding human and livestock populations, unsustainable resource extraction and unfriendly waste dumping. Many species have already disappeared or are in the process of extinction, designated as endangered species. Such a disappearance of genes resources is related to the extinction of innumerable species with which it is intrinsically linked through food webs and food chains. This also leads to serious ecological consequences with an eventual bearing on productivity effecting the basic life support system and livelihoods of millions of organisms living on the planet earth.

The conservation of diversity in plant-based ecosystems has special significance in mountains as people are traditionally bound with the natural resources for multifaceted uses such as food, fodder, medicinal plants and lots of other uses. However, this resource is being lost at an alarming rate due to heavy dependence of people on natural resources for the aforesaid needs and other developmental activities such as roads, hydroelectric projects, industrialization, conversion of forests for agriculture and horticulture, unplanned and unregulated grazing etc. The cattle pressure in hills, in general is much more than their carrying capacity and their uncontrolled invasion into reserve forests affects not only the regeneration, but also, leads towards the extinction of many valuable species. The Pharmaceutical industry is another major factor that is threatening the extinction of these valuable plants.

Biodiversity provides a fundamental base to the mountain agriculture and to the overlap economic systems. It is the source of resiliency and regeneration, necessary for sustainability of agricultural systems. It is the ultimate basis for local self sufficiency, and a global asset, bringing benefits to people in terms of material welfare in more ways than we realize.

There is a high degree of desperation in the people's approach to resource base use. Food shortages of varying degrees are common among the mountain farming communities because the production of adequate amounts of food on small land holdings, with ever declining farm productivity, is impossible and it has set in motion a chain reaction towards an integrated process of poverty-resource degradation-scarcity-poverty. Agrobiodiversity here faces threat from habitat destruction and desperation of mountain farmers for over exploitation of resources for sustenance.

Mountain communities must save their agricultural diversity in order to retain their option for development and self-reliance, but agriculture biodiversity cannot be saved unless it is used. The value of diversity is in its use. Only its use can be appreciated enough to be saved. It can be safeguarded through the use of diverse strategies, what is saved, will depend on who is consulted. How much will be saved, depends on how many mountain farming communities are involved. The need for agro-biodiversity is never ending; therefore, conservation/ management efforts will have to be continued endlessly.

During the long years of man's existence, he has primarily been concerned with the business of becoming human, what is specially and uniquely human in man's capacity is to combine a wide variety of animal propensities into an emergent cultural entity- A Human Personality.

Before man started dominating the other species on earth, he existed as a member of a biotic community and a component of an ecosystem without having much more effect on them than any other animal species would have. Some areas have been subjected to major modifications by man, International conflicts, population and environmental problems are all tied together.

The Indian Hill Farmers even recognized the risk of settled agriculture, thus traditionally developed and adopted sustainable and risk minimizing technologies for land use. These farmers, transformed their surrounding environment into a complex ecosystem (imitating nature) of farm lands, non-farm sectors, grasslands, forests--- an interactive multipurpose biological system that responded to the seasonal rhythms of the area and minimized the social and economic impacts of climate and other biological vagaries that adversely affect monoculture.

## **1.2 Scope of the SAP**

The term biodiversity is being taken in its holistic sense, to encompass the following levels, including related ecological and evolutionary processes:

**Natural Ecosystems:** e.g. forests, grasslands, cold deserts areas, Agro biodiversity (cultivated as well as wild relatives), medicinal and aromatic plants, wild or domesticated animals, local traditional knowledge including existing status of biodiversity, understanding and conservation efforts have been included in the present strategy and action plan at Sub-State site plan for the tribal districts of Kinnaur, Lahaul and Spiti. Due to growing needs of environmental conservation and better

understanding of impact on human being caused by degradation of biodiversity, information on all kinds of biodiversity has become need of the hour. Documentation of traditional indigenous knowledge will act as a technological tool to protect the intellectual property rights of the area in particular and the country in general. The conservation of high value and low value species of medicinal and aromatic plants will usher in economic growth of the people in the longer run.

Species of crops, livestock (including poultry), captive bred fish, pets, and micro organisms *in situ* and *ex situ* conservation and the genetic variation within each of these species needed to be studied, executed and documented for better understanding of the problem and initiating both short term and long term strategies for its conservation and sustained utilization through the efforts of Govt. agencies, NGO's, farmers cooperatives, Self Help Groups and Mahila Mandals etc. in the area.

### **1.3 Objectives of the SAP**

1. Inventorisation of existing species of plants in the area in general.
2. Inventorisation of medicinal and aromatic plants needs top priority.
3. Local traditional knowledge of plants needs to be documented.
4. Agro-technology of endangered and commercial species of medicinal and aromatic herbs/ plants needs to be developed and applied in the area in farmer's fields or Govt. land.
5. Use of biotechnology can be adopted for multiplication of species which are endangered, shy seed bearer or have low germination.
6. Modern tools like GIS and Remote Sensing needs to be employed for the study of biodiversity supported by ground truth realities.
7. Taxonomy or systematic needs to be encouraged in order to identify biodiversity and take necessary initiatives for its conservation and sustenance's accordingly.
8. People's Training programmes including field trips for on the spot awareness of species diversity and their ultimate utility have to be initiated.
9. Scientists and line agencies of development departments should work hand in hand in facilitating the activities by the stake holders (sharing of knowledge and expertise and its percolation to the grass root level).
10. Provision of successful and economically viable alternatives are required to attract people for conservation of biodiversity (Alternate building material, energy and its saving devices, incentives for conservation of agro biodiversity).
11. Incentives like clear and secure property rights within practical limits are required.
12. Scientific knowledge to be translated to the general public through mechanism of training, workshop, field trips, electronic media like Video Films, Radio classes etc.

## 1.4 Process involved in preparation of Sub-State Site Strategy and Action Plan

For preparation of the Sub-State Site Strategy and Action Plan the HP Govt. under the Chairmanship of Commissioner-cum Secretary (TD) to the Govt. of HP constituted a Sub-Steering Working Group for Sub-State Site of Lahaul and Spiti and Kinnaur area, which is as follows:

1.	The Commissioner cum Secretary (TD) to the Govt. of H.P.	Chairman
2.	Deputy Commissioner/Additional Deputy Commissioner	Member
3.	A representative from State Council for Science, Technology And Environment	Member
4.	District Horticulture Officer/ HDO	Member
5.	District Agriculture Officer/DAO	Member
6.	Divisional Forest Officer	Member
7.	DAHO/Assistant Director (AH)	Member
8.	Dr. N.S. Chauhan, Horticulture University, Nauni, Expert in Herbal Wealth of HP.	Member
9.	Shri V. Tandon, C.C.F. (Projects) Expert in Medicinal Herbs.	Member
10.	Shri Hans Raj Negi, Institute of Himalayan Biological Research Technology, Palampur, HP.	Member
11.	The Managing Director, Lahaul Potato Society, Manali.	Member
12.	The Managing Director, Kinnfed.	Member
13.	The Managing Director, HOPS Co-operative Society	Member
14.	The Managing Officers, ITDP, Lahaul at Keylong, Spiti at Kaza and Kinnaur at Reckong Peo, HP.	Member Secretary

### Non Official Members:

15.	Col. Hishe Dogia, TAC Member	Member
16.	Shri R. S. Negi, IAS (Retired) Member	

Thereafter, the meeting of the Sub-Steering Working Groups at three sites namely Kinnaur, Kaza and Keylong were organised on 16.5.2001, 18.5.2001 and 21.5.2001 the proceedings of which are placed at Annexure II & I. A review meeting was organised by the Commissioner-cum Secretary (TD) Govt. of HP on 8.8.2001 for formulation of Sub-State Site Biodiversity Strategy and Action Plan and the following decisions were taken:

(1). Four member group of experts/scientists from the Universities/R&D Institutions were identified for compiling the Biodiversity Strategy and Action Plan at the Sub-State Site which are as follows:

<b>Name</b>	<b>Address</b>
1. Dr. N.S. Chauhan	Dept. of Forestry and Genetic Resources, UHF, Nauni, Solan, (HP)
2. Dr. Sarvesh Sood	Depts. Of Biosciences, HPU, Summer Hill Shimla-5.
3. Dr. H.R. Negi,	Scientist, C. Himalayan Institute of Bio- Resource Technology (CSIR), Palampur- 176061, HP
4. Dr. Rajan Bawa,	Incharge, Regional Research Station, Sharbo, Reckong Peo District Kinnaur, HP

(2). It was also decided to convene three Public hearings each at Lahaul, Spiti and Kinnaur for getting the stakeholders perception on biodiversity for in-corporation of their views/suggestions for formulation of the Sub-State Site Biodiversity Strategy and Action Plan and for holding the Public hearings. Three Co-ordinating NGOs were identified FOR organizing the public hearings alongwith venues at the respective sites identified which are as follows:

<b>Name &amp; Address</b>	<b>Venue</b>
1. Shri Rajinder Chauhan, Director, Society for Scientific Advancement of Hilly Rural Areas (SAHARA), Bhutti Colony, P.O. Shamshi, District Kullu, H.P. 175126.	Keylong (Lahaul)
2. Shri Rajender, Yuvak Mandal, Tabo, P.O. Tabo/ Spiti, District Lahaul and Spiti, HP	Kaza (Spiti)
3. President, Mahila Mandal, Duni, P.O. Duni Tehsil Kalpa, District Kinnaur, HP	Kalpa (Kinnaur)

Three Co-ordinators (Scientists/experts) confirmed their participation for compilation of the work pertaining to the Individual field of specialization for preparation of Sub-State Site Biodiversity Strategy and Action Plan, which are as follows:

1. Dr. N.S. Chauhan      Dept. of Forestry and Genetic Resources,  
UHF, Nauni, Solan, (HP)
2. Dr. Rajan Bawa      Incharge, Regional Research Station, Sharbo,  
Reckong Peo District Kinnaur, HP
3. Dr. H.R. Negi      Scientist, C. Himalayan Institute of Bio-  
Resource Technology (CSIR), Palampur-  
176061, HP

Only one Public hearing to the stakeholders of Lahaul area of Lahaul and Spiti District was organised on 5<sup>th</sup> October 2001 and the other two Public hearings could not be organised because of inclement weather conditions .The Public hearing was convened at the Lahaul Potato Society Bhawan, Karga which was jointly co-ordinated by State Council For Science Technology and Environment, H, P with SAHARA and approximate 50 local stakeholders participated in the Public hearing. Officers from the development Departments also attended the Public hearing alongwith Sub-Divisionl Magistrate, Keylong at Karga.

Letters from the Commissioner cum Secretary (TD) Govt of H.P were issued to the respective Deputy Commissioners and Additional Deputy Commissioner of the respective Areas for providing a comprehensive note about the steps being taken presently in the respective areas for biodiversity conservation by the various line Departments and to know the problems/issues pertaining to biodiversity

Only Additional Deputy Commissioner Kaza could send the comprehensive note, which has been included as a separate chapter in the draft of the Strategy and Action Plan of the Sub State Site.

## **CHAPTER-2**

# **PROFILE OF AREA**

District Kinnaur and Lahaul-Spiti of H.P. have been ideally chosen as one of the 17 NBSAP Sub-State Sites because of its uniqueness of climate, geography, topography and habitation in the country.

## **BRIEF HISTORY OF KINNAUR AND LAHAUL SPITI**

It is believed that the present Kinnaur district until recently was only a Tehsil of erstwhile Mahasu district and has been named after the principal tribal community, which is believed to have descended from the Gandharvas and Kinners of the Mahabharata age. This place has been the region of Agyatvasa (hiding) of Pandava for a year where they seem to have spent the best part of their life. Kinnaur has definitely deep roots in Indian mythology, legends and literature and Kinnaura's are considered as a distinct race. The race of Kinners have been variously described by numerous authorities of Indian art, mythology, culture and history as fabulous beings, half human, half bird, with birds legs and wings and human head and at other places with human body mounted upon by the head of horse or even with the horse's body and the head of human being.

Kinnaur was once part of the Bushahr state, but after its merger into Himachal (then it was a 'C' state) in 1948, it became a part of Mahasu district. Kinnaur became independent district on 1<sup>st</sup> May, 1960. It comprises of three sub-divisions viz., Nichar, Kalpa and Pooh. Nichar is lower Kinnaur and forms its boundary with Shimla district while Kalpa occupies the Central part of Kinnaur and Pooh is in upper Kinnaur adjoining Tibet. The majority of villages lie between and altitude of 2200 m to 4500 m. Nichar and Kalpa fall in the West zone and get monsoon rains, while Pooh falls in the rain shadow region and the deciding line is some where near the village of Spillo famous for almonds. The lower areas comprise mostly the Rajputs or Kanets known by their surname Negi. They form the highest class, equivalent to the Brahmins and those who believe in Hinduism are called the Khasias.

Kinnaur district pose formidable challenges in terms of remoteness, fragility of resources, inhospitable climate and marginality. The inhabitants of the region have superbly explored interactions with the biotic and abiotic components sustaining thereby their village ecosystems. The farming practices are developed through exploration of these interactions. The cropping pattern is adjusted as per their food needs, availability of resources, sloping terrains and altitudinal zonation of land holdings. Barley and millet based cropping, selection and prioritization of crop sowing are synonymous with their traditional knowledge. The long run sustainability is

ensured through a delicate balance between food habits crop grown, socio-cultural ethos and wisdom and specificity's of the area. The land holdings have also been distributed in accordance to societal needs.

There are some unique enterprises in the area and the people have developed these enterprises due to their continuous isolation and marginalization. Some specific stones are used as pesticides, some soils, yellowish in colour act as source of fertilizer. Different bushes and grasses are used in different farm practices. Ethno pharmaceutical remedies for animals are the most prevalent technologies.

## **2.1 Lahaul and Spiti**

According to J. Hutchison and Vogel, the first historical mention of Lahaul is found in Hiuen Tsang's travelogue, which visited Kullu somewhere between 629-645 A.D. He mentioned Lo-u-lo (Lahaul) as lying north of Klu-lu-to (Kullu).

It is believed, that Lahaul in the ancient times, had been ruled by the local chieftains called Jos, which corresponds to the Ranas and Thakurs of the rest of the hill states. These Jos, were believed to be of Tibetan origin and the only symbol of their subjection of the people, was the annual tribute which they used to pay to Jos. These Baronial families mainly were said to be living at Gushal, Kardang, Darcha, Barbog and some other places like the Jagirdar or Thakur families at British time. From about 600 AD., onwards upto the first half of the 9<sup>th</sup> century, Lahaul was an Intermittent battle ground between the kings of Kullu, Chamba, Ladakh and Tibet. It appears that the valley beyond Tandi to Thirot Nallah, was largely under the occupation of the king of ChLadakh king. In between it appears particularly that the Bhaga valley had been under the domination of the Ladakh kind. It is also indicated that one time hoarders of invaders from Central Asia (Yak and) invaded the entire Chandra and Bhaga valleys and on conquering the Chandra Bhaga valley, they reached as far as Brahmapura (Bharmaur) in Chamba. In 1840-41, the Sikhs invaded Kullu and took possession of Lahaul and Spiti passed on to the Sikh domination until 1846. After Anglo-Sikh war, the whole Alpine Punjab from Ravi to Indus including Ladakh and Spiti, was transferred in perpetual sovereignty to Raja Singh of Jammu. But, in the same year, Spiti was exchanged for other territory and added to Kullu with the object of securing a road for wool trade to Chang-Thang in Tibet proper. Under the same treaty, Kullu and Lahaul became British territories and this ultimately marked the beginning of the area of peace and prosperity in the entire region. They remained part of the Kangra district of British India. In 1941, however, a separate sub-Tehsil was set up for Lahaul and Spiti with headquarters at Keylong. Thus, revenue powers of the local Thakurs-Nono's. were diverted from them for the first time in history and perhaps and perhaps not to return to them again forever.

## **2.2 Geographical profile**

According to 1991 census the area of Kinnaur district is 6,401 Sq. Km (10.31% of the state) while the area under Lahaul and Spiti district is 13,835 Kms (24.85%) of total area of Himachal Pradesh, thus covering 35.16 percent of total geographical area.

## **2.3 Location**

### **2.3.1 Kinnaur**

The present name and spelling, that is Kinnaur, were conceived and introduced officially when the separate district was carved out on 1<sup>st</sup> May, 1960, out of the erstwhile Mahasu district. Earlier, it was known by different nomenclature as 'Kanawar', 'Kanaur', 'Kanauring', 'Kanavur', 'Kunawar' and 'Koohawur'. Lying on both sides of the river Sutlej in higher reaches, the district is situated between 77° 00'35" East longitudes and 31° 45'50" to 32° 05' North latitude.

Kinnaur shares its Eastern boundary with Tibet. The zanskar mountains form the international frontier between Kinnaur and Tibet.

By virtue of its locations, Kinnaur experiences the cool, temperate climate the climate found in the district is characterized by long winters from October to March and short summers from June to September. June is the warmest month in the lower Kinnaur. In upper Kinnaur, which is an arid tract, the warmest months are July and August. The rainfall in lower Kinnaur up to Wangtu does not vary greatly from rainfall in Shimla i.e. about 200 cm. Beyond that, the amount of rainfall decreases positively. The climatic conditions in different valleys of Kinnaur do not only vary with elevation, but also with the direction of valley faces and width of valleys.

### **2.3.2 Lahaul and Spiti**

The district of Lahaul and Spiti is situated in the west of The Greater Himalayan Range between 30°, 41° and 30°, 59°, 57° N latitudes and 76°, 46°, 26° and 78°, 41°, 34° E longitudes. The zone is delimited by the Pir Panjal, Great Himalayan range, and the Zanskar range. The great Himalayan range with mean elevation of 5,500 m extends from Kunzam range to Baralacha and Pin Parvati range, separating Chamba-Beas basin from the Sutlej Spiti basin around Pooh and pierced by Sutlej at Kalpa. Zanskar range, beyond the Great Himalayan range extends from Kinnaur bordering China and separates Spiti from Kinnaur and Tibet, which is pierced by the Sutlej at Shipkila. The Cold Deserts in Himachal Pradesh cover about 35 percent of its geographical area.

## 2.4 Socio-economic profile

### 2.4.1 Demography

According to the 1991 census the population of the Kinnaur district is 71, 270 and sex ratio is 38,394 males as against 32,876 females i.e. 856 females per 1000 males. Out of that scheduled castes are 26.87 percent scheduled tribes are 55.58 percent. The total literacy rate is 58.36 percent. Out of this males educated are 72.04 percent and female educated are 42.04 percent. In spite of many positive factors, Kinnaur is one of the most backward areas not only of Himachal Pradesh, but of India also. The economic structure is primarily agrarian and essential rural in character. The size of the land holding is exceedingly small and the methods of cultivation are by and large crude as well as primitive.

According to different census the population recorded in the Lahaul and Spiti area is given below:

**Table-1:**

Year of census	Total Population	Men	Women	No. of person/ Kms
1961	20,453	11,519	8,939	2
1971	23,538	12,975	10,563	2
1981	32,10	18,171	13,929	2
1991	31,294	17,224	14,070	2
2001	33,224	18,416	14,807	2

The scheduled castes and scheduled tribes population of the district as per 1991 census was 2,224 and 24,088 persons, respectively i.e. 76.97 percent of the population falls under ST quota. Literacy percentage is 56.82 which includes 71.78 males and 38.05% females (1991 census).

### 2.4.2 Major ethnic groups

The Kinnaura's belong to different ethnic groups. Among them the Rajputs (also known as Kanet, Khas, Khasia or Khasa) are the dominant group. Next comes 'Koli'- who are weavers and artisans, leather workers and ploughmen (Hali), ironsmiths and silversmiths, carpenters and masons and basket makers, respectively. The Brahmins are conspicuous by their absence from the social groupings. In general, the Kinnaura's have two broad categories i.e. Khasia and Beru. Beru is further sub-divided into two sub-categories.

- a) **The domang**, which includes, the Lohar and the Badhi.
- b) **The chamang**, which includes Nagalu; and the ethnic Rajputs inhabiting the upper part of Pooh sub-division, being Buddhists are called Jad or Zad. The Khasias of the Rajputs have three Khel (status groups) viz., Orang, Morang or Maorang and the Waza. These are endogamous status groups and are based on their hierarchical positions and are found only in the Hinduism dominated area. The Khels are subdivided into a number of lineages or Khandans which are Original and immigrants. The latter are the families who came and settled in villages as wives or as Makpa (son-in-law) or came on migration. The functional difference between them is that while the former can directly take part in social, economical, political and religious functions, the latter cannot come of the Khandans. The reasons for that sub-division are not known. Kinnaura society which although is quite ahead of primitive way of living, yet carries many age old traditions as compared to the ones prevailing in socio-economically advanced area. Some of their customs are better than the so-called advanced customs of modern society.

In the Himalayan setup, inter community linkages are very important. The traditional economic linkages between the Kanet and Koli had been that of landlord and tenant. The savarna do not allow out castes to enter the sanctum-sanctorium of the temple premises. The Rajputs accept food and water only from their own community, but they can accept tobacco, bidi, cigarette, fruits from Badhi, and Koli, Badhi can accept food, drinks and dry things from Koli. The Lohar can accept food and drinks from Rajput and Badhi and dry things from Koli. A Koli can however, accept food from all except from the Nagalu, whereas, Nagalu accept everything from other castes. Inter community marriages are not society recognized. However, these restrictions are breaking down.

In Kinnaur, when ceremonial friendship occurs between a man and women, it is called Jokheya, and when it occurs between two women it is called Konech. The friendship is established by exchanging garlands of fruit called jokheya un or Knoech un, on an auspicious day and by exchanging food and home brewed wine. It is expected of a ceremonial friend to help each other in the hour of need.

Similarly, ceremonial brotherhood and sisterhood is also established within the same ethnic group and same status group, but not with the same Khandan. This is known as Kokheya or dharambhai and rinkche or dharam-bahin. During one's distress, one's Kokheya or rinkche comes forward to help.

The inhabitants of Lahaul and Spiti and Sumdo area of Kinnaur are overwhelmingly Buddhist. Even the XI Century B.C. monasteries at Gumrang, Sissoo, Udaipur, Tabo and Kee are still in good shape. The Hindu temple on Udaipur side depicts the presence of Shiva, The Almighty. However, in Pir Panjal area, Hinduism is practised. In Lahaul valley, the people have their own dialect which developed with ages. While in Spiti and Sumdo area, the language is more near to Tibetan dialect. The entire

population can be categorized into-Swanglas and Lahaulas in Lahaul, Bodhs in Spiti and Kinnaur and Hindus in Pir Panjal area.

Religion-wise breakup of population of district Lahaul and Spiti is indicated below as per 1991 census: Hindus 12,393, Muslims 23, Christians 47, Sikhs 79, Buddhists 18,744, Religion not stated 8. Total 31,284.

### **2.4.3 Major occupation**

The tribals of Kinnaur in Himachal Pradesh are mostly engaged in semi-agricultural activities, such as rearing of cows, sheep, goat, buffaloes etc. and ploughing small fields, which are their sources of sustenance. Agriculture, supplemented by animal husbandry and trade, is the main occupation of these tribal people of Kinnaur. The Kinnauras have primarily been an agro-pastoral tribe. The traditional occupation of the Kinnauras had been agriculture, trade, sheep rearing, but nowadays-different kinds of occupations like cultivation, sheep and goat rearing, spinning and mule tethering are combined together. The other importance is that while most of the male workers of all ethnic groups have more than one occupation, their females have only two occupations-agricultural work and preparing woollen clothes. Very few inhabitants of Kinnaur are landless. Most of them own land though the acreage varies. The average landholding among the Rajputs is higher than among the Kolis. Under the rhingmo or hala system, Koli cultivates the land and does all agricultural work of Rajput families, in lieu of which he gets a fixed amount of cereals. The jajmani system among the Kinnauras is known as bainana system. It is the system of mutual cooperation between the Rajput and Koli, Lohar, Badhi and Nagalu. Under the former, the Kolis are given wool to weave clothes, and in the latter cloth is given for stitching. In lieu of the service rendered, they get cereals and sometimes cash. Similar relations also exist with Ores, Damang and Chamang, where they are paid in cash or in cereals in lieu of the various services rendered by them. Besides Bainana, Bhoara and Mokomokheyasimig systems also co-exist in which under the former, all related persons are invited for economic pursuits and social affairs and under the latter one's neighbour (related or unrelated persons) are invited, and in lieu of the work they are served food. It is socially obligatory on the part of a person to render mutual help whenever called upon to do so. Prior to the closure of the border, trade was carried on with Tibet, which has since been stopped. Now the Kinnauras market their produce through Lavi fair at Rampur and through middlemen to Shimla and other places in the country. The Kinnauras are dexterous in the art of weaving, knitting and basket making and do sell their woollen or basket products.

The Kinnaura's are non-vegetarian. They are also fond of Chhang and smoking tobacco. The staple food of Kinnauras consists of Chapati, wheat and barley or maize with rongi or mah. Chapati of opla and phapra (varieties of buck-wheat) are also prepared. Potato is the staple vegetable, fruit like Apple, Apricot, Pear, Grape, Peach and Nuts are grown on commercial scale and are also consumed locally during the season.

The harsh and inhospitable climatic conditions of the area have resulted in thin population density. As such there is general shortage of labour in villages or a cluster of villages. The people have successfully overcome this problem of labour deficiency through their rich socio-cultural traits and community participation is an unique example. People help each other in all the farm activities. Irrigation, management, crop harvesting, crop threshing and shepherding are the activities of greater community participation. During the events of casualties, community comes forward for rescue. Community lands have also been designated for common produce. Sometimes, monastic lands are distributed on lease to small marginal landholders. This practice of community participation has resulted in long run sustainability of village eco-system.

The tribals of Lahaul and Spiti people have agriculture and animal husbandry as the main occupation. The area is well known for its disease free seed potato and the people have reaped the highest yield in the world. Pea, Kuth, and Hops are the next promising enterprises. Presently, Lahaulis are quite open and highly educated while Spitians are a bit backward. This rise in literacy has abolished the polyandry system from Lahaul, where as it still prevails in Spiti to some extent. In Pir Panjal area, the livelihood is mainly comprised of agro-pastoral system.

## **2.5 Political profile**

The district Kinnaur is sub-divided into three sub-divisions of Nichar, Kalpa and Pooh. Kalpa sub-division comprises Nichar Tehsil Kalpa sub-divisions comprises of Kalpa and Sangla; while Pooh sub-division comprises Pooh and Morang tehsils and Hangrang sub-tehsil with the district headquarter at Reckong Peo headed by the Deputy Commissioner.

The Sub-Divisional Officer (Civil) works as Sub-Divisional Officer (civil). Pooh is administrated by the Additional District Magistrate within his own Sub-division. The Sub-Divisional Officer (civil) is Revenue Assistant of his own Sub-division. The Sub-divisions exercise powers of Assistant collector 1<sup>st</sup> grade under the H.P. Land Revenue Act, and the H. P. Land Reforms Act. Block Development Officers exercise powers of Sub-Judge for trial cases up to pecuniary jurisdiction of Rs. 2000 and this varies in case of the incumbents of the post in view of their background and experience. The Sub-Divisional Officer (Kalpa) is the Land Acquisition Officer for the whole districts. All the Tehsildars in the district are invested with the powers of Magistrate II class. They are Assistant Collector-II Grade under the H. P. Land Revenue Act, the H .P Land Reforms Act. For partition cases they exercise powers of 1<sup>st</sup> Grade under the H.P Land Revenue Act. At Nichar and Pooh, where Sub-Treasuries exist, the Tehsildars are Sub-Treasury officers. They are Sub-Registrars under the Registration Act and also the compensation Officer under the Himachal Pradesh Land Reforms Act. Tehsildars at Sangla and Morang are also invested with the powers of Sub-Judge up to pecuniary jurisdiction of Rs. 500. The Naib Tehsildar, Hangrang wields powers of Assistant Collector II grade under the H.P Land Revenue Act and Magistrate III class for trial of criminal cases. The following table shows the other district level Officers:

**Table-2:**

<b>Department</b>	<b>Designation</b>	<b>Headquarters</b>
Police	Superintendent of Police	Kalpa
Medical and Health	District Medical Officer	--do--
P. W. D.	Executive Engineer, Kinnaur Division	--do--
Panchayat	District Panchayat Officer	--do--
Forest	Divisional Forest Officer	Nichar and Pooh
Agriculture	District Agriculture Officer	Kalpa
Horticulture	Horticulture Development Officer	--do--
Co-operative	District Cooperative and Supplies Officer	--do--
Industries	District Industries Officer	--do--
Education	District Education Officer	--do--
Employment	District Employment Officer	--do--
Animal Husbandry	District Animal Husbandry Officer	--do--
Public Relations and Tourism	District Public Relation Officer	--do--
Welfare	District Welfare Officer	--do--
Home guards	Commandant, Home Guards	--do--
Transport	Assistant Regional Manager	Tapri
Treasury	Treasury Officer	Kalpa

Various organizations of the Government of India with offices in the district include, the Postal Department, Intelligence Bureau, the Area Organizer of the special Security Bureau, the Field Publicity Officer of the Ministry of Information and Broadcasting and the Indo-Tibetan Border Police.

In Lahaul and Spiti 1960, the area was re-organised into a district with two sub-divisions: one, the Spiti Sub-Division with headquarters at Kaza and other, the Lahaul

Sub-Division with headquarters at Keylong headed by the Deputy Commissioner Spiti is administered by Additional district collector similarly as in case of Pooh division in Kinnaur. The Deputy Commissioners are bestowed with vast powers, being the single line administration and have control over all the Govt. departments and his respective districts of Kinnaur, Lahaul and Spiti.

## 2.6 Ecological profile

### 2.6.1 Natural ecosystems (Kinnaur)

In Kinnaur district, three types of natural vegetation is found:

- a) **The wet zone forests** are found on the left side of the Sutlej Valley where common variety is Kail, Spruce and Fir trees. In the depressed tracts, broad-leaved trees of Horse Chestnut, Hazelnut, Maple, Bird Cherry and Walnut are found.
- b) **The dry zone forests** extend from Nichar to Chini. Deodar reaches its optimum height and development in this zone. At lower levels, pine trees abound, spruce and silver fir trees, which are found at higher elevations. Neoza pines, which produce edible nuts, grow in this zone and are the only prominent forests of Neoza in India of its own kind.
- c) The parts adjoining Tibetan border contain arid zone forests consisting of Wild rose and dwarf bushes. On higher elevations with cool aspects, deodar grows.

Only about 282 square kilometer area of the district is under forests.

The soil in Kinnaur generally consists of sand, sandy- loam, clay loam, gravel etc.

There are two small lakes in the Kinnaur district in village 'Nako' in 'Hangrang' Sub-Tehsil. Another small lake is situated above the villages of 'Jemi' and 'Ramni' in Nichar Tehsil. It is locally called 'Sorang'. Springs here are mostly snowfed. One such spring is found at Nathpa, three at Tapri and one at Joktiaring.

### 2.6.2 Lahaul and Spiti

The Lahaul and Spiti valleys differ from each other in their physical features to some extent. Spiti valley is broad, enchanting and completely rugged without any verdure worth the name, while Lahaul valley is narrow and at once steep, but studded with green patches of poplar, willows and other coniferous forests. The Spiti valley has a minimum altitude of about 3,333 mtr. At the entrance to 5,350 mtr. near Kunzum La. The Lahaul valley has a low elevation, broadly ranging between about 2,200 mtr. at the exit (Thirot Nallah) to about 5,000 mtr. Near the source of Chandra and Bhaga. But, both the valleys have very high rugged mountains, covered with massive snow and glaciers rising as high as 6,700 mtr. above mean sea level. The valley of Spiti and

Lahaul remain almost cut off from each other for almost eight months of the year by its mighty wall of Himalayan ranges between them. It is only through Kunzum La with its 5,000 mtr. height, which permits the passage in the remaining 4 months from July to October.

Closely associated with the high elevation and snow mountain ranges are the glaciers and ice caves in the district. The famous being known as Bara Shigri or the big glacier. Capt. Harcourt who visited this glacier in 1869 puts its width as nearly two miles (kms). Across this Bara Shigri, there is another glacier known as Chhota Shigri. Other famous glaciers are Gallgstang, Sonagani (visible from Rohtang Pass) and Perad glacier (having a nice cave), The only metallic mineral of commercial significance, known from this district is stitinite, the ore of antimony. Geology comprises gneiss and schistose rocks, slates, quartzite, phyllites, sandstones, slates, dolomite, shales, limestones and fossiliferous, limestone calcareous shales with rich fossils (Lipak, Hansa and Spiti). Fossils- Ammonites, Tenaculites, Orthis (Paleozoic and Mesozoic) are found with complete sequence from Pre-Cambrian to Quarternary.

In broader sense, the climate can be categorized into spring, autumn, summer and winter seasons. Natural springs and rivers get frozen in winters. Lahaul valley and Pir-Panjal ranges experience heavy snowfall throughout the winters (6 months), while Spiti has very less precipitation during winters. Even, this lowers the mercury level to  $-40^{\circ}$  C. However, a temperature of  $-20^{\circ}$  C is normally observed. Summers are associated with strong winds (40 to 60 km/hr) causing dust storms. Quite high diurnal temperature variations during day and night are observed in summer season. The excessive ultraviolet and infrared radiations coupled with strong chilly winds turn the exposed parts of skin to black.

Both the valleys are, indeed, star studded with enormous rivers and rivulets. The main amongst the numerous rivers in Lahaul being Chandra river which originates from Chandra Tal near Baralacha and extends downward upto Tandi, the other river is the Bhaga which originates from Suraj Tal opposite Baralacha and meets Chandra at Tandi and beyond Tandi the two rivers amalgamate into Chandra Bhaga or Chenab river, adding numerous rivulets on the way until they leave the district at Thirot Nallah to Zangi and onwards to Pakistan and ultimately immortalizes itself into the Arabian Sea. In the Spiti valley, as the name indicates, the main river is the Spiti, which originates from the heights of Kunzum La and swallows on its way with numerous rivers and rivulets joining it. The other famous river joining is the Pin river, which has its source near Bhabha pass and ultimately Joins Spiti river from the right side. From the left side the rivers that join the Spiti river are Lingti, Gumto and Prarchu.

## CHAPTER-3

# CURRENT RANGE AND STATUS OF BIODIVERSITY

Written documents on the distribution and the uses of bioresources can be traced back to as old as the human civilization. Systematic documentation on such resources has begun only after the Rio convention on the biological diversity (Groombridge, 1992; Systematic Agenda, 1934; Heywood, 1995). Moreover, with the advancement of Information Technology, the process of development of databases and their online display in World Wide Web is fast growing, particularly in the developed countries.

There has been an incomplete yet quite satisfactory progress towards documenting taxonomic diversity of flora-fauna, their geographic distribution and uses from these districts through states to the national level (Hooker, 1872-97; Chowdhery and Wadhwa; 1984; Aswal & Mehrotra, 1994; Chauhan, 1999; Mhaskar, et. al, 2000). There have been other attempts such as Jain and Rao (1983), Nayar and Sastry (1987-90), Chatterjee and Prakash (1997), forest working plans and district Gazetteers on assessing biodiversity. Many of the species find place in the Red Data Book of Indian plants and animals. For example, Kumar et al (1997) compiled 65 medicinal and aromatic plant species, many of them from the W. Himalayan, reportedly facing genetic erosion. Notably enough, all the assessments are qualitative, not based on actual empirical study of population densities in their wild habitats. Quantitative measurement of abundance of the species in different landscape element types under various natural as well as human induced pressures, therefore, need to be carried out for any meaningful *in situ* and *ex situ* conservation measures. Ironically, even the available information is scattered and quite often inaccessible. It is high time that electronic data basing of this wealth of information should be undertaken on priority so as to facilitate centralized but easily accessible information about the biodiversity. The Indian satellite IRS IC produces information on reflectance on a scale of 128 intensity values for blue, green, red and near infra red wavebands for picture elements or pixels on a scale as fine as 500 sq. mt. for every 24 days (Kasturirangan, et al, 1996). This information on reflectance can be linked to the ground information on the species interfacing with the GIS techniques so as to develop resource-mapping database (Roy et al, 1991; Nagendra and Gadgil, 1999, Saran et. al, 2000; Negi, 2001).

Current range and status in the Sub State site is as follows:

### 3.1 Natural ecosystem

The flora of the two districts fall under Himalayan dry temperate, dry alpine (cold deserts) in Lahaul-Spiti and Pooch division of Kinnaur, whereas the forests in Nichar, Sangla and Kalpa areas falls under the moist alpine forests. Nichar, Sangla and Kalpa area are dominated by tree species of *Cedrus deodara*, *Pinus wallichiana*, *Picea*

*smithiana*, *Abies pindrow*, *Taxus wallichiana*, *Quercus floribunda*, *Q. semecarpifolia*, *Q. ballot* (Peo and Kalpa region). The vegetation in the other parts of the area covering Pooh, Lahaul and Spiti is sparse, discontinuous and scattered, clearly showing the rugged landscape with brown sand and barren rocks, but at the same time is most varied and attractive owing to the dry alpine nature. Curiously shaped bushes, majority of which form spinescent cushions, dominate vegetation stunted forms, twisted and bent nature of stems, succulency, cushiony and matted habits and strong root systems are the characteristic feature of the vegetation.

The only green patches, soothing to the eyes are available around the villages with activated fields and irrigated hay lands. Only cluster of trees of *Populus balsamifera*, *P. ciliata*, *Salix fragilis*, *S. elegans* and dilapidated *Juniperus macropoda* are seen next to the villages and Gompas. Mommental trees of Poplars, Junipers, Salix and Betula can be seen at Rangrik, Lossar, Pomrang, Gue, Gulling, Tabo, Pooh, Mane, Kungri, Chud, and Nako etc. Many of the trees are surviving because they are considered to be the abode of deities. Birth (Bhojpatra) patch is existing opposite Pooh bridge near Saran in Spiti, Baspa valley in Kinnaur has in plenty, while in Lahaul, small trees can be seen on the right side slopes beyond Gramphoo. Thick forest patch of *Hippophae* exists in Mane village, a tree size *Myricaria* can be seen at Gue and dilapidated Juniper patch is in evidence near Gue and Kaa loops reminding us of the past forests and the present day destruction by biotic interference. Lahaul and Kinnaur are greener than Spiti. Mini Manali at Udaipur has a thick forest patch of Deodar (*Cedrus deodara*). Vast tracts of hill slopes are covered by *Juniperus macropoda*; between Udaipur and Keylong. Whereas, in Pooh area the Juniper trees are badly damaged. *Faxinus xanthoxyloides* grows as medium sized tree in both Pooh and Udaipur areas. The afforestation efforts by DDP projects in Spiti and Pooh area have created green patches of *Populus*, *Salix*, *Robinia* and fruit trees.

Most prominent shrubs include *Rosa macrophylla* (wild rose), species of *Hippophae*, *Myricaria*, *Salix flabellaris*, *S. hastate*, *S. lindeleyana*, *Juniperus recurva*, *Ribes orientale*, *R. alpestre*, *Lonicera spinosa* (Thapp), *L. obovata*, *L. rupicola*, *Capparis spinosa*, *Caragana brevifolia* (Trama). *Rhododendron lepidotum*, *Colutea nepalensis*, *Ephedra gerardiana*, *Clematis vernayii*, *Cotoneaster microphylla* etc. The scrub and spiny cushions are formed by the species of *Caragana*, *Astragalus*, *Artemisia*, *Cousinia*, *Saussurea*, *Lonicera* and *Arnebia*. Herbaceous element is dominated by the species of *Astragalus*, *Chesneya*, *Oxtropis*, *Cicer*, *Lindelophia*, *Allium*, *Rumex*, *Nepeta*, *Heracleum*, *Chenopodium*, *Artemisia*, *Lactuca*, *Gentiana*, *Gentianella*, *Hyssopus*, *Pedicularis*, *Rheum*, *Aquilaria*, *Caltha*, *Taraxacum*, *Plantagos*, *Aconitum*, *Thymus*, *Delphinium*, *Lepidium*, *Crepis*, *Mentha*, *Geranium*, *Bergenia*, *Senecio* and *Mertensia*. *Hyoscyamus niger* (Tukhlang) is frequent near villages in Gulling and Kibber, *Linum perenne* (Linseed) in Pin Valley and Rangrik Hill slopes; *Cicer microphyllum* (Chirri, Wild gram) in Demul pastures Pin Valley; *Eremurus himalaicus* (Fox tail lily) in Sagnam glacier and *Hyssopus officinalis* (Tengu) in Burr-Gulling area and sparsely in Attargu and Kaa slopes.

### **3.2 Agricultural ecosystem:**

In Kinnaur, in general, very little land out of the total geographical area is suitable and available for cultivation of crops in the hills. However, as there is not much scope for other economic activities like industry, commerce and trade etc. Agriculture is the mainstay of livelihood of people in the district.

The district takes advantage of Kharif, as a full cropping season. In the winter, the entire area remains covered under snow. Only Wheat, Barley and Peas are grown in Rabi season, remaining Rabi crops in whole of Kinnaur are grown in Kharif, while in upper Kinnaur, there is only one cropping season and all Rabi crops are sown in summer. Only one crop is grown in a year and as such people have to depend upon imported wheat. Wheat and Barley are grown in summer season in the fields owned by farmers on high hills, locally called 'Kanda'.

Millets and other grains include Oglā, Paphra Cheena, Cholai, Kangni and Bathu. Rabi includes Kalao and (local pea), Lentil and Mustard. The vegetables grown are Cabbage, Peas, Turnip, Tomato, Cauliflower, Lady's finger, Brinjal, Spinach; while the other non-food crops include condiments and spices like Zeera, Saffron, drugs and narcotics as Hops, Kuth, Chicory and Manu (pushkarmool). Rice has been an important crop of the whole village of 'Kilba' since unknown times.

The climate of Kinnaur is cold and dry and is ideally suited for the production of temperate fruits and the fruits that can be dried. Apples, Apricots, Almond, and Walnut are grown all over the district. Grapes are grown in Kalpa and Morang areas. Plum, Cherry, Hazelnut, Pears and Peaches are widely grown in Nichar, Kalpa and Morang area. Kaghzi Almonds grown here match the best quality of almonds grown anywhere. Tibba valley is famous for Grapes.

Agriculture in Lahaul and Spiti district is the predominant occupation of an overwhelming number of households. The traditional crops on the uneconomic holdings used to be Barley and Buckwheat and pulses like Peas, Oils-Seeds etc. These are the cash crops even today. However, with the opening of the vehicular roads etc. people have shifted from cereal crops to commercial crops like seed potatoes. At the moment, Lahaul Sub-division produces seed Potatoes, which are known for its disease freeness and is popular throughout the country. In order to help the farmers with the latest techniques of producing disease free seed potatoes, the Government has started a farm at Gorma in Pattan Valley to aid and advise the farmers. Before the coming of seed potatoes, Kuth used to be the principal commercial crop in the valley for which research station was set up at Keylong in 1960 for doing research on scientific lines. There are another two experimental farms in Lara and Kyuling in Spiti Sub-Division for seed multiplication. Hops cultivation is picking up again in Pattan Valley after its slump in 1996-97.

Lahulas primarily lead an agro-commercial life, the predominantly agro-pastoral. With livestock population outnumbering the human population the Animal Husbandry Department of course, is rendering a pioneering service by trying to popularize quality livestock in the district, there are 8 Veterinary Hospitals and 15 veterinary Dispensaries in the district.

**Table-3: Status of Trees present in Sub. State site**

Sr.No.	Name	Sr.No.	Name
1.	<i>Abies smithiana</i>	30.	<i>Pinus roxburghii</i>
2.	<i>Abies spectabilis</i>	31.	<i>Pinus wallichiana</i>
3.	<i>Acer acuminatum</i>	32.	<i>Pistacia integerrima</i>
4.	<i>Acer caesium</i>	33.	<i>Populus alba</i>
5.	<i>Acer oblongum</i>	34.	<i>Populus ciliata</i>
6.	<i>Acer pentapomicum</i>	35.	<i>Populus euphratica</i>
7.	<i>Aesculus indica</i>	36.	<i>Prunus cerasoides</i>
8.	<i>Amygdalus persica</i>	37.	<i>Prunus cornuta</i>
9.	<i>Betula utilis</i>	38.	<i>Prunus persica</i>
10.	<i>Buxus wallichiana</i>	39.	<i>Pyrus foliolosa</i>
11.	<i>Carpinus faginea</i>	40.	<i>Pyrus malus</i>
12.	<i>Carpinus viminea</i>	41.	<i>Pyrus pashia</i>
13.	<i>Cedrus deodara</i>	42.	<i>Quercus dilatata</i>
14.	<i>Celtis australis</i>	43.	<i>Quercus baloot (Q. ilex)</i>
15.	<i>Corylus colurna</i>	44.	<i>Quercus leucotrichophora</i>
16.	<i>Cpuressus torulosa</i>	45.	<i>Quercus semecarpifolia</i>
17.	<i>Euonymus fimbriatus</i>	46.	<i>Rhododendron arboreum</i>
18.	<i>Grewia optiva</i>	47.	<i>Rhus semialata</i>
19.	<i>Juglans regia</i>	48.	<i>Rhus wallichii</i>
20.	<i>Juniperus macropoda</i>	49.	<i>Robinia pseudacacia</i>
21.	<i>Litsea umbrosa</i>	50.	<i>Salix acmophylla</i>
22.	<i>Machilus duthiie</i>	51.	<i>Salix daphroides</i>
23.	<i>Machilus odoratissima</i>	52.	<i>Salix denticulata</i>
24.	<i>Malus baccata</i>	53.	<i>Salix flagellaris</i>
25.	<i>Morus serrata</i>	54.	<i>Salix karelinii</i>
26.	<i>Olea cuspidata</i>	55.	<i>Salix tetrasperma</i>
27.	<i>Picea smithiana</i>	56.	<i>Salix viminalis</i>
28.	<i>Picrasma quassioides</i>	57.	<i>Salix wallichiana</i>
29.	<i>Pinus gerardiana</i>	58.	<i>Ulmus wallichiana</i>

**Table-4: Status of Shrubs present in Lahaul and Spiti and Kinnaur**

S.No	Name	S. No	Name
1.	<i>Abelia triflora</i>	76.	<i>Lonicera angustifolia</i>
2.	<i>Andrachne cordifolia</i>	77.	<i>Lonicera asperifolia</i>
3.	<i>Astragalus candollianus</i>	78.	<i>Lonicera bracteata</i>
4.	<i>Astragalus rhizanthus</i>	79.	<i>Lonicera discolor</i>
5.	<i>Berberis aristata</i>	80.	<i>Lonicera govaniiana</i>
6.	<i>Berberis ceratophylla</i>	81.	<i>Lonicera heterophylla</i>
7.	<i>Berberis chitria</i>	82.	<i>Lonicera hispida</i>
8.	<i>Berberis concinna</i>	83.	<i>Lonicera hypoleuca</i>
9.	<i>Berberis jaeschkeana</i>	84.	<i>Lonicera myrtillus</i>
10.	<i>Berberis kunawurensis</i>	85.	<i>Lonicera obovata</i>
11.	<i>Berberis lycium</i>	86.	<i>Linicera parvifolia</i>
12.	<i>Berberis pachyacantha</i>	87.	<i>Loniciera quinquelocularis</i>
13.	<i>Berberis petiolaris</i>	88.	<i>Loniciera spinosa</i>
14.	<i>Berberis umbellata</i>	89.	<i>Loniciera webbiana</i>
15.	<i>Bosia amherstiana</i>	90.	<i>Myricaria elegana</i>
16.	<i>Buddleia paniculata</i>	91.	<i>Myricaria germanica</i>
17.	<i>Capparis himalyensis</i>	92.	<i>Myrsine africana</i>
18.	<i>Capparis spinosa</i>	93.	<i>Osbeckia stellata</i>
19.	<i>Caragana brevispina</i>	94.	<i>Periploca calophylla</i>
20.	<i>Caragana gerardiana</i>	95.	<i>Plectranthus rugosus</i>
21.	<i>Caragana versicolor</i>	96.	<i>Potentilla fruticosa</i>
22.	<i>Colutea multiflora</i>	97.	<i>Prinsepia utilis</i>
23.	<i>Colutea nepalensis</i>	98.	<i>Prunus jacquemontii</i>
24.	<i>Cotoneaster acuminata</i>	99.	<i>Rhamnua prostrata</i>
25.	<i>Cotoneaster rosea</i>	100.	<i>Rhamnus purpurens</i>
26.	<i>Cotoneaster thamsoni</i>	101.	<i>Rhamnus triqueter</i>
27.	<i>Cotoneaster bacillaris</i>	102.	<i>Rhamnus virgatus</i>
28.	<i>Cotoneaster duthieanus</i>	103.	<i>Rhododendron anthopogon</i>
29.	<i>Cotoneaster falconeri</i>	104.	<i>Rhododendron campanulatum</i>
30.	<i>Cotoneaster gilgitensis</i>	105.	<i>Rhododendron lepidotum</i>
31.	<i>Cotoneaster microphylla</i>	106.	<i>Rhus cotinus</i>
32.	<i>Cotoneaster nummularia</i>	107.	<i>Rhus punjabensis</i>
33.	<i>Cotoneaster obovatus</i>	108.	<i>Ribes glaciale</i>
34.	<i>Cotoneaster obtusus</i>	109.	<i>Ribes grassularia</i>
35.	<i>Cotoneaster pruinosis</i>	110.	<i>Ribes nigrum</i>
36.	<i>Crataegus sonarica</i>	111.	<i>Ribes orientale</i>
37.	<i>Daphne mucronata</i>	112.	<i>Ribes ribrum</i>
38.	<i>Desmodium concinum</i>	113.	<i>Rosa brunonii</i>

39.	<i>Desmodium floribundum</i>	114.	<i>Rosa eglanteria</i>
40.	<i>Desmodium natans</i>	115.	<i>Rosa macrophlla</i>
41.	<i>Desmodium oxphyllum</i>	116.	<i>Rosa minor</i>
42.	<i>Desmodium podocarpum</i>	117.	<i>Rosa webbiana</i>
43.	<i>Desmodium pseudo-triquestrum</i>	118.	<i>Rubus biflorus</i>
44.	<i>Desmodium tilaeifolium</i>	119.	<i>Rubus biflorus</i>
45.	<i>Deutzia corymbosa</i>	120.	<i>Rubus ellipticus</i>
46.	<i>Deutzia staminea</i>	121.	<i>Rubus lasiocarpus</i>
47.	<i>Elaeagnus pariflora</i>	122.	<i>Rubus purpureus</i>
48.	<i>Elaeagnus umbellata</i>	123.	<i>Sabia campanula</i>
49.	<i>Elsholzia polystachya</i>	124.	<i>Salix hastata</i>
50.	<i>Ephedra gerardiana</i>	125.	<i>Salix lindleyana</i>
51.	<i>Euonymus echinatus</i>	126.	<i>Salix oxycarpa</i>
52.	<i>Euonymus fimbriatus</i>	127.	<i>Salix pycnostachya</i>
53.	<i>Euonymus monbeigii</i>	128.	<i>Skimmia laureola</i>
54.	<i>Euonymus tingens</i>	129.	<i>Sorbaria tementosa</i>
55.	<i>Ficus foveolata</i>	130.	<i>Sorbus accupania</i>
56.	<i>Gaultheria trichophylla</i>	131.	<i>Sorbus lanata</i>
57.	<i>Hamiltonia suaveolens</i>	132.	<i>Sorbus ursina</i>
58.	<i>Hippophae rhamnoides</i>	133.	<i>Spirea canescens</i>
59.	<i>Hippopae salicifolia</i>	134.	<i>Spirea sorbifolia</i>
60.	<i>Hippopae tibetana</i>	135.	<i>Staphylea emodi</i>
61.	<i>Hydroangea anomala</i>	136.	<i>Strobilanthes alatus</i>
62.	<i>Hypericum cernuum</i>	137.	<i>Strobilanthes atropurpurens</i>
63.	<i>Hypericum patulum</i>	138.	<i>Strobilanthes dalhousianus</i>
64.	<i>Incarvillea arguta</i>	139.	<i>Strobilanthes glutinosus</i>
65.	<i>Indigofera gerardiana</i>	140.	<i>Strobilanthes wallichii</i>
66.	<i>Indigofera heterantha</i>	141.	<i>Symplocos crataegoides</i>
67.	<i>Inula cappa</i>	142.	<i>Syringa emodi</i>
68.	<i>Inula cuspidata</i>	143.	<i>Tamaricaria elegans</i>
69.	<i>Jasminum humile</i>	144.	<i>Verbascum traipses</i>
70.	<i>Jasminum officinale</i>	145.	<i>Viburnum cotinifolium</i>
71.	<i>Juniperus pseudo-sabina</i>	146.	<i>Viburnum nervosum</i>
72.	<i>Juniperus recurva</i>	147.	<i>Viburnum stellulatum</i>
73.	<i>Leptodermis lanceolata</i>	148.	<i>Viscum album (Epiphyte on trees)</i>
74.	<i>Lespedeza eriocarpa</i>	149.	<i>Wickstromia canescens</i>
75.	<i>Lonicera alpigena</i>		

**Table-5: Status of climbers.**

S.No.	Name	S.No.	Name
1.	<i>Clematis barbellata</i>	7.	<i>Clematis tibetana</i>
2.	<i>Clematis buchananiana</i>	8.	<i>Clematis verneyi</i>
3.	<i>Clematis connata</i>	9.	<i>Cuscuta reflexa</i>
4.	<i>Clematis grata</i>	10.	<i>Cynachum auriculatum</i>
5.	<i>Clematis montana</i>	11.	<i>Humulus lupulus</i>
6.	<i>Clematis orientalis</i>	12.	<i>Rhynchosia pseudo-cajan</i>

**Table-6: Status of Grasses**

S.No.	Name	S.No.	Name
1.	<i>Agropyron cannaliculatum</i>	56.	<i>Koeleria macrantha</i>
2.	<i>Agropyron semicostatum</i>	57.	<i>Koeleria nepalensis</i>
3.	<i>Agrostis alba</i>	58.	<i>Leymus secalinus</i>
4.	<i>Agrostis filipes</i>	59.	<i>Melia persica</i>
5.	<i>Agrostis gigantea</i>	60.	<i>Oplismenus compasitus</i>
6.	<i>Agrostis griffithiana</i>	61.	<i>Panicum miliaceum</i>
7.	<i>Agrostis munrona</i>	62.	<i>Pennistum flaccidum</i>
8.	<i>Agrosits pilosula</i>	63.	<i>Pennistum lanatum</i>
9.	<i>Agrosits stolonifera</i>	64.	<i>Phacelurus speciosus</i>
10.	<i>Allopecurus arundinaceus</i>	65.	<i>Phleum alpinum</i>
11.	<i>Arthraxon lancifolius</i>	66.	<i>Phragmites australis</i>
12.	<i>Arthraxon priondes</i>	67.	<i>Piptatherum gracile</i>
13.	<i>Arundinaria falcata</i>	68.	<i>Piptatherum hilariae</i>
14.	<i>Arundinaria spathiflora</i>	69.	<i>Piptatherum munroi</i>
15.	<i>Avena aspera</i>	70.	<i>Poa alpina</i>
16.	<i>Avena fatua</i>	71.	<i>Poa annua</i>
17.	<i>Brachyactis pubescens</i>	72.	<i>Poa bactriana</i>
18.	<i>Brachyactis roylei</i>	73.	<i>Poa bulbosa</i>
19.	<i>Brachypodium sylvaticum</i>	74.	<i>Poa calliopsis</i>
20.	<i>Briza media</i>	75.	<i>Poa glauca</i>
21.	<i>Bromus confinis</i>	76.	<i>Poa koelzii</i>
22.	<i>Bromus gracillimus</i>	77.	<i>Poa lahulensis</i>
23.	<i>Bromus himalaicus</i>	78.	<i>Poa nemoralis</i>
24.	<i>Bromus inermis</i>	79.	<i>Poa pagophila</i>
25.	<i>Bromus japonicus</i>	80.	<i>Poa Papratensis</i>
26.	<i>Bromus oxyodon</i>	81.	<i>Poa sikkimensis</i>

27.	<i>Bromus pectinatus</i>	82.	<i>Poa stapfiana</i>
28.	<i>Bromus ramosus</i>	83.	<i>Poa sterilis</i>
29.	<i>Bromus tectorum</i>	84.	<i>Poa stewartiana</i>
30.	<i>Catobrosella himalaica</i>	85.	<i>Poa supina</i>
31.	<i>Chrysopogon gryllus</i>	86.	<i>Poa tibetica</i>
32.	<i>Cymbopogon jwarancusa</i>	87.	<i>Poa versicolor</i>
33.	<i>Cymbopogon olivieri</i>	88.	<i>Polypogon manspeliensis</i>
34.	<i>Dactylis glomerata</i>	89.	<i>Puccinellia himalaica</i>
35.	<i>Danthonia cachemyriana</i>	90.	<i>Puccinellia kashmiriana</i>
36.	<i>Danthonia schneideri</i>	91.	<i>Saccharum ravennae</i>
37.	<i>Deyeuxia compacta</i>	92.	<i>Setaria italica</i>
38.	<i>Deyeuxia scabrescens</i>	93.	<i>Setaria viridis</i>
39.	<i>Digitaria cruciata</i>	94.	<i>Spodisogon dubius</i>
40.	<i>Duthiea bromoides</i>	95.	<i>Spodisogon piliferus</i>
41.	<i>Echinochloa crus-galli</i>	96.	<i>Stipa brandisii</i>
42.	<i>Eleocharis atropurpurea</i>	97.	<i>Stipa capillata</i>
43.	<i>Eleocharis chaetaria</i>	98.	<i>Stipa hoelzii</i>
44.	<i>Eleocharis palustris</i>	99.	<i>Stipa jacquemontii</i>
45.	<i>Eleocharis retroflexa</i>	100.	<i>Stipa mongholica</i>
46.	<i>Elymus dohuristicus</i>	101.	<i>Stipa orientalis</i>
47.	<i>Elymus longe-aristatus</i>	102.	<i>Stipa pennata</i>
48.	<i>Elymus natans</i>	103.	<i>Stipa splendens</i>
49.	<i>Elymus schrenleianus</i>	104.	<i>Trisetum clarkei</i>
50.	<i>Elymus semicostatus</i>	105.	<i>Trisetum spicatum</i>
51.	<i>Eragrostis minor</i>	106.	<i>Yalopoa nutans</i>
52.	<i>Eragrostis nigra</i>		
53.	<i>Eremopa persica</i>		
54.	<i>Hierochloe laxa</i>		
55.	<i>Koeleria argentea</i>		

**Table 7: Status of Medicinal and Aromatic Plants.**

<b>Sr.No.</b>	<b>Name</b>	<b>Sr.No.</b>	<b>Name</b>
1.	<i>Abies spectabilis</i>	109.	<i>Gentiana tianshanica</i>
2.	<i>Abies webbiana</i>	110.	<i>Gentianella moorcroftiana</i>
3.	<i>Achillea millefolium</i>	111.	<i>Gentianella paludosa</i>
4.	<i>Achyranthes aspera</i>	112.	<i>Geranium nepalense</i>
5.	<i>Aconitum laeve</i>	113.	<i>Geranium wallichianum</i>
6.	<i>Aconitum rotundifolium</i>	114.	<i>Habenaria plataginea</i>
7.	<i>Aconitum deinorrhizum</i>	115.	<i>Heracleum candicans</i>

8.	<i>Aconitum heterophyllum</i>	116.	<i>Heracleum thomsonii</i>
9.	<i>Aconitum violaceum</i>	117.	<i>Hippophae rhamnoides</i>
10.	<i>Acorus calamus</i>	118.	<i>Hippophae salicifolia</i>
11.	<i>Adiantum venustum</i>	119.	<i>Hippophae turkestanica</i>
12.	<i>Aesculus indica</i>	120.	<i>Humulus lupulus</i>
13.	<i>Ajuga bracteosa</i>	121.	<i>Hyoscyamus niger</i>
14.	<i>Allium carolinianum</i>	122.	<i>Hypericum perforatum</i>
15.	<i>Allium humile</i>	123.	<i>Hyssopus officinalis</i>
16.	<i>Allium jacquemontii</i>	124.	<i>Inula racemosa</i>
17.	<i>Allium przewalskianum</i>	125.	<i>Jasminum humile</i>
18.	<i>Allium rubellum</i>	126.	<i>Juglans regia</i>
19.	<i>Amranthus cruentus</i>	127.	<i>Juniperus communis</i>
20.	<i>Amygdalus persica</i>	128.	<i>Juniperus macropoda</i>
21.	<i>Anagalis arvensis</i>	129.	<i>Juniperus pseudo-sabina</i>
22.	<i>Andrachne cordifolia</i>	130.	<i>Jurinea dolomoiea</i>
23.	<i>Androsae rotundifolia</i>	131.	<i>Jurinella macrocephala</i>
24.	<i>Anemone obtusiloba</i>	132.	<i>Lamium rhomboidum</i>
25.	<i>Angelica glauca</i>	133.	<i>Linum perenne</i>
26.	<i>Aquilegia fragrans</i>	134.	<i>Malaxis muscifera</i>
27.	<i>Aquilegia pubiflora</i>	135.	<i>Malva rotundifolia</i>
28.	<i>Arnebia benthamii</i>	136.	<i>Meconopsis aculeata</i>
29.	<i>Arnebia euchroma</i>	136.	<i>Mentha longifolia</i>
30.	<i>Arnebia guttata</i>	136.	<i>Morina coulteriana</i>
31.	<i>Artemisia brevifolia</i>	137.	<i>Myricaria germanica</i>
32.	<i>Artemisia dracunculus</i>	138.	<i>Myrsine africana</i>
33.	<i>Artemisia gmelinii</i>	139.	<i>Nepeta eriostachya</i>
34.	<i>Artemisia maritima</i>	140.	<i>Nepeta nivalis</i>
35.	<i>Artemisia parviflora</i>	141.	<i>Nicotiana tobaccum</i>
36.	<i>Artemisia sieversiana</i>	142.	<i>Olea cuspidate</i>
37.	<i>Astragalus candollenus</i>	143.	<i>Onopordum acanthium</i>
38.	<i>Astragalus grahamianus</i>	144.	<i>Onosma hispidum</i>
39.	<i>Berberis aristata</i>	145.	<i>Origanum vulage</i>
40.	<i>Berberis chitria</i>	146.	<i>Oxyria digyna</i>
41.	<i>Berberis jaeschkeana</i>	147.	<i>Paeonia emodi</i>
42.	<i>Berberis kunawurensis</i>	148.	<i>Papaver nudicaule</i>
43.	<i>Berberis lycium</i>	149.	<i>Physochlaina praealata</i>
44.	<i>Berberis pachyacantha</i>	150.	<i>Phytolacca acinosa</i>
45.	<i>Berberis umbellata</i>	151.	<i>Picrasma quassioides</i>

46.	<i>Bergenia ciliata</i>	152.	<i>Picrorhiza kurrooa</i>
47.	<i>Bergenia stracheyi</i>	153.	<i>Pimpinella diversifolia</i>
48.	<i>Bidens pilosa</i>	154.	<i>Plantago depressa</i>
49.	<i>Boenninghausenia albiflora</i>	155.	<i>Plantago lanceolata</i>
50.	<i>Brassica campestris</i>	156.	<i>Pleurospermum brunonis</i>
51.	<i>Bunium persicum</i>	157.	<i>Podophyllum hexandrum</i>
52.	<i>Buplerum falcatum</i>	158.	<i>Polygonatum affine</i>
53.	<i>Buxus wallichiana</i>	159.	<i>Polygonatum cirrhifolium</i>
54.	<i>Caltha palustris</i>	160.	<i>Polygonatum multiflorum</i>
55.	<i>Cannabis sativa</i>	161.	<i>Polygonatum verticillatum</i>
56.	<i>Capparis himalayensis</i>	162.	<i>Polygonum aviculare</i>
57.	<i>Capparis spinosa</i>	163.	<i>Polygonum hydropiper</i>
58.	<i>Cardus nutans</i>	164.	<i>Polygonum plebium</i>
59.	<i>Cassiope fastigiata</i>	165.	<i>Polygonum polystachyum</i>
60.	<i>Cedrus deodara</i>	166.	<i>Polygonum viviparum</i>
61.	<i>Centaurea depressa</i>	167.	<i>Potentilla curviseta</i>
62.	<i>Chaerophyllum acuminatum</i>	168.	<i>Prinsepia utilis</i>
63.	<i>Chaerophyllum reflexum</i>	169.	<i>Prunella vulgaris</i>
64.	<i>Chaerophyllum villosum</i>	170.	<i>Prunus cerasoides</i>
65.	<i>Chenopodium ablum</i>	171.	<i>Ranunculus laetus</i>
66.	<i>Cichorium intybus</i>	172.	<i>Reinwardtia indica</i>
67.	<i>Cirsium arvense</i>	173.	<i>Rheum australe</i>
68.	<i>Codonopsis ovata</i>	174.	<i>Rheum moorcroftiana</i>
69.	<i>Codonopsis rotundifolia</i>	175.	<i>Rheum speciforme</i>
70.	<i>Convolvulus arvensis</i>	176.	<i>Rhododendron anthopogon</i>
71.	<i>Coriandrum sativum</i>	177.	<i>Rhododendron arboreum</i>
72.	<i>Corydalis govanianum</i>	178.	<i>Rhododendron campanulatum</i>
73.	<i>Corylus colurna</i>	179.	<i>Rhododendron lepidotum</i>
74.	<i>Cotoneaster microphylla</i>	180.	<i>Rubia cordifolia</i>

75.	<i>Cousinia thomsonii</i>	181.	<i>Saussurea bracteata</i>
76.	<i>Crocus sativus</i>	182.	<i>Saussurea costus</i>
77.	<i>Cuscuta capitata</i>	183.	<i>Saussurea gossypiphora</i>
78.	<i>Cuscuta europaea</i>	184.	<i>Saussurea obvallata</i>
79.	<i>Cuscuta reflexa</i>	185.	<i>Selinum tenuifolium</i>
80.	<i>Cymbopogon jwarancusa</i>	186.	<i>Selinum vaginatum</i>
81.	<i>Cynoglossum lanceolatum</i>	187.	<i>Skimmia laureola</i>
82.	<i>Cynoglossum micranthum</i>	188.	<i>Solanum nigrum</i>
83.	<i>Cynoglossum microglochin</i>	189.	<i>Solidago virg-aurea</i>
84.	<i>Dactylorhiza hatazeria</i>	190.	<i>Staphylea emodi</i>
85.	<i>Delphineum brunonianum</i>	191.	<i>Symplocos crataegoides</i>
86.	<i>Delphineum cashmerianum</i>	192.	<i>Tanacetum falconeri</i>
87.	<i>Delphineum denudatum</i>	193.	<i>Tanacetum longifolium</i>
88.	<i>Delphineum vestitum</i>	194.	<i>Taraxacum officinale</i>
89.	<i>Dioscorea deltoidea</i>	195.	<i>Taxus wallichiana</i>
90.	<i>Dracocephalum heterophyllum</i>	196.	<i>Thalictrum foliolosum</i>
91.	<i>Elaegnus hortensis</i>	197.	<i>Thermopsis barbata</i>
92.	<i>Elsholtzia densa</i>	198.	<i>Thymus linearis</i>
93.	<i>Elsholtzia eriostachya</i>	199.	<i>Thymus serpyllum</i>
94.	<i>Elsholtzia strobilifera</i>	200.	<i>Tribulus terrestris</i>
95.	<i>Ephedra gerardiana</i>	201.	<i>Tribulus terrestris</i>
96.	<i>Ephedra intermedia</i>	202.	<i>Trillium gavonianum</i>
97.	<i>Eremurus himalaicus</i>	203.	<i>Valeriana hardwickii</i>
98.	<i>Eriophyton wallichii</i>	204.	<i>Valeriana jaeschkei</i>
99.	<i>Euphorbia thomseniana</i>	205.	<i>Valeriana jatamansi</i>
100.	<i>Fagaphyrum esculentum</i>	206.	<i>Verbascum thapsus</i>
101.	<i>Ferula jaeschkeana</i>	207.	<i>Viola biflora</i>
102.	<i>Fraxinum xanthoxyloides</i>	208.	<i>Viola kunawarensis</i>
103.	<i>Galinsogo parviflora</i>	209.	<i>Viscum album</i>
104.	<i>Galium aparine</i>	210.	<i>Waldheimia glabra</i>
105.	<i>Galium rotundifolium</i>	211.	<i>Waldheimia tomentosa</i>
106.	<i>Galium verum</i>	212.	<i>Zanthoxylum armatum</i>
107.	<i>Gaultheria nummularioides</i>	213.	<i>Zehneria umbellat</i>

108.	<i>Gentiana kurroo</i>		
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**Table-8: Status of rare and threatened species:**

S.No.	Name	S.No.	Name
1.	<i>Achillea millefolium</i>	34.	<i>Juniperus recurva</i>
2.	<i>Aconitum heterophyllum</i>	35.	<i>Jurinea tibetica</i>
3.	<i>Aconitum violaceum</i>	36.	<i>Leontopodium frinbriligerum</i>
4.	<i>Arnebia benthami</i>	37.	<i>Limosella aquatica</i>
5.	<i>Arnebia euchroma</i>	38.	<i>Meconopsis bikramii</i>
6.	<i>Arnebia guttata</i>	39.	<i>Orobanchhe hansii</i>
7.	<i>Astragalus candolloianus</i>	40.	<i>Pedicularis albida</i>
8.	<i>Astragalus grahamianus</i>	41.	<i>Pedicularis pychnantha</i>
9.	<i>Astragalus leucocephalus</i>	42.	<i>Pedicularis purpurea</i>
10.	<i>Betula utilis</i>	43.	<i>Physochlaina praealta</i>
11.	<i>Bunium persicum</i>	44.	<i>Picrorhiza kurrooa</i>
12.	<i>Carex borii</i>	45.	<i>Pinus gerardiana</i>
13.	<i>Carum carvi</i>	46.	<i>Podophyllum hexandrum</i>
14.	<i>Chrysanthemum pyrathroides</i>	47.	<i>Potentilla curviseta</i>
15.	<i>Cortusa mathiole</i>	48.	<i>Potentilla fulgens</i>
16.	<i>Dactylorhiza hatagirea</i>	49.	<i>Rheum australe</i>
17.	<i>Draba cachemirica</i>	50.	<i>Rheum moorcroftianum</i>
18.	<i>Draba lasiophylla</i>	51.	<i>Rheum spiciforme</i>
19.	<i>Ephedra gerardiana</i>	52.	<i>Saussurea gnapholoides</i>
20.	<i>Eremurus himalaicus</i>	53.	<i>Saussurea gossypiphora</i>
21.	<i>Euphrasia jaeschkei</i>	54.	<i>Saussurea obvallata</i>
22.	<i>Euphrasia pauciflora</i>	55.	<i>Scrophularia koelzii</i>
23.	<i>Euphrasia platyphylla</i>	56.	<i>Scrophularia suffruticosa</i>
24.	<i>Ferula jaeshkeana</i>	57.	<i>Sedum jaeschkei</i>
25.	<i>Galium serpylloides</i>	58.	<i>Seseli trilobium</i>
26.	<i>Gentiana tianschanica</i>	59.	<i>Silene edoardi</i>
27.	<i>Hedysarum cashmerianuin</i>	60.	<i>Silene stewartii</i>
28.	<i>Heracleum candicans</i>	61.	<i>Thylacospermum caespitosum</i>
29.	<i>Geracleum thomsoni</i>	62.	<i>Valeriana jaeschkei</i>
30.	<i>Heteropappus holohermaphroditus</i>	63.	<i>Veronica biloba</i>

31.	<i>Hyoscyamus niger</i>	64.	<i>Viola biflora</i>
32.	<i>Inular racemosa</i>	65.	<i>Waldhemia glabra</i>
33.	<i>Juniperus communis</i>	66.	<i>Waldhemia stoliczkei</i>
		67.	<i>Waldhemia tomentosa</i>

**Table-9: Inventory of Key Economic Medicinal and Aromatic Plants and their Current Status and Distribution**

Sr. No	Latin Name	Local/Vern. Names	Area of distribution	Uses
1.	<i>Allium carolinianum</i>	Laot, Jangli, Lahasum	Kee Gompa, Kibber, Gue and Gulling	Leaves edible, Flower heads as condiments
2.	<i>A. jaquemontii</i>	Konche, Pharna	Kibber, Sagnum, Dumla, La. Darcha	Leaves, bulbs and flower used as condiment
3.	<i>Arnebia euchroma</i>	Khamet, Ratan jot	Kibber, Dumla, Rangrik and Pin valley	Dyeing/colouring of silk, wool, foodstuffs, hair oil. Root used in eye diseases, toothache and earaches, anticancerous.
4.	<i>Achillea millefolium</i>	Gandana, Millfoil	Sporadic in Pin Valley	Bitter, Pungent, essential oil as astringent, tonic and diaphoretic
5.	<i>Artemisia brevifolia</i>	Nurcha, Seinki	Tabo, Gue, La Darcha, Pin area	Essential oil insecticidal, Santonin in bitter pills against hookworms.
6.	<i>Bergenia stracheyi</i>	Gatikpa, Pashand bhed	Mane lake area and Sagnum glacier	Root diuretic and used for expulsion of urinary bladder stones, Analgesic

			area	
7.	<i>Betula jaquemontii</i>	Bhojpatra, Bhuj	Demule Pastures	Bark is acrid, pungent, heating, tonic, and alexiteric, useful in convulsions, bronchitis. Fungal outgrowth called "Bhurjagranthi" is locally used to cure muscular pain, swellings and its decoction is applied as vaginal douche to avoid conception.
8.	<i>Carum carvi</i>	Shingu, Dru, Mawo	More common in Gue and Gulling and sporadic elsewhere	Fruits as condiments regarded aromatic, pungent, stomachic, carminative and useful in flatulence.
9.	<i>Corydalis govaniana</i>	Bhutjata	Demule pastures	Twisted entwined, brown rootstocks are used as tonic, diuretic and in eye diseases.
10.	<i>Dactylorrhiza hatagirea</i>	Angbolagh, Panja, Salampanja	Mudh area and Shego	Roots are used as farinaceous food, nervine tonic and aphrodisic.
11.	<i>Ephedra gerardiana</i>	Som, Chha, Tutganthaa, Chhedang	Common between Sumdo, Tabo, Mane lake, etc.	Ephedrine useful in asthma and respiratory problems.
12.	<i>Gentiana Kurroo</i>	Tikta, Karu. Kour	Sagnum Pasture only	The root is a bitter tonic useful in the diseases of

				liver and spleen.
13.	<i>Gentiana moorcroftiana</i>	Tikta	Moderate in Pin Valley	Plant is used in colic, sore throat and chest complaints.
14.	<i>Colchicum luteum</i>	Suranjan Kukum	Rare and endemic to Kukumseri area in Lahaul (Udaipur range)	Colchicine obtained from its bulbs are used in plant breeding programme to induce polyploidy.
15.	<i>Hyoscyamus niger</i>	Khurasani ajwain, Henbane	Common near villages all over the area and more so in the valley	Used in nervous affections asthma and whooping cough. Leaves yield Hyosyamine and Hyoscine used in various formulations in modern medicines.
16.	<i>Heracleum condicans</i>	Heypomo Padara	Rangrik, gulling, Mudh area, Sagnum glacier	Roots yield xanthotoxin, which is highly efficacious in the treatment of leucoderma and psoriasis.
17.	<i>Hyssopus officinalis</i>	Tengu, Juffa	Common in Pin valley	Highly scented herb yielding upto one percent essential oil. Local lamas in fevers and blood related diseases use flowering tops.
18.	<i>Juniperus communis</i>	Hauber, Dhuppi	Sporadic in Pin valley	Its fruits and essential oil is used in dropsy and diseases of urinogenital tract.

19.	<i>Juniperus macropoda</i>	Dhup, Dhoop	Pooh, Gue, Tabo, Lari, etc.	Wood is used for making pencils, pen-holders and walking sticks, Volatile oil used as a substitute for oil of <i>J. communis</i>
20.	<i>Malva rotundifolia</i>	Khubasi	Kaza and elsewhere near villages	Plant is used as a potherb and shoots as salad. Seeds are useful in bronchitis. Flowers contain tannin.
21.	<i>Onoma hipidum</i>	Ratanjot Gaojaban	Sporadic in Gue, Ledang, Rangrik and Sagnum area	Red roots are adulterated in Ratanjot; Red dye obtained from the roots is used for dyeing and colouring foodstuffs. Plant is regarded as tonic demulcent, diuretic and refrigerant. Root paste can be applied to cuts and wounds.
22.	<i>Physochlaina praealta</i>	Latang	Sporadic in Mane and Pin Valley areas	Tield alkaloids like Aropene and Hyoscyamine, which enter into various modern fomulaitions as antidote, sedative, narcotic, anodyne and in dilation of the pupil.
23.	<i>Rhododendron anthopogon</i>	Talis, Talispatra	Alpine area in Pin valley,	Leaves posses stimulant properties. These are aromatic and

			Gulling, Bar and Kungri	are administered as an errhine to produce sneezing
24.	<i>Taraxacum officinale</i>	Khurmang, Dandelion	Sporadic to moderate all over the area	Roots are used as diuretic, stomachic, hepatic stimulant and tonic. Young plant is used as vegetable.

## Wild life

The wild animals of Lahaul and Spiti are not numerous. The fauna is quite unique with palaeartic affinities and Tibetan fauna like Ibex, Bharal, Brown bear, Tibetan wolf, Nayan, Marmot, Snow leopard, Ibex, Weasel, Vole, Snow cock, Snow partridge, Chukor, Chough, Raven etc. Two sanctuaries namely Pin Valley National Park in Spiti and the Sechu Tuan Nala in Chamba have been formed in the Cold Deserts of Himachal Pradesh. Lippa Asrang Sanctuary is located on the high latitude area and one of the few in India from where the Yak has been reported, though it may well be feral. Musk Deer and Ibex are also present. The area is largely flat, like a huge plateau and apart of it is barren cold desert. This sanctuary is among the few in Himachal Pradesh, which is not open to tourists.

## Fauna (Mammals)

Species, which are believed to locally threaten, are Himalayan Black Bear, Brown Bear, Musk Deer, Ghoral, Ibex, Leopard, Blue Sheep and Yak. **Rakchham Chittul Sanctuary** is located at high altitude and is a good habitat for the endangered Musk Deer. **Rupi Bhaba Sanctuary**. A remarkably wide variation in altitude supports a large diversity of habitats and wild life in this catchment area of the Sutlej River. The Great Himalayan and Pin Valley National Parks are located on its Western and Northern boundaries, respectively.

## CHAPTER-4

# STATEMENT OF PROBLEMS RELATING TO BIODIVERSITY

Statements of the problems relating to biodiversity in Sub-State site are as follows:

### 4.1 Proximate causes of loss of biodiversity

- a) Increasing population pressure.
- b) Destruction of habitats due to construction of large hydroelectric dams, roads and buildings had lead to deforestation and excessive landslides.
- c) Excessive harvesting of natural and plantation trees for construction purpose.
- d) Due to extreme and prolonged winters, heavy demand for fuel wood takes toll of existing vegetation, shrubs, bushes and perennial species along with their roots.
- e) Monoculture in the form of plantation of Salix and Poplars is detrimental as the existing and well-adopted species remain neglected and face extermination.
- f) Unscientific and overexploitation of medicinal and aromatic plants results in creating blanks and poor regeneration.
- g) Low precipitation in the form of rains during spring and summer hampers proper growth and development of plants.
- h) Early snowfall hampers seed development leading to poor maturity and often lack of regeneration.
- i) High rate of soil erosion due to wind and water in cold deserts, flash floods in rivers in Kinnaur and Lahaul leads to loss of biodiversity.
- j) Landslides due to flow of glaciers sweeps away the landmass along with the vegetation cover.
- k) Watershed management programmes have not yielded wanted results due to lack of peoples active participation.
- l) Lack of control over land use for the benefit of the total society.
- m) One sided or at best, narrow application of technology to achieve certain goals without the consideration of the effects of this technology on human environment or man himself.

#### 4.2.1 General causes

- a) Lack of knowledge amongst the people about biodiversity existing in the area (people have knowledge only about the plants, which they use for one or the other purpose).
- b) Increase in population.

- c) Excessive grazing by domesticated and migratory animals during spring and summers.
- d) Shortage of fuel wood forces people to harvest bushes and shrubs including perennials along with root system causing degradation of ecosystem and loss of diversity.
- e) Heavy demand for fodder compels people to harvest grasses and annuals before seed shedding stage, thereby making natural regeneration impossible.
- f) Excessive harvesting of natural or plantation trees/branches for construction purpose/thatching of roofs and making of temporary bridges over rivulets.
- g) Over exploitation of certain medicinal and aromatic plants for pharmaceutical industries.
- h) Diversion of glacial waters from the open towards agricultural fields leads to poor growth of species growing in such areas.
- i) Lack of seed and planting material needs encouragement of nursery development.
- j) Fading cultural practices of biodiversity conservation such as community regulations on high altitude grasslands and ban on mass harvest of certain medicinal plants before seeding.

#### **4.2.2 Abiotic factors responsible for low productivity**

1. Short growing season, long freezing winters.
2. Extreme variation in diurnal as well as seasonal temperatures (40° C to-40° C).
3. Too scanty precipitation during growing season.
4. Strong velocity winds (40-60 Km per hour).
5. Low oxygen content in the air.
6. Heavy influx of infra-red and ultra-violet rays.
7. Coarse, highly porous, immature sandy soils prone to wind and water erosion.

#### **4.2.2 Eco-physiological reasons for poor plant growth**

- a) Reduced seed production, poor germination, excessive heat and lack of soil moisture hinder natural regeneration.
- b) High velocity winds lead to deformed canopy.
- c) Excessive frost lead to leaf injury, results in its desiccation and less photosynthetic activity.
- d) High rate of transpiration in high temperatures.
- e) Heavy respiration loss during darkness and winters.
- f) Inadequate shoot primordial formation in terminal buds leading to limited shoot increment during next growing season.

### 4.2.3 Socio-political factors

- a) Inadequate sources of livelihood in most of the families in the area.
- b) Inadequate vocational as well as higher education institutions for education, research and training relating to biodiversity.
- c) Poor communication network leading to isolation.
- d) Lack of post harvest techniques/processing industries in agriculture, horticulture and Allied fields (medicinal and aromatic plants).
- e) Communication gaps for effective transfer of technology for agriculture, horticulture forestry, livestock etc., due to poor extension facilities.
- f) Lack of women organizations and NGO's.
- g) Deep rooted religions and rigid traditions hampers adoption of new innovations.
- h) Lack of awareness on biodiversity access, benefit sharing and intellectual property rights.
- i) Lack of community ownership to bio-resources in surrounding public and forestlands leading towards "Tragedy of commons" like situations.
- j) Inadequate measures to resolve conflicts between conservation and development.
- k) No mechanisms to deal with emerging challenges of Intellectual Property Rights (IPR) issues and genetically modified organisms.
- l) Inadequate effects to biodiversity enterprise based enhancement of quality of life of local communities.
- m) Poor efforts towards promotion of sustainable livelihood through giving economic incentives to the community leaders now engaged in potato and Apple co-operatives. These leaders otherwise, may take a lead in promoting sustainable utilization of resources and conservation of biological diversity.

## CHAPTER-5

# MAJOR ACTORS AND THEIR CURRENT ROLES RELEVANT TO BIODIVERSITY

Major actors and their current roles relevant to biodiversity are as follows:

### 5.1 Govt. agencies, Armed Forces and others

- a) Desert Development agency in Pooh and Spiti divisions has encouraged plantation programmes, mainly the species of Salix and Populous, construction of irrigation channels, fencing of the plantation are through stonewall and providing Solar lights, heaters and improved chullahs to ease pressure on fuel wood.
- b) The line departments like the department of Forest Farming and Conservation, Rural and Tribal development, Agriculture, Horticulture and Animal Husbandry are involved in different activities as per their mandate for these areas:
  - i) The Department of Forest is engaged in afforestation programmes.
  - ii) The Tribal Development Department is helping the people to adopt new technologies and innovations and is providing subsidiary facilities.
  - iii) The Department of Horticulture has been successful in motivating the people in growing fruit crops like Apple, Grapes, Hops, Walnut, and Apricots, Almonds etc.
  - iv) The farmers engage the department of Animal Husbandry in cattle, sheep and goat improvement programmes and introduction of high milk yielding breeds of cows. Fishery is being given impetus and these are introduced and reared in the existing lakes and streams.
  - v) The Department of Agriculture is encouraging cultivation of off-season vegetables and disease free seeds.

### 5.2 Perception of local communities( Rural and Urban)

- i) People are not aware of biodiversity conservation programme.
- ii) Traditional crops are declining and only selected commercial crops are being grown.
- iii) Population has increased whereas ,the landholding remains the same.

- iv) The area remains snow covered for more than 6 months and diversification of crops becomes difficult.
- v) Local species of trees and shrubs like Bhojpata, Junipers, Deodar, *Pinus gerardiana*, Kail etc. are not being grown by the Forest Department and only Willows and Poplars are encouraged.
- vi) People participation is negligible. If they are involved, the plantations will be more successful. Example is the pine plantation raised by the people successfully near Keylong.
- vii) The glaciers in the area are receding and the local people are worried about the availability of adequate water for drinking and irrigation.
- viii) Due to loose soil strata, irrigation water is not retained by the soil.
- ix) Hydram technology should be popularized for irrigation in the area.
- x) Timber is distributed to the farmers under T. D. brought from out side the districts and is very costly beyond the reach of poor people.
- xi) Govt. land may be made available to the farmers for cultivation.
- xii) The progress of watershed development programmes in the areas has neither been effective nor encouraging.
- xiii) Use of chemical fertilizers/insecticides/pesticides is causing harm to the soil strata in the area and is also causing water pollution.
- xiv) In the field of horticulture, Lahaul area has the potential to grow apple and other fruits in the area, but the department is yet to popularize and introduce these crops in the area on large scale.
- xv) Livestock population of traditional species like Yak, Churu and Goat, Sheep is declining.
- xvi) Medicinal and aromatic plants/herbs are being extracted widely from the areas, which are causing loss of the germplasm of rare and valuable species.

## **5.2 Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan:**

For the holistic development of High Mountain areas in Himachal Pradesh, The University has a separate Regional Research Institute at Sharbo (in Dist. Kinnaur), Tabo (Dist. Lahaul & Spiti) and Chamba (Dist. Chamba), which cater to the various needs of the local people and also carry out different developmental as well as research activities related to biodiversity.

## CHAPTER-6

# ONGOING BIODIVERSITY INITIATIVES (INCLUDING ASSESSMENT OF THEIR EFFICACY)

A large gamut of biodiversity friendly programs such as desert development (DDP), watershed development, afforestation, plantation, soil and water conservation, pasture development, fishery, yak breeding etc. are going on in these Sub-State Sites. However, positive outcome of most of these programmes are yet to be ascertained, other projects such as DDP has registered failure results despite of expenditure crossing millions of rupees. This probably happened due to poor cross-sectoral co-ordination and poor participation of local people for implementing the whole programme. This has come to prominence when a local individual effort started showing results in one of the places viz. Thankarma in district Kinnaur that has earlier witnessed the failure results under DDP. Now, there is more greenery than ever before indirectly questioning the unsuccessful efforts initiated by the Government Agencies that have initially overlooked local traditional wisdom of irrigation and the use of farmyard manure. Protected areas such as viz. Rupi- Bhaba Wild Life Sanctuary in Kinnaur and Pin Valley National Park in Lahaul- Spiti have been set aside to protect wild animals and plants. However, focus is now shifting from just flagship species to the entire landscapes and waterscapes. Realizing the importance of the biological resources and paucity of information, Institute of Himalayan Bioresource Technology (IHBT)- Palampur in association with CSK-HPKVV- Palampur, UHF-Solan and BSI-Dehradun has recently initiated databasing of plant resources from the Sub-State site. IHBT is also carrying out ecosystem assessments and ecological monitoring of medicinal and aromatic herbs and plant resources and developing agro-techniques to cultivate them so as to reduce pressures on their natural populations. The Institute further continues to work on its overall objectives of inventorying, monitoring and conservation of biological diversity in the region besides imparting information, training and technology transfer.

Some of the ongoing biodiversity related initiatives according to different sectors are as follows:

### 6.1 Governmental initiatives

- i) Afforestation under DDP in Spiti and Pooh is continuing for about 20 years.
- ii) Afforestation by State Forest Department.

- iii) Under the Non-timber forest product scheme (CSS) being run in Spiti, the forest department is conserving the M&AP species and some species are being planted in gap plantation areas wherever irrigation is possible.
- iv) About 50 hectares of forestland in Spiti is being planted every year under *Hippophae* (Seabuckthorn) and about 50,000 seedlings have been raised in nurseries for future plantations.
- v) Wild animals are fully protected under the Wild Life Management of Pin Valley National Park and Kibber Wild Life Sanctuary areas. As a result, the population of Snow Leopard, Blue Sheep, Ilex and Tibetan Wolf etc. has shown significant improvement over the last 3 years.
- vi) Dr. Y. S. Parmar University of Horticulture and Forestry, Solan under its Herbarium section in the department of Forest Products headed by Dr. N.S. Chauhan has conducted frequent surveys in Kinnaur, Lahaul and Spiti, 477 species of plant diversity have been documented for Spiti alone.
- vii) The Directorate of Extension Education has published a bulletin on 30 major medicinal and aromatic plants along with a bilingual coloured bulletin on medicinal and aromatic plants of Spiti.
- viii) A project on Botanical Survey, Chemical Screening and Cultivation of Medicinal and Aromatic Plants was successfully completed during 1996-1997 funded by DDP Spiti at Kaza. 74 species of medicinal and aromatic plants and 104 species of use in traditional remedies have been documented.
- ix) Efforts are being made to produce seed and planting material of high altitude medicinal and aromatic plant species having great demand from drug industries in its herbal garden at Rahla, District Kullu.
- x) Documentation of traditional knowledge about 300 plant species from tribal areas has been completed.
- xi) Research is going on regeneration of Chilgoza and Junipers species.
- xii) Aswal and Mehrotra of CDRI Lucknow have published flora of Lahaul and Spiti, which also contains and large number of species from Rohtang-Marrhi areas in it.
- xiii) The scientists of Dr. Y.S Parmar University of Horticulture and Forestry, Nauri, Solan, H.P. have also standardized propagation techniques for Seabuckthorn.
- xiv) Report on Himachal Pradesh herbal wealth and traditional system of medicines having information on NGO's contribution documented by HP ST&E Council, Shimla.

## 6.2.1 Wild diversity

### Plants:

Willows, Poplars, Chharma, Bhojpatra, Trama, Thapp, Sia (Wild rose) Umboo (Myricaria), Junipers, Ribes etc.

### Medicinal and aromatic plants :

Patish, Salampanja, Somlata, Rhubarb (Lechu and Tukshu), Kalazeera (Shingu), Tukhland, Chora, Bankakri, Dhoop, Nurcha, Seinski (Artemisia) Kabra (*Capparis spinsosa*), etc.

## 6.2.2 Cultivated plants

Barley (both awned and awnless), Wheat, Buckwheat, Local Peas, Peas, Potato, Mustard, Kodra, off-season vegetables like Onion, Cabbage, Cauliflower, Spinach etc. and, medicinal and aromatic plants like Kuth, Kalazeera, Manu (Pushkarmool), Chicory and Hops etc.

## Fruits

### a) Wild fruits

Ribes spp. (Currants), Chharma, Apricot, Behmi, Rubus, Lonicera, Marphop, Capparis, Chenopodium, Foliolosum, Chigloza, Walnut, *Pyrus lanata*, *Sorbaria* spp. and *Berberis* species.

### b) Domesticated

Apple, Grapes, Walnut, Almonds, Apricot, (drying type).

## 6.2.3 Animals and birds

### a) Wild

Ibex, Snow Leopard, Tibetan, Wolf, Red Fox, Woolly Hare, Himalayan Chough, Snow pegeon, Snow cock, Vulture, Ducks, Murgabi, Himalayan Crow, Golden Eagle, Chakor, Dove, Sparrow etc.

**b) Domesticated**

Yak, Churu, Cows, Oxen, Donkey, Ponies and Mules, Horse, Sheep, Goat, Pashmina, Dog, Cat, Fish, Cock.

### **6.2.4 Afforestation**

- i) Local plants growing in the area are not being propagated. Emphasis is on willows and poplars only .
- ii) Techniques needed to be developed for local species well adapted to the sites.
- iii) People have raised chir pine forest adjacent to Keylong, which is growing well and has established at the site. If any body cuts wood from here, he is fined Rs. 500/- and in case of encroachment by cattle a fine of Rs. 5/- per cattle is imposed.
- iv) Plantation raised by people themselves is successful as it is taken care of by the people themselves.
- v) Sufficient funds are provided by the Govt. for tribal areas, but neither the money nor the technical know-how reaches them.
- vi) Timber provided under TDS is costly and beyond the purchasing power of common people.
- vii) Adequate irrigation facilities are required for raising plantations.
- viii) Kuth cultivation is getting set back as the Govt. demands license for its cultivation.
- ix) Use of chemical fertilizer is causing harm to the soil, organic manures should be encouraged.

### **6.3 Universities**

Some of the major activities covered by the universities (Agriculture and Forestry and research stations) are:

- i) A collection of 72 cultivars of fruit crops have been maintained which include 30 cultivars of Apple, 20 of Almond, 18 of Apricot, 3 of Grapes and one of Prune. These have been evaluated for their growth parameters. All the collections have survived well in the extreme climatic conditions and have started bearing sample fruits.
- ii) Pride of India variety of Cabbage, PTWG variety of Turnip, Spanish White and RRWT of Radish, Ladakhi Palak, Kasturi Methi have been raised as fresh vegetable and quality seed produced successfully.
- iii) Pollinator fauna for different temperate fruits have been worked out, which consisted of *Syrphids*, *Eristalis spp*, *Xylocopa* and four species of solitary bees.
- iv) Willow (*Salix spp*) is most successful forest plant in the cold desert due to higher survival rate. Giant willow aphid *Roberolachnus salignatus*

(Gmelin) was recorded as serious pest causing 70 to 80 percent infestation upto 3,500 m elevations. Plants above 4,000 m altitude were found free from its attack.

- v) Under Seabuckthorn aided project, its complete screening of germ plasm, propagation technology through cuttings, seeds and root suckers, establishment, biomass production, nutrient estimations, seed oil, post harvest technology for pulp, jam squash, hard drinks, etc., have been standardized.
- vi) Seabuckthorn for socio-eco-economic rehabilitation of cold deserts with the rationale to explore the possibilities and develop strategic plan for eco-economic harnessing of Seabuckthorn.
- vii) A Cold Desert Action Plan: Herein 22 developmental models related to the development of horticulture, agriculture, forestry, grazing areas and high altitude pastures, watershed, development nomadic settlements, animal husbandry, floriculture, fisheries, ecotourism, gender force, introduction of fast growing indigenous and exotic species, MPRs, seed production, non-conventional energy sources, agro forestry, wildlife, creating awareness among elderly and school children, etc., have been proposed.
- viii) Identification and Enumeration of Flora of Cold desert area with special reference to medicinal and aromatic plants has been studied and herbarium of important species established.
- ix) Ecology and Ethnobotany of Spiti area has been documented.
- x) Propagation technologies of important medicinal and aromatic plants from Spiti have been developed and many species are established in the University Herbal Garden for future studies.
- xi) Chemical Constituents of few aromatic plant species has also been worked upon. Biological activity of half a dozen species has been undertaken.
- xii) Studies on ecological linkages between major cold desert ecosystems viz., agriculture, horticulture, farm forestry, grasslands, etc., for Lahaul and Spiti areas are near completion.
- xiii) Evaluation of survival rate of plantations in Ladakh and Leh Forest Division (1994-95) plantations at Leh, Hyoma, Changthang, and Nubra have been carried out.
- xiv) **Eco development in Ladakh-** A case study of Leh District to assess the present status of developmental activities have been carried out by different agencies incorporating ecosystem, land use pattern, agriculture, horticulture, forestry, animal husbandry, soil and moisture conservation, etc. for identifying and formulating various strategies for socio economic upliftment of the rural poor has been studied.
- xv) Studies on bioproductivity of cold deserts and role of women in plantation management with the basic objectives such as key factors in land mass protection and conservation, role of women in vegetation/forest protection, technological base of existing farming practices for conservation, women in economic transformation, people

participation for rehabilitation and developing policy issues have been completed.

- xvi) **Evaluation of DDP of Spiti Areas:** Aspects covered include complete status of all the developmental activities covered including irrigation, afforestation, agriculture, horticulture, cost effectiveness and awareness etc.
- xvii) **Ecological aspects of pasture management in alpine zone of Himachal Pradesh:** The intention was to study the effect of grazing on forest ecosystem and study their historical perspectives of management practices.

**Other related studies being carried out at the University Research Stations at Sharbo (Kinnaur), Tabo (Spiti) and Chamba include the following:**

- i) Spur type apple cultivars viz., Red Fuji, Star Crimson, Golden Spur Delicious, Oregon Spur, Silver Spur, Royal Gala, Red Spur, etc., have also been introduced in dry temperate and cold desert areas, and are being evaluated for their suitability for future use of the growers.
- ii) Different cultivars of Cherry have also been introduced and out of which, cultivar Durone Nero-III gave the larger fruit size as compared to the other.
- iii) Twenty-one varieties of Almond have been introduced and Merceed recorded the highest fruit yield in cultivar Drake followed.
- iv) Sixty plants of Pistachionut cultivars Kerman and Peters (Pollinator) have been introduced from abroad at Sharbo (Kinnaur) to observe their performance under dry temperate conditions.
- v) Out of the different cultivars of Pear introduced at Sharbo (Kinnaur), Red Bartlett, Bartlett and William Bon Cheriton were performing very well with regards to both growth as well as fruit production and its quality.
- vi) Twenty-one cultivars of almond have also been raised and evaluated for their performance studies.
- vii) Introduction/plantation of Scarlet Gala, Red Fuji, Vance Delicious, Royal Delicious, and other Spur type apple cultivars, along with Almond, Apricot, Pistachio nut and Walnut have also been carried out at Tabo (Spiti).
- viii) Seven cultivars of Strawberry have also been introduced for further evaluation studies.
- ix) Mulathi (*Glycyrrhiza glabra*) has been successfully grown as an under crop in this region.
- x) Twenty-two clones of *Populus ciliata* have been tested at nursery stage for their growth performance and the most promising ones will be tested in field under different altitudinal and microclimatic conditions.
- xi) Grafting of Neoza pine has been standardized.
- xii) Different fertilizer trials of Kalazeera have been carried out in order to improve seed size and quality and also to increase its seed yield.

Similarly, many isolated studies have also been carried out by the Agricultural University, Palampur, Sher-E- Kashmir University of Agriculture , Science and Technology, State Forest, Horticulture and Agriculture Departments; Irrigation Department, Animal Husbandry Department, Desert Development Projects, etc. of Himachal Pradesh and Jammu and Kashmir.

## CHAPTER-7

# GAP ANALYSIS

Gaps in the field of biodiversity for conservation of biological resources at Sub State Site are as follows:

### **7.1 Gap in information:**

A huge gap exists in information amongst the stakeholders in the area about the importance of biodiversity, nature and extent of biodiversity both wild and domesticated (existing vegetation and cultivated crop including pseudocereals), medicinal and aromatic plants, traditional knowledge about plant uses.

### **7.2 Gaps in vision (e.g. inability to look in the long term or consider the inherent value of biodiversity):**

Since the people are not aware about the significance of biodiversity, their main concern is survival and sustenance. Lack of construction timber and high cost of imported timber forces people to cut and use any tree available due to severe cold and prolonged winters forces them to gather and accumulate fuel wood from trees, shrubs, bushes, perennial herbs alongwith roots to keep their houses warm in the winter season and cook meals for the family. Scarcity of fodder takes toll of bark of the trees, grasses and herbs during growing season totally ignorant of breaking the life cycle of the plant and hindering regeneration, thereby causing loss to biodiversity. Unscientific methods of harvesting medicinal and aromatic plants also are resulting into loss of the valuable resource.

### **7.3 Gaps in policy and legal structure**

The impact of National Forest Policy and State policies is negligible. Ignorance prevails all through with regard to National and State Forest Policies. Wild life protection act has some effect and the major influence in wild life protection comes from Buddhism, as majority of people in Spiti are Budhists. The policies towards natural resource management for sustainable and equitable use, land-water issues including drinking water, energy-light, fuel and fodder, agriculture-food grains, vegetables, soil, seed, fertilizer, pesticides, housing, health and sanitation, employment generation, women empowerment and joint forest management are to some extent visible at places and altogether missing elsewhere in the area.

- Lack of adequate awareness on the part of decision makers.

- Lack of knowledge about the importance of sustainable minor forest produce (NTEP) development and related research and development.
- Lack of adequate funds, facilities, trained manpower, long-term research plans, and appropriate extension facilities are the causes of tremendous technological gaps.

## **7.4 Gaps in institutional and human capacity**

Involvement of people in identification of problems, keeping in view their preferences and priorities; of keeping them in confidence in project formulation, its implementation, monitoring and evaluation has yet to be ensured. A bottom up approach has to be adopted. There is a huge gap between Science and Technology generators working in universities and institutions and the people at large. There is no mechanism in vogue to upgrade the skills of the people especially in the area of traditional knowledge; people being highly conservative do not reveal the age-old knowledge existing in the area. People attach very less importance to the treasure of rare medicinal and aromatic plants, which otherwise can bring revolution to their economic development, create a chain of employment at their doorsteps and provide starting material to the pharmaceutical industries.

## **7.5 Researches and Development**

Impetus is not being given for improvement of the local genetic stock of the biological resources which has potential can withstand the harsh climatic conditions in the area for taking up plantation, improving the vegetation through development of propagation techniques for the local trees, shrubs, bushes, herbs etc. in and around the villages, making improvement in the livestock through cross breeding with exotics.

Irrigation is the major problem in the area because of loose soil strata and water is not retained in the cultivable fields. A lot of technological input is required to be applied in this regard and effective storage and lifting techniques needed to be developed for the benefit of the local inhabitants in the area.

Water is received through the melt of glaciers and for the last few years glacial melt has increased due to global warming effect and precipitation in the form of snow has decreased and the glaciers have started receding as per the observation made through the glacial studies carried out which is quite alarming. Research in this regard needed to be taken up to assess the impact of global warming in this fragile area of the state.

## CHAPTER-8

# MAJOR STRATEGIES TO FILL GAPS AND ENHANCE/ STRENGTHEN ONGOING MEASURES

- Development of an easily accessible and user friendly data base on plant diversity in general, medicinal and aromatic plants in particular for effective dissemination of this information. This will help in future planning initiatives.
- *In situ* and *ex situ* conservation of medicinal and aromatic plants/herbs and other useful forestry species. *In situ* conservation can be achieved through conservation of medicinal and aromatic plants in their natural habitat by creating protectorates, biosphere reserves at requisite places. *Ex situ* conservation can be affected by developing germplasm banks outside their natural abodes. It can be achieved either through seeds or propagules or tissue culture or cryopreservation (storage at low temperature).
- Identification of endemic and endangered species.
- Screening and identification of new medicinal plants for multipurpose utility giving new leads in drugs, as a substitute for imported high value drugs/chemical compounds and also as substitutes for European medicinal plants in global markets.
- Improvement of collected varieties of medicinal plants in terms of higher biomass and higher chemical compounds.
- Faster multiplication of improved varieties.
- Standardization of cultural practices by organic farming, scientific and appropriate harvesting schedules, integrated pest management through multiplication trials.
- Standardization of post harvest technology in terms of drying, grading, pasting, storage, fumigation and transport.
- Development of simple, value added processing facilities at the community level near the farms to create employment opportunities, reduce transportation cost and increase benefits.
- Development of linkage between the producers and the manufactures (industry).
- Development of quick and simple isolation techniques for chemical ingredients and quality control standards for the compounds.
- Documentation of traditional knowledge on medicinal plants and its validation through modern tools and methods by using toxicological studies and chemical trials leading to inclusion of such tested and proven medicines in the National Health Care Programmes.
- Patenting to process and products in order to sustain in the global market.

- Providing training and enhancing skills of the stakeholders covering all the aspects listed above (Manpower Development).

## **8.1 Strategies to conserve biodiversity of cold desert areas of Himachal Pradesh**

The cold Deserts in Himachal Pradesh are restricted to the district of Lahaul and Spiti. Parts of Kinnaur (Sumdo side) and Pir Panjal in Chamba. These areas have very difficult terrains with ice fields perpetual snow covered peaks and hostile climate.

About 40 percent of the total geographical area of Himachal Pradesh falling towards North-Eastern region and covering the divisions of Spiti and Pooch is characterized by severe cold and scanty rainfall, thereby inhibiting the establishment and growth of vegetative cover on major portion of its landscape and have been designated as cold deserts. This is the land of rolling hills and massive, rocky, snow-clad mountains interspersed with tinkling streams and mighty rivers of Chandra, Bhaga, Spiti and Sutlej flowing at the bottom of narrow valleys. In this area, not only the annual mean temperature is low, but also the daily as well as annual temperature ranges are very wide. During winters, the temperature drops to as low as  $-40^{\circ}\text{C}$  and during summers rises up to  $35^{\circ}\text{C}$ . Majority of the areas is a denuded mountain terrain with dry sandy plains and devoid of natural vegetation. Following strategies needed to be initiated for conservation of biodiversity:

- There should be proper check on human and live stock pressure in the such areas.
- Proper irrigation facilities should be available.
- Pressure in terms of fuel wood and fodder should be eased through adopting advanced agricultural technique such as agroforestry systems.
- People should be made aware of the harmful effects of deforestation and importance of vegetation through organizing seminars, lectures and posters etc.
- Government of should take special steps for the development of these areas.
- People's participation should be appreciated in all kind of developmental programmes.
- Adequate funds should be provided in order to maintain the existing biodiversity of the area.
- There should be more and more plantation of forest-trees and exotic species should be introduced to bring more and more areas under vegetation.
- The species to be planted should have high soil binding and nitrogen fixing abilities.
- Emphasis should be given especially for the conservation of endangered species.

## CHAPTER-9

# REQUIRED ACTIONS TO FILL GAPS, AND TO ENHANCE/ STRENGTHEN ONGOING MEASURES

Following actions are suggested to fill the present gaps, and to enhance/ strengthen ongoing measures for the conservation and sustainable use of biodiversity in the Sub-State site of Himachal Pradesh.

## 1. FOR PROMOTING KNOWLEDGE ON CHARACTERISTICS, USE AND VALUES OF BIODIVERSITY

### Action Plan 1a. LANDSCAPE MAPPING & MONITORING:

- i) Satellite imagery based mapping of landscape element types.
- ii) Consider habitat continuity and fragmentation.
- iii) Regulate and monitor encroachment.
- iv) Linkage of ground truthing information to the compilation of scientific and community based inventories

### I. b. INVENTORYING AND MONITORING BIODIVERSITY

- i) Formulate multi scale, multi-agency, nested programmes addressing the entire landscape and waterscape.
- ii) Periodic monitoring of a range of economically and ecologically useful organisms in the landscape-waterscapes at the sub-state site.
- iii) Involve Forest-Fishery-Agriculture Departments; Botanical and Zoological Surveys, Universities, Agricultural University and Research Institutions.
- iv) Inventorying and monitoring Genetically Modified Organisms (GMOs) and Formulate Bio-Safety Protocols at Tehsil/Sub-Tehsil levels.
- v) Biodiversity inventories and compilation of community based knowledge involving schools and colleges, local knowledgeable individuals, Community Leaders, Village Development Committees, and Panchayat Institutions etc.
- vi) Identification and Inventory of biological indicators of atmospheric pollution and Habitat Quality.
- vii) Identification, Inventory and Monitoring of Exotic Invasive Species.

- viii) Establishment of Herbaria, Museums and Electronic Data Bases in relevant Institutions located in the State.
- ix) Developing computerized information system with regulated access.

#### **I.c. SOCIO-ECONOMIC ACTION PLANS**

- i) Documentation of traditional conservation and sustainable use practices.
- ii) Revival of sustainable use practices, such as community regulations of Alpine pastures and extraction of medicinal plants.
- iii) Role of women in promoting conservation and sustainable use of bio resources.
- iv) Studies on forces promoting dissolution of traditional conservation and sustainable use practices.
- v) Changing religious beliefs, community structure, market forces, food habits and social values.
- vi) Documentation of traditional systems of management and knowledge of uses of biodiversity.
- vii) Studies on livelihood implications of biodiversity loss.
- viii) Studies on health implications of biodiversity loss.
- ix) Documentation of response of people to newly emerging challenges such as IPRs and GMOs.

#### **I.d. ENDS AND FORCES DRIVING BIODIVERSITY CHANGE**

- i) Documentation of major changes taking place over time and forces driving such changes in the major ecosystems, namely forests, grasslands, agricultural lands, orchards and plantations, streams and rivers, tanks and lakes and habitations.
- ii) Scientific and community based inventories on bio resources and ecosystem mapping.
- iii) Documentation of major changes taking place over time and forces driving such changes in the major biodiversity resource such as medicinal plants, timber and non-timber forest produce, land races and domesticated and wild animal genetic resources.

## 2. FOR *IN-SITU* AND *EX-SITU* BIODIVERSITY CONSERVATION

### ACTION PLAN

#### 2. a. *IN-SITU* CONSERVATION

- i) Establishment of conservation sites protecting special habitats such as *Dactylorhiza* rich swamp in Spiti and medicinal herb rich Alpine meadows and Musk Deer home forests in Kinnaur.
- ii) Establishment of Yak and Musk Deer breeding conservation sites.
- iii) Establishment of *Neozsa* tree genetic diversity conservation sites.
- iv) *In-situ* conservation of bio-resource rich sites representing different vegetation types.
- v) Establishment of on-farm crop genetic diversity conservation sites.
- vi) Need to establish pilot sites of organic agriculture harbouring high levels of crop genetic diversity with novel institutions and instruments including green markets to motivate people to co-operate, and to encourage/facilitate ongoing farmers or NGO initiatives towards it.
- vii) Need to establish pilot sites for on-farm conservation of indigenous livestock breeds and encourage/facilitate ongoing pastoralists or NGO initiatives towards this.
- viii) Conservation of Sacred Lakes viz. Nako Lake in Kinnaur and Chandra Tal in Lahaul-Spiti.
- ix) Need institutions and instruments to motivate people to continue conservation traditions.
- x) Biodiversity-friendly management of community controlled sustainable use area such as village forests and grasslands.
- xi) Need to bring under control invasive exotic species in a variety of habitats.

#### 2.b. *EX-SITU* CONSERVATION

- i) Extend institutional arrangement such as Village Panchayats and Mahila and Yuvak Mandals to promote cultivation of medicinal plant land races and fruit species in degraded lands.
- ii) Induce medicinal trees such as *Taxus baccata*, *Betula utilis* and *Juniperus* in avenue plantation.
- iii) Establishment of medicinal plant genetic resource centers in watershed catchment areas.
- iv) Promote village level “Ethno-Bio-Resource Gardens”.
- v) Focus on propagation of economically useful rare and endangered species.

- vi) Establishment of fish gene banks in representative aquatic habitats.
- vii) Establishment of wild relatives of cultivated plant genetic resource centers in association with agricultural research centers as well as community gene banks in representative agro-ecological sites.
- viii) Fully involving women who often serve as selectors and preservers of seeds.
- ix) Promoting breeding of indigenous livestock, poultry and pet breeds to maintain the animal genetic resources and to make them available to people.

### **3. FOR SUSTAINABLE USE OF BIODIVERSITY RESOURCES**

#### **ACTION PLAN**

- i) 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.
- ii) Need to co-ordinate relevant actions pertaining to knowledge base, *in-situ* conservation, policy and legislation, capacity building, education, awareness and communication.

### **4. FOR INTEGRATED POLICY AND LEGISLATIVE FRAMEWORK FOR THE CONSERVATION, SUSTAINABLE USE, AND EQUITABLE SHARING OF BENEFITS OF BIODIVERSITY**

#### **ACTION PLAN**

- i) Establishment of State-District-Panchayat level Biodiversity Management Institutions.
- ii) Establishment of State Biodiversity Boards and Local Biodiversity Management Committees as proposed in Biological Diversity Bill 2000.
- iii) Development of a Realistic System of Economic Instruments such as Access Fees, Incentives to encourage prudent use and penalties to discourage non-sustainable utilization of biological resources.
- iv) Develop new instruments, including positive incentives for biodiversity conservation.
- v) Ensure that biodiversity conservation and sustainable use efforts help enhance the quality of life at all levels including women and the weaker segments of the population.
- vi) Promote Eco-Tourism and resources generated through its may support conservation efforts.

- vii) Award Panchayats or any other Village Institutions especially for good performance and give social recognition for biodiversity conservation endeavors.
- viii) Incorporate considerations of habitat connectivity and broader spectrum of biodiversity issues in Environmental Impact Assessments (EIA).
- ix) Creation of a policy, incentives and regulatory framework for management of biodiversity in forest and a regulatory framework for *in-situ* protection of agro-biodiversity.
- x) Establish new institutions and instruments including promotion of organic agriculture and green markets.
- xi) Facilitate the conservation of indigenous breeds of livestock resources.
- xii) Promote new perspectives on biodiversity through public debate on relevant policy issues.
- xiii) Develop appropriate guidelines for consideration by the broad spectrum of Government line departments whose activities impinge on biodiversity resources.
- xiv) Create mechanisms for sound inter-sectoral co-ordination.

## **5. FOR CAPACITY BUILDING FOR INSTITUTIONALIZING BIODIVERSITY CONSERVATION AND MANAGEMENT**

### **ACTION PLAN**

#### **5.a INSTITUTIONAL CAPACITY**

- i) Strengthen capacity of civic bodies ranging from Gram Sabha and Gram Panchayats to Zilla Parishads to be alive to biodiversity concerns.
- ii) Creation of a Geographical Information System database on boundaries of forest and revenue land holdings to reduce confusion in demarcation of land holdings in Revenue and Forest Department records.
- iii) Creation of a satellite imagery based database on boundaries of Protected Areas.
- iv) Prevent disruption of habitat corridors.
- v) Establish Block level Biodiversity Information Systems.
- vi) Create awareness and build the capacity in all sectors. Scientists and Technologists, Government officials, private sector and local knowledgeable individuals.
- vii) Promotion of NGO involvement at State, District, Blocks and Panchayat levels as members of committees, through public hearings and other mechanisms to ensure full access to pertinent information.
- viii) Ensure independent selection of organization undertaking EIA by some authority such as the State Biodiversity Board.

- ix) Create institutional mechanisms to monitor proper implementation of EIA based recommendations.

#### **5.b HUMAN RESOURCES DEVELOPMENT**

- i) Development of capacity of school and college teachers and students on Biodiversity Inventorying and Monitoring.
- ii) Strengthening educational institutions for generating time and locality specific information on biodiversity resources through scientific observations as well as by working with local knowledgeable individuals.
- iii) Development of Capacity on Biodiversity Inventorying and Government agency personnel.
- iv) Develop capacity of Amchis, farmers and pastorals contributing towards community based biodiversity inventorying and monitoring efforts.
- v) Formation of expert committees to develop curricula and educational materials containing biodiversity issues.
- vi) Revise educational curricula to include first hand observations on biodiversity elements as well as interactions with local knowledgeable individuals as a component of educational activities.

### **6. FOR MOBILIZING INFORMATION, EDUCATION AND COMMUNICATION SYSTEM FOR BIODIVERSITY CONSERVATION**

- i) 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-6.**

##### **6.a BIODIVERSITY CONSERVATION AWARENESS AND INFORMATION**

- i) Develop Biodiversity Inventory and monitoring educational material and training programmes for school and college teachers and students.
- ii) Organize Biodiversity Conservation Training for Local Stakeholders.
- iii) Involve women and weaker segments of the population in conservation training.

##### **6.b. COMMUNITY-BASED BIODIVERSITY CONSERVATION EDUCATION AND RESEARCH**

- i) Development of appropriate human capacities at Government agencies, local educational institution and Panchayat levels.
- ii) Strengthen human capacities of local knowledgeable individuals such as medicine man (AMCHI), traditional livestock managers and forest produce collectors etc.
- iii) Establishment of a Pilot Village for Biodiversity Research and Management supporting Biodiversity Information system.
- iv) Initiate activities on a pilot scale in a group of specially selected villages, e.g. those involved in good management of surrounding bio-resources.

### **6.c ALTERNATIVE SUSTAINABLE LIVELIHOOD DEVELOPMENT**

- i) Capacity building for development and management of Biodiversity based enterprises such as eco-tourism. Cultivation and value addition to bio-resources including medicinal plants and non-timber forest produce.
- ii) Initiate activities on a pilot scale in a group of villages specially selected for the ready availability of bio-resources for value addition.
- iii) Promote private sector to organize buy-back agreements and other biodiversity friendly measures.

### **PROPOSED FUTURE RESEARCH AND DEVELOPMENTAL ACTIVITIES FOR CONSERVING HIGH MOUNTAIN –LAND DIVERSITY**

Following future Research & Development, activities for conservation of the biological resources of high Mountainous Land at the Sub State Site are proposed which are as follows:

- Land development and soil improvement activities (soil resource mapping, microbial activity, pH, Micro and macro-nutrients, salinity, organic matter, etc).
- Harvesting glacial melts and its efficient utilization (retarding flow velocity, multi channel irrigation, storage, drip irrigation, water lifting, etc).
- Rejuvenating grazing lands and alpine pastures (introduction of palatable species, fast growing species, rotational grazing, nitrogen fixing herbs, etc).
- Controlling and monitoring nomadic grazing
- Developing nurseries for supply of healthy planting stock of important fruit and forestry plants.
- Multi-tier utilization of arable land (agro-forestry).
- Introduction of high yielding and disease resistant varieties of agricultural and vegetable crops from other countries with similar conditions,

- With regards to orchard management, the problems that need immediate attention include replant problems; root borer and mite; collar rot, root rot and canker diseases; introduction of beehives and other pollinators problems, etc.
- Encourage plantation of off -season vegetables (for lower areas).
- Develop technology for increasing shelf life of vegetables and fruits.
- Develop seed production areas for both indigenous and exotic vegetables and other cash crops.
- Entomological and pathological studies for agricultural, horticulture and vegetable crops be worked upon (especially for Barley loose smut (*Ustilago nuda*) Hill Blunt, Codling Moth (*Cydia pomonella*), Chalcid (*Eurytoma* spp), Brown Tail Moth (*Euproctis* spp), Cutworm (*Mythimna separata*), Bugs (*Stenoderma* spp, *Lygus* spp), Leaf Eating Insects (*Myabros* spp) etc.
- Introduction of high yielding and climate resistant milch cattle, sheep and goats for crossing with local breed.
- Conservation of local yak, double hunched camel and other migratory wild life species (Snow Leopard, Ibex, Blue Sheep, Fox, Chefs, Partridges, Rodents, etc).
- Harnessing medicinal and aromatic plant resources.
- Establish biomass banks through fodder trees, shrubs, herbs and grasses to reduce fuel wood and grazing pressures from scarce/sparse natural vegetation.
- Document Indigenous Technical Knowledge (ITK) developed since ages through experience and blending it with modern research.
- Harness solar energy for cooking and heating purposes and energy saving devices be introduced.
- Mandatory involvement of children and women in developmental activities.
- Integrated training programme and exchange programmes to be organized to show other success stories.
- Develop Eco- Tourism.
- Identification of similar eco zones on micro climatic basis.
- Selection of suitable crops, varieties and cropping pattern (single, double mixed or multi-tire).
- Efficient water harvesting for supplemental irrigation.
- Rapid fertilization for proper crop canopy development.
- Response farming for monitoring general climatic behaviors for standardizing crop selection, sowing period, varieties to be sown.
- Counter wind hazards to reduce plant breakage, abrasion, lodging, flower and fruit shedding, etc.
- Reduce wind induced spread of sand over agricultural land through windbreaks, shelterbelts.
- Identification of promising grass and legume species of the area.
- Introduction of suitable grasses and legumes in Command Areas for improving soil fertility, planting agro forestry species such as *Poplar*, *Salix* and *Robinia* species in project command areas and private lands.
- Encouragement of seed production of grasses and legumes for producing seed to meet the requirement of pastures and newly reclaimed areas.
- Establishment of nurseries for multiplication of agro forestry tree species.

- Identification and introduction of shade loving vegetable, temperate fruit trees, small wild fruit species, to be grown along with tree plantations.
- Increasing production of the MFP by regeneration management and domestication of important medicinal and aromatic plants.
- Carrying out soil conservation work preferably by vegetative methods in the upper catchments.
- Establishment of demonstration plots in villages, government farms, and Army and Para Military establishments for popularizing the biomass base and water conservation strategies.
- People's education/awareness regarding importance of energy and biomass.
- Mandatory women's representation in each and every sphere of developmental work.
- Crop diversification.
- Long and medium range weather forecasting.
- Use of simulation models which are sensitive to weather parameters soil physical nutrition and water stress and crop/genotype trials.

**Considering the above issues in larger perspective, the following actions in the areas are proposed for attaining the identified goals**

- Inventory, characterization and monitoring of natural resources, as adequate information is lacking on characterization of soil and water resources and climatic parameters at micro level which is very essential for efficient land-use planning and resource development.
- Development of efficient and sustainable land-use plans for each agro-ecological zone or sub-zone considering his or her resource base, potential productivity, risk factors and social acceptability at micro-level. It will help in creating essential infrastructure to support the system for yield maximization and its commercialization without causing ecological threats.
- Improvement in fertilizer-use efficiency.
- Enhancing the contribution of organic and bio-fertilizers.
- Integrated technologies for management of nutrients, tillage and weeds in major cropping systems.
- Multi-purpose tree components for different agricultural production systems to be identified to augment the supply of fodder, fuel, industrial wood and timber in rural areas.
- Development of appropriate methodologies for improvement in Agro-met Advisory Services and their effective use in mitigation of adverse effects of aberrant weather conditions on agricultural production systems.

**The major factors that needed to be researched include**

- Soil studies
- Natural vegetation cover (floral distribution, its frequency and natural regeneration).
- Ecological status (niche studies, associations, indicators species).

- Land use (cropping pattern, water bodies perpetual snow cover, glacial melts, silt load/turbidity levels, watersheds-water use and its distribution rights etc).
- Habitat studies (pattern density architecture).
- Energy consumption pattern (food intake and quality, heating).
- Resource use (medicinal, fuel, fodder, water rights, grazing rights, resource rights).
- Socio economy (interaction with natural vegetation, economic gains, religious linkages, influence of tourism, employment, education).
- Synergetic studies (vegetation vs. soil type, demographic setup, water bodies).
- Biodiversity conservation (monitor changes over time and space for fragmentation).
- Conservation and utilization of genetic resources.
- Ecosystem conservation (primary reservoirs of Biodiversity ).
- Potential effects of climatic alterations.
- EIA-EMP (Environmental Impact Assessment and Environmental Monitoring Plan) studies of major developmental activities for optimal resources utilization.

## CHAPTER-10

# PROPOSED PROJECTS FOR IMPLEMENTATION OF ACTION PLAN

Following projects for implementation of the action plan at the Sub-State Site are proposed for future conservation of biodiversity in the area:

- 1. TITLE OF THE PROJECT:** Popularizing Medicinal &  
Aromatic Plants/herbs  
Cultivation for there  
Conservation & utilization

**OBJECTIVES:**

- Creation of awareness amongst the local people and community about existing wealth of Medicinal and Aromatic Plants, their utilization potential, short term and long term gains.

**ACTION PLAN:**

- Imparting on the spot field training about the identification and usefulness of the Medicinal Herbs and Plants.
- Developing skill amongst the stakeholders for documentation of traditional knowledge existing in the area about human health as well as for animal health care through the use of medicinal and aromatic plants.
- Laying demonstration plots by cultivating endangered and commercial species on the farm (on private as well as Govt. lands).
- To develop agro-technology for cultivation of species in great demand from the industry.
- Imparting skill to the farmers in scientific harvesting of the crop.
- Organizing training to farmers, officials of agencies in post harvest practices like; collection, drying, grading, packing, storage and post harvest processes.
- Inculcate awareness amongst the communities and public at large about the existing biodiversity, its significance and need for conservation for its sustenance and rehabilitation especially the low value and high value species of Medicinal and Aromatic Plants.

- Orientation and Training programmes for conservation of biodiversity (domestic and wild)

**IMPLEMENTING AGENCIES:**

Universities, Department of Ayurveda, Horticulture, Forests

## **2. HUMAN RESOURCE DEVELOPMENT**

### **OBJECTIVE**

Create awareness about the existing biodiversity, its significance and need for conservation for its sustenance and rehabilitation. Impart technical know-how to officials of development departments, farmers, NGO's, Mahila and Yuvak Mandals, school teachers, students and parents about the fragile ecosystem, natural resources and acquiring the benefits to the community.

### **PLAN OF ACTION:**

- Protect the knowledge, skills, and attitudes on the basis of tests (oral and written objective type tests)
- Identify the training needs on the basis of the tests. Develop training programmes
- Identify the group of trainees on the basis of needs of the area
- Organize training programmes according to a fixed schedule through lectures, participatory discussions, and through visits, etc.
- Evaluation of gains in terms of benefits, training effectiveness, and new proposals by local people.
- Evaluation of the training's and possible modifications; use of mass media (Radio, Television, etc).

### **IMPLEMENTING AGENCIES:**

Universities, Development departments, ST&E Council, NGOs, PRIs & Mahila Mandals

### **3. INVENTORIZACION, SELECCION, PROPAGACION DE MULTIPURPOSE SPECIES**

#### **OBJECTIVES:**

- Selection and documentation of important ethnobotanical species
- Study of habit, habitat, and reproductive biology of selected species
- Propagation of selected species through various available techniques to raise planting material.
- Domestication and demonstration of identified species

#### **PLAN OF ACTION:**

- Identification of the locally existing plant genetic resources and their conservation practices
- Exploration, enumeration and documentation of underutilized and unexplored plant genetic resources of ethno-medicinal importance
- Collection of seeds and planting material
- Raising nursery through suitable techniques
- Standardization of propagation techniques through cuttings, layering, grafting, etc.
- Employ phyto-culturing and in-vitro techniques for rising true to type genetic plant material.
- Standardize seed technology, germination vigor and measures to break dormancy

#### **IMPLEMENTING AGENCIES:**

Universities, State Development Departments namely Forest, Horticulture and Agriculture.

## **4. AGRICULTURE DEVELOPMENT**

### **OBJECTIVES:**

- Increasing area under irrigated agriculture
- Introduce commercial high value crops
- Improve physical conditions of terrace farming by hedge row plantation

### **PLAN OF ACTION:**

- Timely availability of inputs
- Conservation and cultivation of land races, pseudo-cereals and lesser millets
- Introduction of high yielding varieties for increasing productivity
- Introduction of cash crops like off season vegetables, Kesar, Kalazeera and other medicinal and aromatic plants
- Proper management of irrigation water
- Introduction of cheap polyhouses for off-season production especially at places with adverse/hostile climates
- Ensuring proper market for the produce
- Mechanism of awards and rewards for conserving the traditional crop varieties and existing land races.

### **IMPLEMENTING AGENCIES:**

Universities, Development Departments, NGOs, Farmers Self Help Groups, Mahila Mandals

## **5. HORTICULTURE DEVELOPMENT**

### **OBJECTIVES:**

- To lay top priority to potential of indigenous wild fruits
- Introduction of exotic germplasm for similar agro-climatic regions and their testing
- Introduction of small scale fruit processing technology

### **PLAN OF ACTION:**

- Screening, identification, improvement, and domestication of potential wild fruits
- Introduction of improved high yielding varieties of pome and stone fruits
- Plantation of fruit trees on marginal, waste and sloppy lands
- Introduction of fruit trees on grazing lands and fringes of scrub forests
- Introduction of fruit processing technologies
- Proper marketing management
- Availability of exotic fruits

### **IMPLEMENTING AGENCIES:**

Universities, Department of Horticulture, NBPGR and NGOs

## **6. ESTABLISHMENT OF PLANT NURSERIES**

### **OBJECTIVES:**

- Raise nursery stock of species required in the watershed areas
- Encourage peoples participation through educational institutions
- Provision of institutional finance for rural poor to raise nurseries
- Promote raising of adequate and quality planting stock for agro forestry purposes
- To encourage co-operative nursery raising as an alternative vocation

### **PLAN OF ACTION:**

- Identification of villages and schools for raising of nurseries
- Create awareness regarding the importance and need of raising nurseries
- Choice of species to be raised suitable to the site (project area)
- Imparting training to village and school children for raising, and management of nurseries
- Availability of critical inputs
- Marketing of raised plants

### **IMPLEMENTING AGENCIES:**

Universities, Development Departments, Farmers Co-operatives, and NGOs.

## **7. FARM FORESTRY**

### **OBJECTIVES:**

- Increase the production of timber, fodder and fuel wood
- Produce additional fodder by inter-cropping alfalfa with trees
- Raise nursery stock of Poplars and Willows through Progressive Farmers (Buy Back Policy)
- Plantations at wider spacing on irrigated marginal and cultivable lands along natural and manmade water channels (kuhls)

### **PLAN OF ACTION:**

- Selection of sites
- Selection of suitable species, especially broad leaved with multi-purpose uses including nitrogen-fixing species.
- Identification and involvement of Progressive Farmers
- Introduction of superior clones for increasing productivity of biomass
- Raising demonstration plots on Military and Paramilitary areas, School compounds, gompas, temple premises and progressive farmers areas of improved planting stocks
- Development of nurseries by Progressive Farmers, Non-Governmental Organizations (Buy Back Policy), Government Department and Service Areas
- Popularize the use of fertilizer/ manure, both in nurseries and plantations for better results
- Provide planting stock along with fencing cost
- Improve silvicultural practices to reduce wastage during harvest

### **IMPLEMENTING AGENCIES:**

Universities, State Forest Department. NGO's and DDA's

## **8. PASTURE DEVELOPMENT**

### **OBJECTIVES:**

- Meet out the demand of grasses and leguminous seeds for establishment and improvement of pastures.
- Improve the seeding capacity of grazing lands and pastures.
- Supply of foundation and breeders seed to the seed production farms.

### **PLAN OF ACTION:**

- Identification of seed production areas.
- Establishment of seed production farms.
- Collection and establishment of promising strains of grasses and legumes.
- Production and processing of seeds.
- Procurement of seed from private growers.
- Encourage farmers to produce grasses and leguminous seeds.
- Raising of seed production demonstration plots and distribution of grasses and legume seeds to the NGOs and farmers.

### **IMPLEMENTING AGENCIES :**

Universities, Line Departments namely Agriculture, Horticulture, Animal Husbandry, Forests and NGOs, Mahila Mandals, Farmers etc.

## **9. NON-CONVENTIONAL ENERGY SOURCES**

### **OBJECTIVES:**

- Evaluate the efficiency of various solar, hydro, wind, and fuel (Chullahs and Bukharis) devices
- Evaluate the cost benefit ratio for these energy devices
- Improve the existing energy devices so as to achieve low cost and energy efficient replicable devices which could be popularized amongst the people

### **PLAN OF ACTION:**

- R&D efforts to concentrate on the improvisation of the local chullah and bukharis, by testing models among people
- Select suitable models of solar, hydro and wind energy prevalent in the area for improvisation and making these locally acceptable
- Involvement of voluntary groups and peoples representatives in designing informative material in local language based on these devices
- Making available the replicable solar passive design model houses to the local people and training of artisans in these designs
- Selection of sites for micro-hydel projects with village co-operatives
- Evaluation and design of improved multipurpose gharats (water mills) in the area

### **IMPLEMENTING AGENCIES :**

Universities, ST&E Council, Tribal and Rural Development Department and NGOs

## **10. WOMEN EMPOWERMENT**

### **OBJECTIVES:**

- Creating awareness through literacy campaign
- Introduction of women vocational courses
- Exploring women employment potentials
- Encouraging women participation

### **PLAN OF ACTION:**

- Literacy drive
- Identification of potential women NGOs
- Creation of women organizations
- Exchange of ideas through visits
- Awareness to child care/family health
- Economic handling of family resources
- Better understanding of importance of biodiversity and its day-to-day occurring benefits coupled with long-term gains.

### **IMPLEMENTING AGENCIES:**

Universities, Social and Women Welfare Department, Mahila Mandals and NGOs

# **11. LIVESTOCK IMPROVEMENT**

## **WILDLIFE CONSERVATION STRATEGIES:**

### **OBJECTIVES:**

- Identify and evaluate the habitat, distribution, and conservation status of major species
- Redefine conservation and wildlife management priorities in the area

### **PLAN OF ACTION:**

- Make systematic field based ecological studies and regular census of the various species in these areas
- Construct status and distribution maps of the major species all their habitats and evaluate the present conservation priorities based on historical as well as present collected information
- Design informative material on wildlife species and their habitats, so as to encourage eco-tourism and develop nature awareness center's
- Reappraisal of existing protected area network in these areas so as to make them more representative of the ecological diversity, critical species and migration corridors e.g. black necked crane, wild yak, snow leopard, gazelle and antelope
- Protection of breeding and migratory birds habitats
- Involvement of local people in the conservation efforts
- Formulate field evidences and survey methodology guide for naturalists
- Encourage intensive studies on endangered species so as to study their biology, breeding and habitat requirements involving radio-telemetry, tagging, and bird migration and ringing studies.

### **IMPLEMENTING AGENCIES:**

Universities, ST&E Council and NGOs

## **12. AFFORESTATION OF COLD DESERTS**

### **OBJECTIVES:**

A large portion of the area is devoid of forests, exposed to vagaries of weather and prone to erosion. In order to provide green cover to the soil, afforestation with local, well adopted and multipurpose species is required which in the long run will not only improve the ecology of the area, but will also provide timber, small wood, fuel wood, fodder and fertilizer in addition to other minor products. It will also help in supplementing natural regeneration and increase the production of valuable species.

### **PLAN OF ACTION:**

- Selection of suitable species (keeping in view the requirements of the people, suitability of the species to be raised and cost of raising the species).
- Amelioration of the site
- Soil and water conservation
- Production of timber, fuel, fodder and other products
- Raising of nurseries to provide sufficient planting material
- Protection and improvement of existing forests and alpine grasslands.
- Encouraging agro forestry systems.

### **IMPLEMENTING AGENCIES:**

State Forest Department, DDP, Department of Agriculture, Horticulture and Animal Husbandry.

## CHAPTER 11.

# COMPREHENSIVE NOTE

### COMPREHENSIVE NOTE ON BIODIVERSITY CONSERVATION– PROPOSED STRATEGY AND ACTION PLAN IN RESPECT OF ITDP, SPITI RECEIVED FROM ADDITIONAL DEPUTY COMMISSIONER, KAZA.

#### **Introduction:**

Biological diversity or biodiversity, “the library of life” is the variety of all the genes, species and ecosystems that are found on our planet. It embraces microorganisms, plants and animals, wild life and the water land and air in which they live and interact. This richness, the earth’s living wealth, provides an abundant and essential supply of indispensable goods and services. Biodiversity describes the diversity of life on earth. Broadly speaking, the term encompasses all species of plants, animals and microorganisms, their genetic material and the ecosystems of which they are part much of which have developed over millennia of evolutionary history. In nutshell, the biodiversity includes on a wider scale, the variations in the biological communities in which species live, the ecosystem in which these communities exists, and the interaction that take place amongst these various levels.

#### **Land use pattern:**

There were limited irrigation facilities in the past for irrigating the agriculture land, but with the passage of time and also on account of population explosion, more and more land is being put to agriculture use by way of cultivating cash crops like green peas and potatoes etc. as a result of vibrant developmental activities. Hence, there is drastic change in the landuse pattern as compared to past practices.

#### **Conservation of medicinal herbs and plants:**

Many of the medicinal plants like Salam panja, Atish, Patish, Karru, and Somlata etc. have become endangered due to easy access of extraction. There are about 62 species of medicinal plants identified by FRLHT, Bangalore, which are being conserved under the NTFP scheme, being funded under CSS. So, these species are being propagated in this valley and are being planted in the gap plantation areas. The efforts are being made to protect these species of endangered nature in the Spiti valley. Due to over exploitation of the raw material, marketing is another problem.

## **Conservation of Flora and Fauna:**

Great efforts are required to conserve and carry out plantation of Seabuckthorn (SBT), which is of immense medicinal value, and the villagers also use this species as firewood. During the year 2001-2002, Spiti Forest Division has raised about fifty thousand numbers of SBT seedlings in the nurseries to be planted out in the fields in the next plantation season. Besides this, about 50 ha. of forestland is being planted every year to improve adverse environmental status in the Spiti valley. There are about 23 species of wild life found in this cold desert area. These wild animals are fully protected under the WL Management of Pin Valley National Park and Kibber Wild Life Sanctuary Areas.

The population of highly endangered Snow Leopard, Blue Sheep, Ibex and Tibetan Wolf etc. has shown significant improvement over the last three years as is evident from the enclosed list of WL census report. This is a good indication of healthy status of Wild Life found in the valley.

## **Buddhism as a protector of Wildlife:**

The people of Spiti valley are Buddhists. On account of practice of non-violence as preached by the Buddhism, highly endangered species like Ibex, Snow Leopard, Blue Sheep, Tibetan wolf etc. stand protected in the Spiti valley down to the day as such the religious sentiments of the local people play important role in the conservation and preservation of these highly endangered species. The healthy status has resulted in the development of Eco-Tourism potential in this valley.

## **Proposed Action Plan and Strategy**

The following action plan is proposed to maintain the Biodiversity conservation in this valley:

### **1. Afforestation:**

Wherever the irrigation facilities are available, the areas for afforestation are tackled every year.

### **2. Pasture development:**

Similarly under pasture development scheme, the suitable areas are being tackled for biomass production under this scheme to improve the wildlife habitat under the habitat management scheme.

### **3. Soil and Water conservation:**

Efforts are also being made to carry out minor engineering works like check walls, check dams etc. to check the status of soil erosion in the valley. This activity shall help in the *in situ* effective conservation of soil and moisture regime in the cold desert area.

### **4. Embankment Stabilization:**

The check walls/crate wire structures are being constructed by the Irrigation and Public Health Department to check soil erosion near the plantations

along the riverbank areas. This activity is helpful in bringing about effective stabilization of the riverbanks in this valley.

### 5. Environmental Education and Awareness programme:

NGOs would be involved and strengthened to educate people about the benefits of biodiversity. One NGO is already working at Tabo whose services can be utilized.

**Table- 10: Medicinal Plants of Spiti Valley found in Kibber Wild Life Sanctuary & Pin Valley National Park, Kaza.**

S. No	Botanical name	Local name	Locality	Use
1.	<i>Betula utilis</i>	Takpa	Dothen	Part use
2.	<i>Plantago erosa</i>	Tharam	Gecheng	-do-
3.	<i>Gentiana kurrooa</i>	Pangyin	Minguit	Cough
4.	<i>Sassorea bracteata</i>	Pangtisi dowo	Nur	-do-
5.	<i>Hippophae rhamnoides</i>	Tarngoo	Mane	Lung infection
6.	<i>Clematis orientalis</i>	Emong nakpu	Mane	Fever
7.	<i>Saussurea sps.</i>	Pangtisi	Minguit	Cough
8.	<i>Corydalis govaniana</i>	Tongrusilva	Tarbak	Fever
9.	<i>Oxyria digyna</i>	Churtsa	Hikkim	Diarrhea
10.	<i>Rhododendron anthapogon</i>	Balu	Nur	Internal pain
11.	<i>Taraxacum officinale</i>	Khurmang	Gechang	Mouth blisters
12.	<i>Codonopsis clematidea</i>	Luded dorgo	Mane	Skin disease
13.	<i>Allium carolinianum</i>	Gogcheegma	Mingiut	Indigestion
14.	<i>Ferula jaeschkenevaltk a</i>	Thunak risho	Gulling	Chest pain
15.	<i>Bergenia stacheyi</i>	Dak kya hawo	Fooma	Blister
16.	<i>Picrorhiza kurrooroyal</i>	Honglen	Tarbak	Fever
17.	<i>Pleurospermum angelicoides</i>	-	-do-	Herb

18.	<i>Rheum moorcroftianum</i>	-	Fooma	Internal injury
19.	<i>Sausurea lappa</i>	Kul	Gechang	Herb
20.	<i>Delphinium cashmirianum</i>	-	Chhoem	Throat ache
21.	<i>Rheumemodi wall</i>	Tuksu	Kevargoche	Internal ache
22.	<i>Hyoscyamus niger</i>	Thangdam langtangtse	Mane	Tooth ache
23.	<i>Dactylorhiza hatagerea</i>	Angpolapa	Pilshur	Aphrodisiac
24.	<i>Rumex dentacus</i>	Shoma	Kornic	Joint pain
25.	<i>Aconitum rodumdifolium</i>	Bomkar	Summa	Cough
26.	<i>Iris eusata</i>	-	Tabo	-
27.	<i>Thymus linearis</i>	Taksa nakpo	Gue	Tonik
28.	<i>Arnebia euchroma</i>	Dimok	Gue	Cough
29.	<i>Ephedra gerardiana</i>	Tse	Gurling	Respiratory disorder
30.	<i>Aquilegia fragrans</i>	Zudul dorge	Komik	-
31.	<i>Trigonella emodi</i>	Bhusu hung	Kibber	Herb
32.	<i>Rosa webbiana</i>	Shulik	Chicham	Indigestion
33.	<i>Bistoria vivipara</i>	Narum nagargph	Kibber	Diarrhea
34.	<i>Thermopsis inflata</i>	Khyabla chudup	Kibber	Swelling
35.	<i>Pedicularis oederi</i>	Lugri servo	Tarbak	Headache
36.	<i>Gentiana nubegena</i>	Pangyin	Kibber	Cough
37.	<i>Sassurea gnapheloides</i>	Pangtis	Kibber	Cold
38.	<i>Germanium praectense</i>	Nygon boo	Tarbak	Headache
39.	<i>Hussopus officinale</i>	Jip chi chibu	Thango	Fever
40.	<i>Waldhemia tomentosa</i>	Lugmik serpo	Tarbak	Joint pain
41.	<i>Aconogonum tortulosum</i>	Nyalo	Chitt	Blood purification
42.	<i>Aconitum violaceum</i>	Zinba dusilume	Tarbak	Cough cold

43.	<i>Solanum vaginatum</i>	-	Gue	-
44.	<i>Carum carvi</i>	Gonyat	Mane	Nose pain
45.	<i>Podophyllum hexandrum</i>	Tandik	Gue	Blood diarrhea
46.	<i>Waldhemia glabra</i>	Sa palu	Mane	Headache
47.	<i>Pedicularis tenuirostrus</i>	Lungro mukpa	Tarbak	-do-
48.	<i>Primula macphyla</i>	Kilcha	Tarbak	Joint pain
49.	<i>Eritrichium canum</i>	Changser tuksa	Mud	-
50.	<i>Bistorta officinis</i>	Langna	Tarbak	Back pain
51.	<i>Gentianella moorcroftinia</i>	Teekta	Kibber	Fever
52.	<i>Silence tibetica</i>	Timuksa	Gue	-do-
53.	<i>Rhodiola heterodonta</i>	Sholo marvo	Gue	Cough
54.	<i>Pedicularis megalantha</i>	Langruk makpoo	Gechang	Acidity
55.	<i>Lancea tibetica</i>	Payak tse	Gechang	Cough
56.	<i>Llodia serotina</i>	T seawa	Ka	Eye pain
57.	<i>Chrysanthemum pyrothroides</i>	Burse khampe	Gachang	-
58.	<i>Oxytropis sps.</i>	Taksa	Mud	Joint pain
59.	<i>Tragopogon gracilis</i>	Thar- noo		Latex
60.	<i>Potentella salisovians</i>	E- mongkarbo		Body itching
61.	<i>Tanacetum longifolia</i>	Bhuse- khampe		-
62.	<i>Heracleum candicans</i>	Tumak - tukar		Liver complaint

**Table-11: The population figures of important animals during the last three years.**

S.No.	Kind of Animal/ bird	1998-99	1999-2000	2000-2001
1.	Ibex ( <i>Capra ibex siberica</i> )	10	11	13
2.	Snow Leopard ( <i>Panthera unica</i> )	2	5	6
3.	Himalayan Blue Sheep ( <i>Pseudois nahyaur</i> )	848	414	435
4.	Tibetan Wolf ( <i>Cannis lupus</i> )	5	18	19
5.	Red Fox ( <i>Vulpus vulpus</i> )	8	14	10
6.	Wooly Hare	2	16	19
7.	Himalayan Chough ( <i>Phyrhocorax gracumus</i> )	2270	3400	4020
8.	Snow Pigeon ( <i>Columbia rupestris</i> )	750	445	367
9.	Snow cock ( <i>Tetragallus himalyensis</i> )	14	15	39
10.	Vulture ( <i>Nephron persnopterus</i> )	39	23	30
11.	Ducks ( <i>Avthva ferina</i> )	0	2	0
12.	Murgabi ( <i>Anas crecca</i> )	10	0	0
13.	Himalayan crow ( <i>Corvus tibeteana</i> )	0	14	1
14.	Picca ( <i>Ochotona roylei</i> )	11	5	11
15.	Raven ( <i>Corvus corax</i> )	0	9	10
16.	Golden Eagle ( <i>Aquila chrysaetos</i> )	2	6	5
17.	Griffan ( <i>Gyps himalayansis</i> )	0	0	2

18.	Red Start ( <i>Phoenicurus orchruros</i> )	8	48	25
19.	Hoope	3	0	0
20.	Chakor ( <i>Alpalectoris chakor</i> )	99	18	43
21.	Dove	0	12	0
22.	Himalayan Finches ( <i>Carduelis carduelis</i> )	2	12	0
23.	House sparrow ( <i>Passer domesticus</i> )	100	600	373
	Total	4183	6767	7539

## CHAPTER-12

# PUBLIC HEARING

Public hearing was organized for getting the feedback from the stakeholders of biodiversity in the Sub-State site for knowing the actual problems being faced by the people and their views/ suggestions for future conservation and sustainable use of biodiversity. For this, Co-ordinators for holding Public Hearings were identified by the State Council for Science Technology and Environment with the collaboration of Tribal Development Department H.P., which were as follows:

<b>Name &amp; Address of Organization</b>	<b>Venue</b>	<b>Date</b>
1. Shri Rajinder Chauhan, Director, Society for Advancement of Hilly & Rural Areas (SHARA), Bhutti Colony, P.O. Shamshi, District Kullu, H.P.	Karga	5-10-2001
2. Shri Rajinder, Yuvak Mandal, Tabo, Spiti District, Lahaul and Spiti H.P.	Kaza	14-10-2001
3. President, Mahila Mandal, Duni, P.O. Duni, Kalpa, District Kinnaur, H.P.	Kalpa	20.10.2001

The State Council in consultation with the Co-ordinating NGO fixed the dates and venue. One of the Co-ordinator was briefed about the purpose of the Public Hearing/Meeting during the meeting organised for the Co-ordinators in the office of the State Council on 11-7-2001.

For organization of the Public hearing, the literature was given to the Co-ordinator namely; brochure prepared by NBSAP (Hindi and English), "Jaiv Vividhta Per Karya Yojna Banane Mein Jan Sahbhagita Ko Le Kar Jan Sunwai," Awareness by the Co-ordinator was created within the area of his operation before organization of the public hearing. Also the stakeholders were identified for participation in the Public hearing. Only one Public hearing to the stakeholders of Lahaul area of Lahaul and Spiti District was organised and the other two Public hearings could not be organised because of inclement weather.

The Co-ordinator identified for organization of the Public hearings before organization of the Public hearing visited the people of all age groups in the villages and created awareness about the Biodiversity concept and identified the stakeholders for participation in the Public hearing. The details of the Public hearing convened at Karga in Lahaul area of Lahaul and Spiti District of H.P is given as follows:

## **Report of the Public hearing at Karga in Lahaul & Spiti Distt**

<b>Venue:</b>	Karga
<b>Date:</b>	5 <sup>th</sup> Oct. 2001
<b>Organizer:</b>	State Council for Science Technology and Environment H.P. Shimla.
<b>Co-ordinator:</b>	Society for Advancement of Hilly and Rural Area, Distt. Kullu, H.P.

The State council for Science Technology and Environment and Tribal Development Dept. H.P. organized a public hearing for getting the stakeholder's perception regarding biodiversity of Lahaul area of Lahaul & Spiti Dist. for incorporation of their views/suggestions for formulation of Sub-State Site Biodiversity Strategy and Action Plan on 5<sup>th</sup> Oct. 2001 at Karga in Lahaul & Spiti Dist. The issues/problems and the views, which came up for discussion in the public hearing, are as follows:

### **1. Biodiversity/ Jaiv Vividhta:**

- People are not aware of the term but know about vegetation around (plants, animals, birds etc.)

#### **Suggestion:**

- Awareness is needed to be done amongst the local people for conservation of Biodiversity.

### **2. Agriculture:**

- Traditional crops cultivation in the area decreasing and selected commercial crops being grown.

#### **Suggestions:**

- Traditional crops cultivation needed to be encouraged by the Govt .by providing incentives.
- Value addition and Marketing of the traditional crops needed to be taken up in the area.

### **3. Population explosion:**

- Population has increased in the area and landholding is the same.
- Pressure on local biodiversity for fuel, fodder and medicinal herb

#### **Suggestions:**

- Efforts on control of local population needed to be initiated by Health Dept.
- Because of increased population pressure mechanism needed to be developed for sustainable use of the local biological resource.

#### **4. Grazing lands/ Pastures/ Grasslands:**

- Grazing land/Pastures/Grasslands shrinking in the area.
- The area remains snow covered for more than half year.

#### **Suggestions:**

- Grazing lands /Pastures /Grasslands needed to be developed/maintained in the area and introduction of New/improved varieties of grasses can be done in the area.

#### **5. Forest:**

- The local plants growing in the area are not being propagated namely Juniperus, Betula, Deodar by the forest Dept. only Two types of plants namely Willow and Poplar are being propagated in the area. Local people have planted Pine forest adjacent to Keylong, which is growing well and has established at the site.
- The local people go for plantation of two/three cuttings instead of one cutting being practiced by the Forest Dept. for Willow plantation.

#### **Suggestions:**

- Local plants needed to be planted in the area on large scale for which techniques needed to be developed.

#### **6. Glacier Receding:**

- The glaciers in the area are receding and the local people are worried and very much concerned about the problem.

#### **Suggestion:**

- Efforts needed to be initiated for control of pollution arising from vehicles.

#### **7. Water/ Irrigation:**

- There is irrigation problem in the area because of loose soil strata moisture is not retained by the soil.

#### **Suggestion:**

- Hydram technology should be popularized for irrigation in the area.

#### **8. Timber Distribution:**

- T.D. is given to the local people for whom timber is brought from outside the Dist., which is very costly.

#### **Suggestion: -**

- Deodar and Kail plantation should be also be encouraged in the area.
- T.D should be given on nominal rates.

#### **9. Land use:**

- Govt. land is also used by local people for agriculture purpose in the area

#### **Suggestion:**

- Policy should be framed by the Govt. for practicing such farming in the area.

## **10. Watershed programme:**

- No output is seen being carried out under the watershed programme in the area. Lot of money is available but the utilization and the result is not effective and encouraging.

### **Suggestion:**

- Watershed programme needed to be carried out with the active anticipation of local people.

## **11. Chemical fertilizer/insecticides/pesticides:**

- Use of chemical fertilizer/ insecticides/ pesticides causing harm to the soil strata in the area and water being polluted.

### **Suggestions:**

- Old practice of farming needed to be revived.
- Minimum use of chemical fertilizer and other chemicals user as spray for controlling diseases needed to be minimized.
- Biofertiliser needed to be used in the area.

## **12. Horticulture:**

- Lahaul area has got the potential for introduction of Apple and other stone fruits in the area but the Dept. is yet to popularize its introduction in the area war footing.

### **Suggestion:**

- Apple, Stone fruits should be introduced in the area on large scale.
- Package of practice about the cultivation techniques should be given to the local farmers.

## **13. Animal Husbandry:**

- The traditional animal (livestock) husbandry population decreasing. Churu, Churi, Yak declining.

### **Suggestion: -**

- Local livestock rearing should be encouraged

## **14. Forest fire:**

- Pine forests being exposed to forest fires, which is damaging the local forest vegetation and micro-biodiversity of the area.

### **Suggestion:**

- Committees should be constituted at each village.
- Local Fire fighting squad should be trained for fire control.

## **15. Medicinal Plants:**

- Medicinal/ aromatic herbs being widely extracted from the area which is lowering the medicinal wealth of the area, mainly patish, atish, karoo, salampanja etc.

### **Suggestion:**

- Cultivation for income generation headed to be taken up in the area.

**16. Kail, poplar, Willow trees drying:**

- The local plants growing in the area adjoining areas of the villages are drying.

**Suggestion:**

- R&D Institutions, Forest Dept. should take timely action for looking into such problems.

**17. Hunting:**

- Hunting is still prevalent in the area In spite of ban by the Govt.

**Suggestion:**

- Guilty should be punished as per the law.

## **CHAPTER- 13**

### **SYNTHESIS OF THE ISSUES/ PROBLEMS**

Since the areas falling under the Sub-State Site of the State of H.P poses a greater development challenge than any other area in the State due to their rugged terrain, isolation, hostile abiotic conditions, water resources in plenty but restricted due to seepage and storage problems, lack of communication closed social life, poor marketing structure with weak economy, varied and different ethical and religions denominations thus it is imperative that the conservation of the local biological resources and the Research and Development activities at the Sub-State Site be executed properly with in disciplinary and institutional linkages.

The chapter deals in assessing analytically the various issues/problems pertaining to biological resources being faced at the Sub-State Site for future development and conservation of biodiversity for sustainable use. The concern is not only for conservation of environment but ensuring the use of biological resources judiciously by the present generation and for the survival of future generation in this unique area. The present need is not only to conserve depleting biological resources at the Sub-State site through better management of the available land and water for conservation but also for making the development humane, ecologically friendly and sustainable. The analysis has been carried out on the basis of the reports submitted by the Co-ordinators and the feedback received through stakeholders at one of the Public hearing and strategy and action has been evolved accordingly. The aspects covered in this chapter are as follows:

1. The issues (i.e. The gaps on the information, vision, policy, legal structure, institutional and human capacity) are biodiversity related initiatives.
2. Propose major strategies to fill these gaps through holistic approach.
3. The required action to fill the gaps and to enhance (strengthen) ongoing measures.
4. Outlining the major actors who will be responsible for the future action.

Various aspects of biodiversity which have been evaluated for initiating strategy and action on the basis of the issues/problems for conservation of biodiversity at the Sub-state site is detailed as follows:

S.No.	Issues	Strategy	Action	Responsibility
1.	There is lack of information and awareness among the stakeholders about importance of biodiversity both wild and domesticated (existing vegetation and cultivated crops including pseudo cereals) medicinally/aromatic herbs, traditional knowledge about plant uses.	Need to promote awareness on biodiversity related information, education and communication system for biodiversity conservation.	Develop biodiversity inventory and monitoring educational material for training programmes for school and college teachers, students and stakeholders. -Organize biodiversity conservation training for local stakeholders. -Involve women and weaker sections of the area in for conservation of biodiversity.	UHF, HPU, HPKV, SCSTE, TDD, NGO's
2.	Unscientific methods of harvesting medicinal and aromatic plants and poor control on contractors for medicinal plants collector resulting into loss of biodiversity.	Standardization of post harvest technology in terms of drying, grading, pasting, storage, fumigation and transportation & value addition etc. -Collection of medicinal and aromatic plants should be done on scientific basis. -Need to develop <i>in situ</i> and <i>ex situ</i> conservation of medicinal and aromatic plants.	Efforts to be initiated for scientific harvesting of medicinal /aromatic herbs/plants in the area and complete control on contractors to be imposed through proper monitoring by the local people in the areas.	Forest Dept., UHF, TDD, PRI's, NGO's, Mahila Mandals SCSTE.
3.	Lack of knowledge about the importance of sustainable minor forest produce (NTFP) development and related research.	Research and development activities should be initiated to disseminate knowledge about the importance of NTFP.	Develop computerized information system with regulated access.	UHF, R&D Inst. (Central/ State Forest Depts. SCSTE PRI's, NGO's

				TDD
4.	Lack of adequate funds, facilities, trained manpower, long-term research plans, and appropriate extension facilities are the causes of tremendous technologies gaps.	Tribal sub plans to be channelised for creation of facilities (infrastructure) manpower training for capacity building, research and development and extension of appropriate technologies.	Long-term research activities, to be carried out and to engage skilled/technical manpower, create extension facilities and funds for conservation of Biodiversity	UHF, HPKV, TDD, MoEF, SCSTE, Forest Dept.
5.	Poor co-ordination amongst development plan executing bodies, local communities, and research and academic institutions is adversely affecting biodiversity conservation initiatives.	Strengthening of co-ordination amongst the Development Depts. Research Institutions and local communities.	Efforts to be initiated for effective co-ordination amongst the line Depts. R&D Institutions and local communities.	UHF, HPKV, R&D Inst., Panchayat s, Forest Dept., Hort. Dept., Agri. Dept., Ayur. Dept., SCSTE, local communities TDD.
6.	Transformation from joint families to a nuclear family system leading towards erosion of traditional knowledge base.	Steps to be taken for documentation of traditional knowledge base at local levels in the area.	Documentation of traditional knowledge based on livelihood, lifestyle and culture	UHF, HPKV, HPU, NGO's, PRI's, SCSTE, local communities, Mahila Mandals
7.	Use of subsidized chemicals in the form of fertilizers, pesticides, fungicides, insecticides etc. in agriculture lands is also causing a great threat to	-Excessive use of chemicals in the form of fertilizers and pesticides/insecticides/fungicides should be checked/ stopped. -Biofertilizer use and organic farming to be	Enhance the use of organic fertilizers and biofertilizers.	UHF, HPKV, NGO's, PRI's, Agri. Dept, Hort. Dept. SCSTE, TDD

	biodiversity.	popularized/practised in the area.		
8.	No mechanism to deal with emerging challenges of Intellectual Property Rights (IPR) issues and Genetically Modified Organisms.	Mechanisms to be established for emerging challenges of IPR's in the Tribal areas.	Documentation of newly emerging challenges such as IPR's and GMO's.	UHF, TDD, IARI, HPKV, R&D Inst., Panchayat s. SCSTE
9.	Inadequate efforts to biodiversity enterprise based enhancement for improvement of quality of life of local communities.	Biodiversity based enterprises needed to be explored and developed.	Biodiversity based enterprises in the area will be explored for the local stakeholders.	Panchayat s, NGO's, R&D Inst., HPU.
10.	Lack of control over landuse for the benefit of the society.	Land use control on Govt. land in the area for the people to be reformulated through legislation in the area.	Policy for land use in the Govt. land to be framed for effective utilization of the area.	TDD, Forest Dept., Soil Dept., PRI's
11.	Destruction of habitat due to the construction of large hydroelectric dams, roads and buildings had lead to excessive landslides causing a great threat to biodiversity.	Environment impact assessment to be done before taking up any development programmes in the area namely; construction of roads and establishment of hydroelectric power projects.	Environment impact assessment for establishment of Hydroelectric dams, roads, buildings other development projects to be carried out before undertaking any development in the area.	MoEF, Forest Dept. TDD, PRI's, PWD, Deptt., HPSEB, TDD, NGO's
12.	Due to extreme and prolonged winters, heavy demand for fuel wood takes toll of existing vegetation, shrubs and perennial species along with their roots	Fuel wood, coal and kerosene, LPG arrangement to be done in bulk and non-conventional energy resources to be utilized in the area.	Effective mechanism to be developed for use of non-conventional energy resources	Himurga, HPSEB, TDD, Dept. of Civil Supplies, UHF, SCSTE

13.	High rate of soil erosion due to wind and water in cold deserts, flash floods in rivers in Kinnaur and Lahaul leads to biodiversity loss in the area.	Efforts for control of erosion due to wind and water/ glaciers to be done on war footing by introduction of improved varieties of grasses/ shrubs Resistant to cold climates. -Research to be carried out for development of the germplasm, which could establish in harsh cold climatic conditions laying emphasis on leguminous varieties.	Deep-rooted plants should be planted which can withstand strong winds and glacial water and can prevent soil erosion.	Forest Dept., NGO's, SCSTE, Horti. Dept. UHF, HPKV IARI, ICAR
14.	Low precipitation in the form of rain during spring and summer and early snowfall hampers seed development and proper growth and development of plants.	Irrigation facilities to be strengthened and watershed programme to be properly managed by involving local communities based upon their needs.	Plants which require less water (xerophytes) should be grown in the area.	Forest Dept. Horti. Dept. TDD, R&D Inst., UHF (state & Center), HPKV, Local Communities
15.	Excessive grazing by domesticated and migratory animals during spring and summers also cause a great loss to biodiversity in the area.	Controlled grazing to be practiced keeping in view the carrying capacity of for the area for the animals and livestock at local levels.	Controlled grazing as per the carrying capacity (location specific) will be done for regulation/ management.	Forest Dept., Panchayats, Mahila Mandals, TDD, Forest Depts.
16.	Landslides due to flow of glaciers sweeps away the landmass along with the vegetation cover is also causing loss to the biodiversity.	Steps needed to be taken around the villages for control of glaciers sweeping the landmass along with vegetation in the area for check on loss of biodiversity.	Research to be initiated to check the flow of glaciers around inhabitations in the area.	Snow and Avalanche Depts. GSI, MoEF, SCSTE, TDD, Local Communities
17.	Diversion of glacial water	Steps needed to be taken for effective	Storage tanks to be constructed in	IPH, SCSTE,

	from the open towards agricultural fields leads to poor growth of species growing in such areas.	use of glacial melt water in the agricultural fields of the farmers in the area.	which water heating through use of non-conventional energy sources to be utilized for maintaining the temperature for irrigation in the cultivable fields in the area.	TDD, Him Urja, Local communities
18.	Extreme variation in diurnal as well as seasonal temperatures, strong velocity of winds, low oxygen content in the air, heavy influx of infra-red and ultra violet rays and presence of coarse, highly porous, immature sandy soil are also responsible for low productivity and loss of biodiversity.	Efforts should be laid for introduction of exotic/improved varieties (indigenous), which can withstand the harsh conditions at the respective areas.	Identification of species (exotic) as well indigenous for plantation in the area.	UHF, HPKV, IHBT, Forest Dept. Local communities
19.	Transformation from diversified animal –crop system to a system of monocultures of Apple/Pea /or keeping just jersey cows as compared to a variety of traditional livestock assemblage leading towards unrecoverable erosion of local genetic and cultural diversity.	Multiple crops for different agricultural production system should be grown and popularized. -Facilitate the conservation of indigenous breeds of livestock resources.	Local people to be encouraged for maintaining mixed cropping pattern and discouraging monoculture in the area. Traditional crops cultivation to be popularized for maintaining the local biodiversity. Local livestock rearing to be encouraged.	Forest Dept., Agri. Dept., Animal Husbandry, TDD, SCSTE, and Local communities, NGO's
20.	Hunting is still prevalent in the area In spite of putting a ban by	Strict action should be taken as per the law against the defaulters who will	Work force/ committees of the local people at the respective	Forest Dept., Panchayat s, NGO's

	the Govt.	be engaged in hunting.	Panchayats/villages should be constituted for keeping vigil against hunting, illicit felling of the trees and for causing other damages to biological resources in the area.	
21.	Forest fire is a problem in the Lahaul area of Lahaul and Spiti and Kinnaur Dist.	Protection of forest from fire to be undertaken to save the biodiversity in the area.	Publicity about forest fire by involving school children, villagers for protection of forests in the area to be done.	Forest Dept., NGO's, PRI's, TDD, SCSTE
22.	Local livestock rearing declining in the area.	Policy should be framed for encouraging rearing of local livestock in the area. -Steps should be taken for increasing the rates of wool from the livestock reared at local level.	Incentives to be given for encouraging local livestock rearing in the area.	Animal Husbandry, Panchayats, NGO's, Mahila Mandals, TDD.
23.	Woolen rates are very low and there is no good infrastructure for processing the wool and no hosiery/ handloom based industries.	Steps should be taken for increasing the rate of local wool and to strengthen the local handlooms with improved equipments. -Efforts needed to be taken as for building an infrastructure for value addition of the local wool and sheep/goat based products.	Local wool rates to be increased for providing remunerative prices to the sheep/ goat rearers. -Local Handlooms to be upgraded. -Value addition of wool/sheep/ goat based products to be done.	WFI, HHC, TDD, PRI's
24.	High costs of timber imported for construction and trees, shrubs, bushes and perennial herbs are used as fuel wood during prolonged winter	Efforts should be made for reducing the cost of important timber and complete ban to be executed for cutting of local trees, shrubs, and perennial herbs for	Plantation of timber trees to be carried out on large scale in the area. -Fuel wood from the other parts of the State mainly fallen trees in the forest due to	Forest Dept., TDD, PRI's, SCSTE, MoEF.

	season.	use as fuel wood during the winters.	damage caused by unprecedented snow, wind and other calamities to be arranged for making use as timber and for fuel wood purpose at the specific sites in the area.	
25.	Impact of National and State Forest Policies negligible.	Efforts needed to be taken for creating awareness about the National and State Forest Policies amongst the local people.	Awareness to be created for implementation of the Forest Policies in the area amongst the local people at Panchayat level.	Forest Dept., MoEF, SCSTE, TDD, PRI's, NGO's, Mahila Mandals.
26.	Lack of stakeholder's participation in Forest Management for livelihood.	Stakeholder's participation in Forest Management to be made compulsory.	Local stakeholders will be involved to participate in Forest Management at local level.	MoEF, TDD, SCSTE, PRI's, Forest Dept.
27.	Prevalence of feeling amongst the stakeholders that maintenance, preservation and regeneration of forests and other development activities carried out in the common land around the villages is only the State Govt. duty.	Local people to be awakened by inculcating the feeling that maintenance, preservation and regeneration of forest and other development activities carried out in the common land around the villages is not only the duty of the Govt. but it is the prime duty of the local citizens.	Awareness to be created amongst the local communities for maintenance, preservation and regeneration of local forest and in other development activities.	TDD, SCSTE, PRI's, NGO's, Mahila Mandals.
28.	Lack of policy for proper management of the wastelands, common property. Resources, encroachment and extraction of forest produce which leads to the problem of soil erosion.	Policy for proper management of wasteland, common property resources and extraction of forest produce needed to be framed.	Policy to be framed for proper management of wastelands, common property resources and extraction of Forest Produce.	Forest Dept., Wasteland Development Board, GOI, TDD, SCSTE, PEI's, Mahila Mandals
29.	Lack of	Steps to be taken	Remote Sensing &	GSI,

	methodology for recording and ascertaining the actual production of fruit crops.	for working out methodology for recording and ascertaining accurate production of fruits and other agricultural crops in the area.	GSI technology to be applied for estimation of production of fruits and other agricultural crops in the area.	SCSTE,
30.	Water in plenty is available in the area through river flowing and glaciers round the year especially during summer/ crop growing season but irrigation is the major problem in Lahaul, Spiti and Pooh Sub-Divisions because of the shallow soil strata of the cultivable land.	Water harvesting to be popularized for storage of running water and Hydram technology needed to be popularized for lifting water from the river beds/running streams for irrigation purpose.	Water harvesting technology to be propagated in the area by constructing water tanks and lifting water through Hydrams in the area for the irrigation purpose.	IPH, TDD, SCSTE, Himurja, Forest Dept.

## **ABBREVIATIONS USED**

NGO's	: Non Government Organizations
SCSTE	: State Council for Science Technology and Environment
UHF	: University of Horticulture and Forestry
HPKV	: Himachal Pradesh Krishi Visvavidyalaya
IARI	: Indian Agricultural Research Institute
ICAR	: Indian Council of Agriculture and Research
MoEF	: Ministry of Environment and Forestry
GSI	: Geological Survey of India
HPU	: Himachal Pradesh University
R&D	: Research and Development
GOI	: Govt. of India
PRI's	: Panchayati Raj Institutions
IPH	: Irrigation and Public Health
WFI	: Wool Federation of India
HHC	: Himachal Handloom Corporation
IHBT	: Institute of Himalayan Bio-resource Technology
PWD	: Public Works Department
HPSEB	: Himachal Pradesh State Electricity Board
Agri.	: Agriculture
Hort.	: Horticulture
Dept	: Department
Inst.	: Institute
Ayur.	: Ayurveda

## CHAPTER-14

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## **ANNEXURE-1**

**Proceedings of the meeting of the Sub-Steering Working Group Committee Organised on 16.5.2001 at 11.00 A.M. under the Chairmanship of Shri J.M. Pathania, Additional District Magistrate, Pooh organized by Tribal Development Department, Kinnaur at Reckong- Peo for Sub-State.**

The Tribal Development Department Kinnaur organized a meeting of the Steering Committee Working Group on Biodiversity Strategy and Action Plan on 16.5.2001 at 11.00 A.M. The following were present:

1. Shri R. K. Sharma, Assistant Commissioner to Deputy Commissioner Kinnaur
2. Shri Surender Mohan Sani, Project Officer, D.R.D.A. Kinnaur
3. Shri C.M. Sharma, Divisional Forest Officer, Kinnaur
4. Dr. R. Bawa, R.H.R.S. Sharbo, District Kinnaur
5. Shri Kamraja Kaisth, Senior Scientific Officer, State Council for Science, Technology and Environment, Himachal Pradesh, Shimla
6. Dr. Hans Raj Negi, Scientist 'C' Biodiversity Division Institute of Himalayan Bioresource Technology CSIR, Palampur
7. Dr. D. K. Negi, Assistant Director, Animal Husbandry, Reckong Peo
8. Mr. Parveen Kumar Sharma, Research Scholar, Dr. Y.S. Parmar University, Solan
9. Dr. Satish Sharma, Agriculture Development Officer, O/O District Agriculture Officer, Reckong Peo, District Kinnaur
10. Dr. R.N. Sharma, Horticulture Development Officer O/O Deputy Director Horticulture, District Kinnaur.

At the outset of the meeting the members were welcomed by the Sub-Divisional Magistrate-cum Project Officer, ITDP, Shri Manmohan Sharma. Thereafter Shri K. Kaisth, Senior Scientific Officer, State Council briefed the members about Biodiversity Strategy and Action Plan Project of NBSAP.

After the briefing, discussion started on the agenda fixed for the meeting. Dr. Rajan Bawa, Incharge Regional Research Station, Sharbo informed that the land use pattern has changed in the area. There is potential for eco-tourism in the area. Extraction of medicinal herbs/plants is being done which may pose threat for future survival of the species in the region. Raw material marketing is another problem, which is extracted from the forest.

Thereafter, Shri Parveen Kumar Sharma Research Scholar, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. informed that the University has published a book on medicinal plants/herbs available in the State and the copy of the book was shown to the Chairman and the members present.

Dr. Hansraj Negi, Scientist, Biodiversity Division, Institute of Himalayan Bio-resource Technology (CSIR) Palampur, H.P. informed that the institution is

working for the conservation and preservation of Biological resources of the State. IHBT has developed the technique for domestication of some medicinal plants/herbs at its campus.

Shri K. Kaisth, Senior Scientific Officer, State Council intervened and informed that the Biodiversity Strategy and Action Plan is to be prepared within a span of six months and the draft of the Strategy and Action Plan needed to be prepared on priority basis because the project duration is upto March 2002. He also elaborated the points for preparation of Strategy and Action Plan namely issues and problems, ongoing initiatives regarding the issues and problems, identification of experts, strategies needed to plug the gaps for effective ongoing initiatives, identification of key elements needed for implementation and time frame for implementation etc for implementation of the project.

Shri C.M. Sharma, Divisional Forest Officer Kinnaur informed that Sanjhi Van Yojana has been started this year for conservation of biodiversity. Earlier the programme was under Joint Forest Management.

Dr. D.K. Negi, Assistant Director (Animal Husbandry) informed that Yak, Chiggu, Blue Sheep, Ibex etc. which used to be in a abundance earlier are facing problem in the area. Efforts needed to be taken up for conservation of these animals.

Shri S.M. Sani, Project Officer DRDA suggested that for conservation of biological resource at local level could be conserved only with the association and co-operation of the local communities.

Shri J.M. Pathania, Additional District Magistrate-cum-Project Director, Desert Development Project, Pooh informed that the past experience of the Agro-forestry horti-pastoral programme etc. initiated under Desert Development Programme has shown that without people participation we can not think of getting good results for conservation of biodiversity as per the need of the local people.

Dr. Satish Sharma, Agriculture Development Officer, Agriculture Department, Rekong Peo, H.P. informed that Kalazira cultivation is being done in the area by the local people. Vegetables are also being grown and the traditional food, which used to be cooked in the area from the local Pseudo-cereal crops, is at the depleting stage now.

Dr. R.N. Sharma, Horticulture Development Officer, Horticulture Department, Rekong Peo, H.P. informed the members that grapes are being introduced besides the traditional horticulture plants already being in the area for commercial purpose.

The local people in the area also held discussion with reference to settlement rights in grazing/grass land and extraction of medicinal plants/herbs. Juniper and Chilgoza regeneration is problem in the area.

Dr. Rajan Bawa suggested that documentation of traditional water sources of the area should be done. Water harvesting structure for moisture retention/conservation should be encouraged.

After the detailed discussion following recommendations were made: -

1. Biodiversity status of the area should be prepared
2. Brief note of the biodiversity status for identification of the gaps should be supplied by the department of Forest, Agriculture, Horticulture, Animal Husbandry, Ayurveda, Irrigation and Public Health and R&D Institutions.
3. Experts/expert agencies/stakeholders should be identified by the District co-ordinator with the collaborations of Regional Research Station, Sharbo.
4. People participations in the process of preparation of strategy and action plan should be ensured, through organization of public meeting/ public hearing at grass root level.

The meeting ended with a vote of thanks to and from the Chair.

## ANNEXURE-2

**Proceedings of the meeting of the Sub-Steering Committee working group on Biodiversity Strategy and Action Plan (Sub-State Site) organised by the Agriculture Department (Nodal agency) under the Chairmanship of Shri Ashwani Kumar, Sub- Divisional Magistrate, Keylong, Lahaul and Spiti District, Himachal Pradesh on 21.5.2001 at 11.00 A.M. in the Conference Hall office of the Deputy Commissioner, Lahaul and Spiti, Himachal Pradesh**

A meeting of the Sub-Steering Committee working group on Biodiversity Strategy and Action Plan (Sub-State Site) was organised by the Agriculture Department (Nodal agency) certified by the District Administration) under the Chairmanship of Sub-Divisional Magistrate, Keylong, District Lahaul and Spiti (H.P.) Shri Ashwani Kumar, on 21.5.2001 at 11.00 A.M. in the Conference Hall of the office of the Deputy Commissioner, in which the following members were present: -

<b>Sr. No.</b>	<b>Name &amp; Designation</b>	<b>Department</b>
1.	Shri Kamraja Kaisth	Sr. Scientific Officer, State Council for Science and Environment Himachal Pradesh, Shimla-171009.
2.	Shri Roop Singh	Block Development Officer, Lahaul at Keylong
3.	Shri Soman Angrup	District Horticulture Officer, Keylong, District Lahaul and Spiti, H.P.
4.	Shri Vijender Malik	Assistant Development Officer (Agri) Lahaul at Keylong, Dist. Lahaul & Spiti, H.P.
5.	Dr. S. Kapoor	Medical Officer, District Hospital Keylong, Dist. Lahaul & Spiti, H.P.
6.	Shri Top Singh	Superintendent o/o D.F.O. Lahaul Division at Keylong, Dist. Lahaul & Spiti, H.P.

7. Shri Amar Lal Inspector, Co-Operative, Keylong  
Dist. Lahaul & Spiti, H.P.
8. Shri Rakesh Kumar District Ayurvedic Officer, Keylong  
Dist. Lahaul & Spiti, H.P.

The meeting started with a welcome address to the participants by Shri K. Kaisth, Senior Scientific Officer, State Council for Science, Technology and Environment, Himachal Pradesh.

Thereafter, the participants were briefed by Shri K.Kaisth, Senior Scientific Officer, State Council for Science, Technology and Environment, Himachal Pradesh Shimla about the purpose of the meeting. He informed that the NBSAP project has been initiated by the Ministry of Environment and Forest, GOI, New Delhi and Implemented by Technical and Policy Core Group consisting of experts from various fields, headed by Kalpvariksh (an environment NGV) with logistic support from Biotech Consortium India Limited, New Delhi with a limited financial support from UNDP under Global Environment facility. He emphasized on the need of conservation of biodiversity of Lahaul area and outlined the role of the Sub-Steering Committee Working Group in evolving a comprehensive plan so that all the biological resource could be used on sustained basis in the area.

After the briefing about the purpose of the meeting the discussion started on the agenda fixed for the meeting, which focused the following points:

- (i) Identification of issues/ problems and areas for biodiversity conservation.
- (ii) Identification of experts in the field of biodiversity in the area.
- (iii) Identification of Institutions and initiatives taken by them for biodiversity conservation.
- (iv) Identification of major stakeholders in biodiversity.
- (v) Delineating the mechanism for people participation.

Thereafter, Shri Top Singh, Superintendent, representative from office of the Divisional Forest Office informed that the Willow plants planted by the villagers from Sissu to Gondlha are drying. The Forest Department has informed both the Universities namely HPKV, Palampur and Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, District Solan, Himachal Pradesh about the problem. The plants grown by the Forest Department in the area are not facing such problem at present. Dr. Kapoor from Department of Health informed that similar problem is being faced by the people in Assam for the plants grown by them in the area. *Pinus roxburgii* plants are also drying in the valley from Thiroth to Tindi. Reasons are not known and it has been reported to the Conservator, Forest for getting expert opinion to know the exact cause for drying of the trees. Juniperus plant is growing in the area, which regenerates

naturally. No technique has been evolved so far for its propagation the area, which is a potential plant. Mountain plantation Research needs to be taken up in the area. The valley is experiencing decrease in the precipitation in the form of snow for the last five to six years. Water scarcity is being faced. Spring water sources are also drying. Snow harvesting is the need of the hour for irrigation of the plantation as well as agricultural fields in the valley. He also informed that the practice of toilets installation in the area has decreased the application of local manure, which used to be applied in the agriculture fields and plants transplanted by the local people in and around the village.

Shri Sonam, Angrup, District Horticulture Officer, informed that Apple, Apricot Almonds, Plum, Hops, Walnut, Hazelnuts etc. have been taken up by the Department of Horticulture for popularization of plantation amongst the local people in the area. The area is rich repository of valuable medicinal plant wealth and Kalazira, Jurinea, Karoo and Patish are collected by the local people which have got potential for cultivation in the area for commercial purpose.

Shri Vijender Malik informed that there is water seepage problem in the area because of the sandy soil texture. Problem of land slide is there in the valley in which culturable land of the farmers as well as Govt. land is going waste.

Shri Top Singh informed that the wildlife of the area namely Ibex, Snow Leopard, Wild Dogs, Snow Cock, Musk Deer, Wild Fox, Wild Mouse, Bear, Crow, Fish (Trout). Chung, Rats are available in the area but there is need for conservation of these wild species. Yak, Churu, Ox, Churu cow are facing threat, and need conservation.

Shri Top Singh, representative of D.F.O., Lahaul further informed that the Deputy Commissioner, Lahaul and Spiti, Shri CRB Lalit has directed the Forest Department to raise quality nursery stock of Seabuckthorn saplings numbering to one lac for transplantation in the area but so far the Department has been able to raise only 20,000 saplings in its nursery at Jispa and Sissu. Shri K. Kaisth, Senior Scientific Officer, State Council suggested that Dr. Virender Singh, Senior Scientist of Regional Research Station, Kukumseri, HPKV, Palampur, should be contacted and requested for helping the Department for propagation of the planting material which should be raised at three or four sites in the area. He has standardized the technique for raising the nursery for large scale multiplication and propagation of the plant.

Shri Ashwani Kumar, Sub-Divisional Magistrate, Keylong emphasized at the need for conservation of wildlife especially Snow Leopard, Ibex, Musk Deer etc. in the valley. Shri Top Singh informed that the matter pertains to Divisional Forest Officer, wildlife Kullu, as the area come under his jurisdiction for conservation purpose and wildlife protection, activities pertaining to Lahaul area is being executed by him. During the discussions, need was also felt for establishment of a sanctuary for wildlife conservation and also for introduction of grasses in the valley. The use of fungicides/pesticides and chemical fertilizers is causing environment pollution in the valley, which may affect health of human and livestock in the valley.

After the detailed discussions on the subject the following recommendations were made:

- i) Efforts should be made to collect information related to biodiversity of the area from the experts/ Researchers of the Universities and R&D institutions in the form of document/ data.
- ii) Efforts should be made by the Project Officer, ITDP Lahaul to collect information related to Biodiversity on R&D activities from Local R&D institutions of the Lahaul Valley for Biodiversity Conservation.
- iii) ITDP Lahaul will workout a methodology in ensuring effective participation of all stakeholders of the Lahaul Valley.
- iv) For preparation of the Biodiversity Strategy and Action Plan Dr. Virender Singh, Senior Scientist RRS, HPKVV, Kukumseri and Dr. Arvind Bhatt, Assistant Prof. Department of Biotechnology HPU, Shimla, HP may be included.

The meeting ended with a vote of thanks to the chair.