



State of Environment Report Himachal Pradesh

**Department of Environment, Science & Technology
Government of Himachal Pradesh**

In association with:

**H.P. State Council for Science, Technology & Environment
H.P. State Pollution Control Board**



State of Environment Report Himachal Pradesh

**Department of Environment, Science & Technology
Government of Himachal Pradesh**

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PROF. PREM KUMAR DHUMAL
CHIEF MINISTER
HIMACHAL PRADESH



ELLERSLIE
SHIMLA-171 002

MESSAGE

I am very pleased to learn that the Department of Environment, Science & Technology, Government of Himachal Pradesh is bringing out the second *State of Environment Report* for the State. Today, Himachal Pradesh is witnessing rapid economic growth but at the same time we are also committed to improve the effectiveness of environmental management, protect our vulnerable ecosystems and ensure sustainable development. Our ultimate aim is to improve the well being of the people of Himachal Pradesh and to bring about socio-economic prosperity in the State.

Our vision is to conserve the pristine Himalayan environment and yet keep the wheels of progress moving. My Government aims for all round development of the State without compromising the need for protection of fragile Himalayan ecology and environment. I am sure that the Department of Environment, Science & Technology will continue to play a proactive role in harmonizing environment with development, an approach which we so desperately need in present times.

I compliment the Department of Environment, Science & Technology for bringing out such a comprehensive scientific document. I am sure it will serve as a baseline data set for designing development interventions. I am convinced that the *State of Environment Report* would serve as a repository of environmental knowledge for the benefit of students, planners and scholars.

I am given to understand that such reports shall be published periodically and will be of immense use to policy makers in taking decisions which are environment friendly, thereby furthering the goal of sustainable development. I convey my heartiest congratulations and best wishes to the Department for success in this endeavour to protect the Himalayan ecology and environment. This endeavour would take us close to our cherished dream of making Himachal Pradesh the first Carbon Neutral State of country.


(Prof. Prem Kumar Dhumal)



ELLERSLIE
SHIMLA-171 002

JAGAT PRAKASH NADDA
Minister (Forests, Science & Technology)
Himachal Pradesh

MESSAGE

It gives me immense pleasure to learn that the Department of Environment, Science & Technology, Government of Himachal Pradesh is bringing out the second State of Environment Report for the State.

I have been given to understand that the State of Environment Report being published by the Department would display vital information on the environment related aspects of the State. As a Minister in-charge of the Department it shall be my endeavour to equip the Department in such a way that it successfully carries forward the protection, prevention and conservation agenda in a most sustainable manner.

Himachal Pradesh, which has its own peculiar environmental problems, needs to tread the developmental path without compromising with its pristine environment. Climate change and biological diversity loss are the two major planetary environmental threats facing mankind today and they are closely interlinked. Himachal Pradesh is a sensitive and highly bio-diverse ecosystem.

To conserve our Himalayan heritage, we must jointly strengthen our endeavours to tackle the climate change and to curb the loss of biological diversity through adoption of sustainable environmental management practices.

Under the able leadership of Prof. Prem Kumar Dhumal, Hon'ble Chief Minister Himachal Pradesh, we would integrate environment protection in development agenda of the State.

I congratulate and wish all success to the Department of Environment, Science and Technology.

(Jagat Prakash Nadda)

FOREWORD

Environmental concerns are growing each day with huge advancements in industrial development and infrastructure. We have reached the stage where we have to realize that all that we do impacts our delicate balance with nature. To sustain this balance, it is essential that development is in harmony with nature.

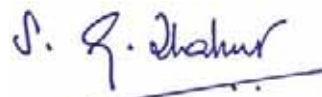
Various sectors exert impact on the environment in their own ways and to various degrees. It is essential to understand these pressures and impacts so that timely mitigation and adaptation measures may be taken to correct the situation.

The State of Environment Report is a sincere effort in this direction. It provides the reader with sector wise pressures, status, impacts and responses needed to take corrective action. The report is supported by a significant quantity of data thoughtfully presented in a user friendly form of tables and graphs rendering the statistical data easy to comprehend. The report is in essence a one-stop gateway to the environmental scenario of Himachal Pradesh.

This report has fulfilled a long standing need of our state and I am confident that it will be used by policy makers in arriving at decisions that will help in sustainable development. I also hope that the report will be equally useful to research scholars, students, NGOs and the public at large in understanding the environmental concerns of our State.

It is not an easy task for any organization to compile such diverse information and therefore I feel immensely proud that the Department of Environment, Science & Technology has risen to this challenge, under the initiative of Ministry of Environment and Forests, Government of India, and has successfully completed the same.

The purpose of the report will be served if it is able to facilitate various stake holders to take informed decisions which will result in better management of the state's environment and improve the quality of life in Himachal Pradesh.



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The State of Environment Report (SoER) has been prepared by Department of Environment, Science & Technology in collaboration with H.P. State Council for Science & Technology, Himachal Pradesh State Pollution Control Board and with the active support of several organizations, institutions and individuals. I express my sincerest gratitude to Smt. Sarojini Ganju Thakur, IAS, Additional Chief Secretary, Environment, Science & Technology who not only provided valuable comments in her capacity of Chairperson of the Steering Committee constituted by the State Government for overseeing the preparation of this report but also provided her wholehearted support to the project. We also express our sincere gratitude to other members of the Steering Committee, the 'Team Environment' for providing valuable inputs in the report.

This report contains large amount of data which has been collected and collated from various Departments through the Nodal Officers appointed within each Department. Our sincere thanks are extended to all the Departments/Nodal Officers without whose help it would not have been possible to prepare this document. I duly acknowledge the efforts of the Resource Persons of the various sectors who put in untiring efforts in writing and compiling the report. I also wish to put on record the efforts made by all the concerned organizations/persons without whose constant efforts and guidance this report would not have been possible.

In the last I would like to once again express my thanks to 'Team Environment' who were a guiding spirit through out the duration of the project. I also thank Ministry of Environment & Forests for providing financial assistance to this endeavour.



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DOCUMENTATION PROCESS

Documentation Process of SoER:

The Ministry of Environment & Forests Govt. of India (MoEF), in order to assess the state of environment in the country, initiated a plan scheme for assisting the State Governments / UT's to bring out State of Environment Report during the 10th Five Year Plan.

To facilitate the State Governments in the preparation of the State of Environment Report, four National Hosts were identified by the MoEF. Environment Protection Training and Research Institute (EPTRI), Hyderabad was identified National Host Institute for the State of Himachal Pradesh.

The Hon'ble Governor of Himachal Pradesh declared Department of Science, Technology and Environment as the "Nodal Agency" for coordinating with the Govt. of India and also nominated the State Council for Science, Technology and Environment (SCSTE) as the State Host Agency vide Notification No. EDN (S&T) A (4) 22/96 –II dated 29-10-2000. In line with the instructions of the Govt. of India, a State level Steering Committee was also constituted under the Chairmanship of the Chief Secretary for the preparation of the report.

Main Objectives of SoER:

SOE reporting is a process in order to understand, describe, analyse and communicate information on the conditions and trends in the environment. The following figure shows a schematic description for the SOE and its place in the environment management of a region.

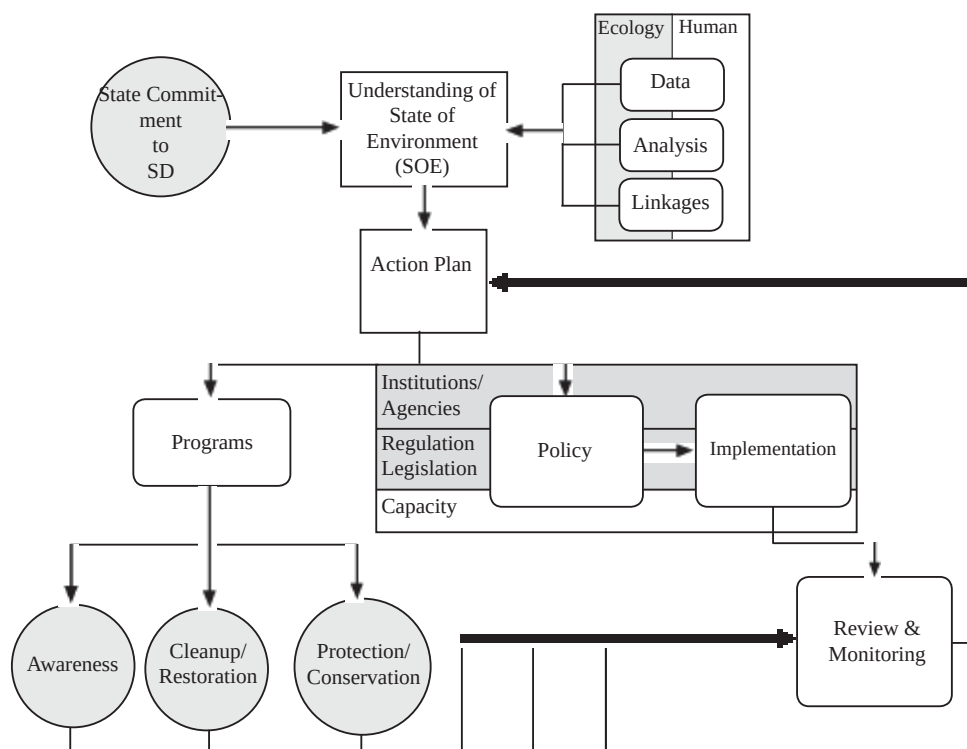


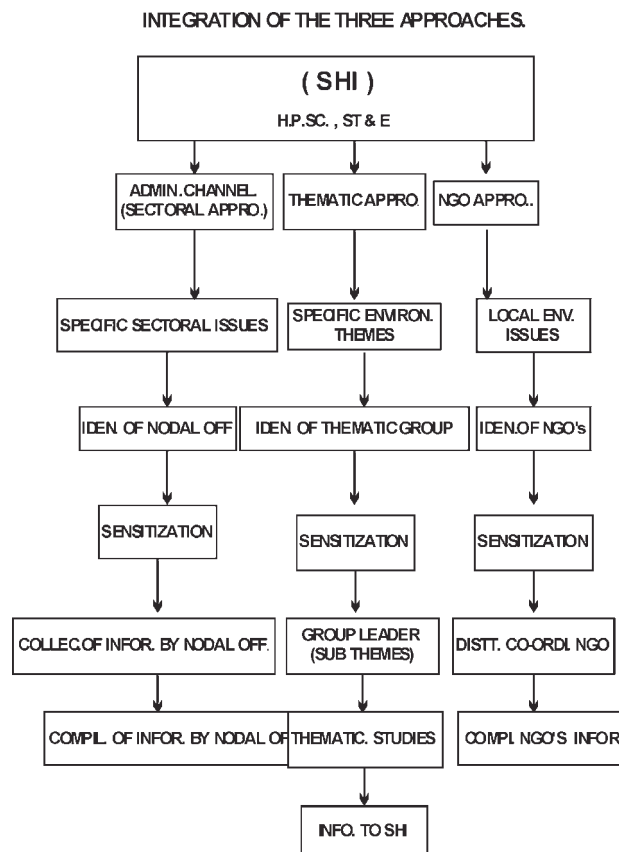
Fig. 1.1 SoE in Context of State Environment Policies

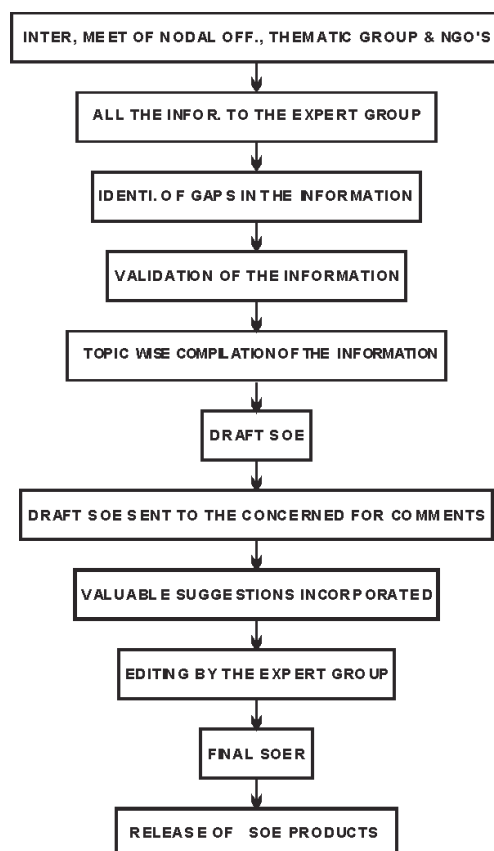
Key Objectives:

- To identify gaps in the State of Knowledge of environmental conditions and trends, and recommend strategies for research and monitoring to fill these gaps;
- To provide early warning of potential problems, as well as allowing for the evaluation of the possible scenario for the future;
- To report on the effectiveness of the policies and programmes that has been designed to respond to the environmental changes;
- To assess the State's progress towards achieving ecological sustainability.

The SCST &E initiated the process for the preparation of the State of Environment Report by getting a Notification issued regarding constitution of the State Steering Committee under the Chairmanship of Chief Secretary, to the Govt. of H.P. Thereafter, the State Council organized a meeting of the State Advisory Committee constituted under the Chairmanship of Secretary (S&T) to the Govt. of Himachal Pradesh.

Since data was essentially required to be collected from the various development departments, it was decided that each department will appoint a Nodal Officer who will coordinate and assist in supplying the data. A three way approach was decided to be adopted for the preparation of a comprehensive SoER.





Identification of Priorities:

In order to obtain professional input on the major areas of environmental concerns and issues, it was decided to float an open advertisement in the leading newspapers to identify resource persons who could contribute expert thematic input on the major environmental areas. Thereafter, a meeting of the selected thematic experts was organized and they were given formal exposure to the process and their role in the preparation of the report. After discussions with the selected experts thematic topics were allocated to them as per their expertise and interest.

The following themes were identified to be included in the report, after discussions with the experts:

Name of the Theme	Appendices
• Physiography of Himachal Pradesh • Agriculture and Allied Activities (Horticulture and Animal Husbandry) • Bio-Diversity • Energy • Land use • Forest • Health	• Environment Legislation • Environmental Accounting

• Transport • Industries and Mining • Tourism and Culture • Water Resources • Environment Pollution and Management • Society & Environment • Natural Disasters and Climate Change	

A formal consultation meeting with the Departmental Nodal Officers was also held to make them aware of the process and to identify their role in the preparation of the report and supply of data. A specific proforma was devised for the nodal officers so that relevant information could be processed and supplied by them from their respective departments.

In order to identify specific local issues and public concerns on the subject of the environment, district level consultation meetings with Non-Government organizations, local bodies and other citizens were organized. This information was collected through a specifically designed questionnaire supplied to them. This process was also utilised to identify hot- spots.

After the information received from thematic specialists, Departmental Nodal Officers and NGO, the report was compiled and sent to the concerned departments for scrutiny and comments if any, before its inclusion in the Final Report.

* * * * *

PHYSIOGRAPHY OF HIMACHAL PRADESH

Physiography of Himachal Pradesh

Introduction to the Area:

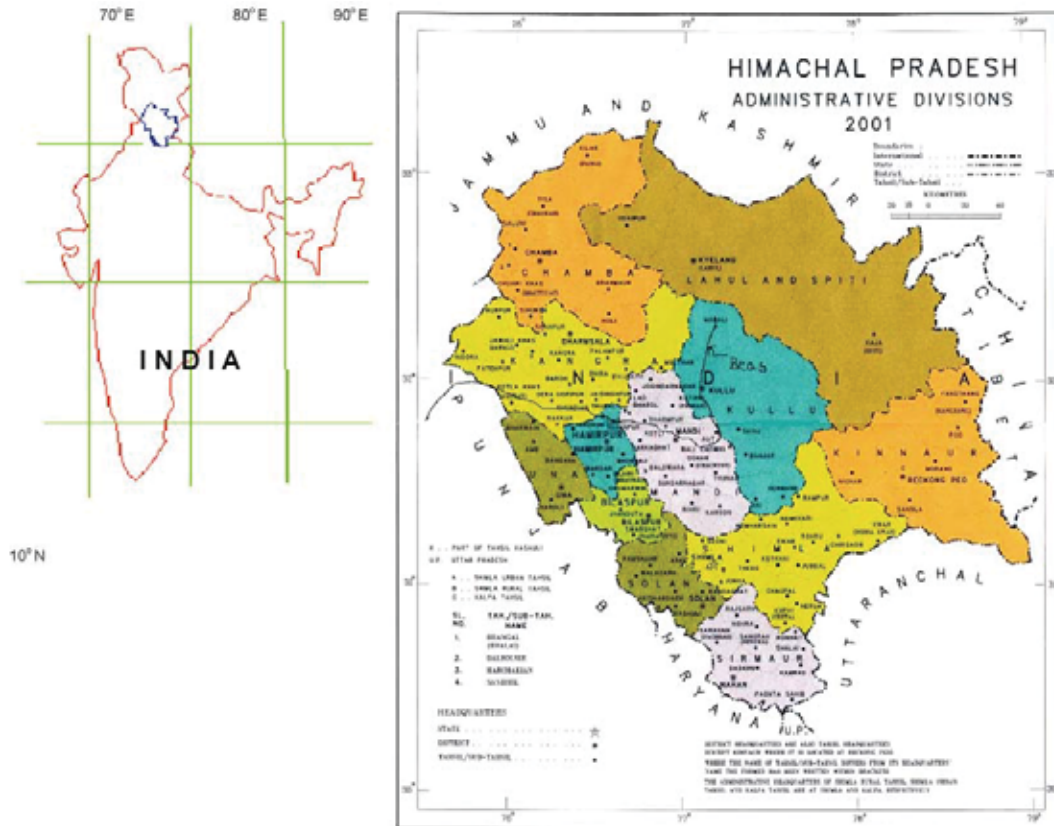
Himachal Pradesh, the land of beautiful landscape, lush green forests, bubbling streams, emerald meadows, enchanting lakes, eternal snows, ethnic communities and colourful people, is situated in the lap of the north-western Himalayas. It is bounded by Tibet to the east, Jammu and Kashmir to the north, Uttaranchal in the southeast, Haryana in the south and the Punjab in the west. It harbours one of the most richly diverse mountain landscapes.

Himachal Pradesh, formed as a Union Territory in 1948, after amalgamation of 31 erstwhile princely states, attained full statehood on 25th January, 1971.

1.1 Himachal Pradesh – At a Glance:

➤ Geographical Location (SFR, 1999)	30022' to 33013' North Latitude and 75036' to 79002' East Longitudes
➤ Geographical Area	55,673 km ² (1.7% of country's Geographical area)
➤ Elevation	350 m to 6816 m (Reo Purgyal in Zaskar range in Kinnaur)
➤ Population (2001 Census) Males: Females:	60.77 lakhs (0.59% of the country) 30.85 lakhs (0.57% of the country) 29.92 lakhs (0.60% of the country)
➤ Sex Ratio (females per thousand males)	970 (933 National)
➤ Sex ratio of Child Population (0-6 years)	897
➤ Infant Mortality Rate (IMR)	82
➤ Population Density	109 per km ² (313 National)
➤ Decadal Population Growth (1991 to 2001)	(+) 17.53% ((+) 21.54% National)
➤ Literacy Rate	76.5 % (64.8% National)
➤ Administrative Divisions	12 Districts (Bilaspur Chamba Hamirpur, Kullu, Lahaul & Spiti, Kangra, Kinnaur, Mandi, Sirmour, Solan, Shimla, Una), 75 Tehsils, 34 Sub-Tehsils
➤ State Capital	Shimla
➤ Towns	57
➤ Villages	20,118 (3.15% of the country)
➤ Urban Population	6.0 lakh (0.20%)
➤ Rural Population	54.8 lakh (0.73%)

➤ Total Forest & Tree Cover of State's Geographic Area of country's forest area Per Capita Forest & Tree Cover	14,894 km ² 26.66% 1.91% 0.24 hac
➤ Bio- Diversity Plant Species Animal Species	3295 (7.32% of the Country) 5721 (7.41% of the Country)
➤ Total Live stock	52.24 lakh
➤ Grazing Land / Pasture Available per Livestock	0.26 hectares
➤ Milk Production (2003-04) Per Capita Availability	784 tonnes 359 gm /day
➤ Gross Cropped Area (1997-98)	9.86 lakh hectares
➤ Cultivable Land	6.38 lakh hectares
➤ Net Area Sown	5.83 lakh hectares
➤ Total Food Grain Production (2002-03)	1110.86 thousand tonnes (1.1 Million Ton)
➤ Area Under Fruits Apple Production Other Temperate Fruits	1,82,441 Hectares 527.60 tonnes 60.16 tonnes
➤ Per capita income of Himachal Pradesh at current prices in 2004-05)	Rs 27486. This shows an increase of 9.7% over 2003-04 (Rs 25059)
➤ Average Annual Growth Rate (9th Plan)	+ 6.4 % (+ 5.6 National)
➤ Roads Motorable Double Lane (Dec 2004) Motorable Single Lane	2344 kms 22,152 kms
➤ Allopathic Institutions (Dec 2004)	634
➤ Hydro Electric Potential	21000 MW (1/5 of the Country)
➤ Electricity Generated (2003-04) Electricity Consumed	1356.95 million kWh 2726.32 million kWh
➤ Per Capita Consumption of LPG (Domestic) (2000)	21.37 Kg
➤ Per Capita Consumption of Kerosene Oil (2000)	12.77 Kltr/ person
➤ Incidence of Crime (2004)	17,029
➤ % age of Families Below Poverty Line	27.59%
➤ Tourism Tourist Arrivals in the State during 2004 Foreigners Tourist Arrivals in the State during 2005	5.5 Million 1.80 lakh 7.1 Million



Map 1.1 Political Map of Himachal Pradesh



Map 1.2 District and Tehsil Boundaries of Himachal Pradesh



Map 1.3 Regional Setting & Political map of Himachal Pradesh

1.2 Geographical/ Land Profile:

1.2.1 Topographic Features:

Himachal Pradesh is a hill state with altitude ranging from 350 m above msl at its boundary along the Punjab plains to 6816 msl at Reo Purgyal in the Zaskar range in Kinnaur. The altitude increases from west to east and south to north. The general landscape presents an intricate mosaic of mountain ranges, hills and valleys. Important mountain ranges in the State include the Shiwaliks, Dhauladhar, Pirpanjal, Great Himalaya and the Zaskar. Separated by valleys, glens and hills, distinct physiographic zones run almost parallel to each other throughout the length of the State from west to east. The state can be divided into three main topographic regions, (i) the Shiwaliks, (ii) the Lesser Himalaya and (iii) the Greater Himalaya.

The Shiwalik – known as ‘Mainak Parbat’ in ancient literature and mythologically regarded as the locks of Lord Shiva – is the outermost mountain range in the State. This range stretches for about 70 km with an average elevation of about 1000 m and is the origin of Ghaggar and the Markanda rivers. This range is composed of unconsolidated deposits, which are subject to severe erosion. The lesser Himalaya or the middle Himalaya, having most of the high altitude conifer and broad-leaved forests, alpine meadows and land under horticulture, covers the major part of the State and all the major hill stations are located in this zone. The Greater Himalaya lies further north of the lesser Himalaya and covers the trans-Himalayan cold desert areas of the State, characterized by glaciated landscape, thin vegetation and low human population density.

1.2.2 Soils:

The soils of Himachal Pradesh vary according to aspect, slope and climatic conditions. They may be classified as brown hill soils and sub montane soils. The brown hill soils are found in the Shiwalik and lesser Himalayan regions and cover 42.16 percent of the state’s area. The middle and greater Himalayan zones are characterized by podsollic or sub-montane type of soils covering nearly 46.07 percent of Himachal Pradesh. The glacial and eternal snow types of soils cover an area of 11.77 percent. These soils are not fully developed as they are found in the snow-covered areas. The soils of Himachal Pradesh are mostly thin, but deep only in the valleys.

The soils of Himachal Pradesh are under great stress and strain due to sheet and gully erosion. Large-scale deforestation and unscientific cultivation on the slopes have been mainly responsible for the large-scale soil erosion. The total cultivated land of Himachal Pradesh is estimated to be 7.59 lakh hectares out of which nearly 43% is prone to very high and high intensity of erosion.

Soil Types

(a) Udalfs - Ochrepts (20, 24)

(b) Orthents - Ochrepts (58)

(c) Ochrepts - Orthents - Ustalfs (70, 72, 73, 74, 82)

(d) Udolls (89) and

(e) Glaciers & Snowcaps (103)

(a) The udalfs-ochrepts are high base status soils of humid regions such as Chamba, Lahaul & Spiti, Kinnaur and the southern part of Sirmour. A combination of udalfs-ochrepts is found in Mandi, Bilaspur and the eastern part of Shimla as well. The ochrepts are shallow black, brown and alluvial soils.

(b) The orthents-ochrepts soils represent the combination of shallow black, brown and alluvial soils. These are recently formed soils and are found in lower and lesser Himachal region such as Sirmour, Solan, Una, Hamirpur, Kangra and part of Chamba district. They are mainly alluvial soils which were recently formed. They are shallow black as well as red loamy and red sandy in nature. Kullu, parts of Kinnaur and Shimla are characterised by these types of soils. These soils are very good for horticulture.

(c) The udolls are found in northern part of Lahaul & Spiti. They represent the characteristics of the Terai soils of humid regions.

(d) The glaciers and snowcap soils are spread in patches in part of Kullu, Lahaul-Spiti and Kinnaur where glaciers and snow cover is present throughout the year.

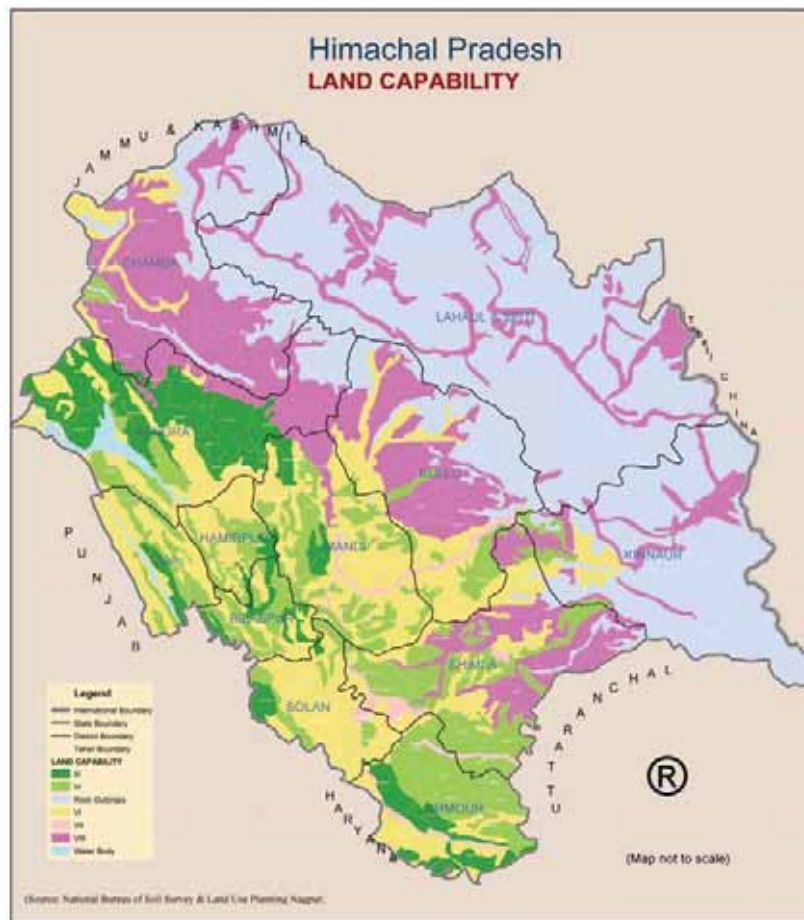
1.2.3 Land Capability:

Before allocating any piece of land to any use it is important to take into account the carrying capacity of the land so that any future environmental implication is avoided. Land suitability is basically an interpretation of groupings of different soil units and serves an important role in land use planning to show the relative suitability of soil for cultivation of crops, pastures, forestry and focusing the problems which needs preventive measures. This provides clues to the management and improvement of different soils for increasing production. Therefore, the strategy would be to identify the lands according to its natural (environmental) suitability in a way that the use is not adversely affecting its natural condition and/or its natural functions on a sustainable basis. This means the identification of suitable region for different type of development. The general guiding principle of surface utilization, therefore, would be that cultivation should be restricted between I to IV capability classes, horticulture & grazing V to VII and forestry to class VII, leaving class VIII for conservation and recreation.

In the study undertaken by NBSS & LUP, the soils of the state have been interpreted into 5 land capability classes. Majority of the soils belong to class VIII (40.6%), class VII (14.7%) and class VI (23.0%). These soils are not suitable for agriculture. Class VI lands can be utilized for growing forests and pastures. Class VII lands are mostly rock outcrops, which can be utilized as recreational areas. Class VII lands can be marginally utilized for forests and pastures. Class III and IV lands can be utilized for cultivation by adopting suitable soil conservation measures. Class II lands though not mentioned here but exists in small patches and is included in the classes.

Land Capability Classes

DIFFERENT LAND CAPABILITY CLASSES AND THEIR LIMITATIONS AND POTENTIALS				
Class	Area		Limitations	Potentials
	000 ha	%age		
III	370	6.7	Moderate problems due to moderate depth, gravels, moderate slopes subject to water erosion	Modertately good cultivable land
IV	816	14.7	Moderately steep lands subject to serious water erosion, shallow depth, gravels and stones.	Fairly good land suited for cultivation
VI	1281	23.1	Steep lands subject to severe erosion if cover	Well suited for grazing, forestry and plantations and limited cultivation.
VII	819	14.8	Very steep land subject to erosion, if cover is depleted, very shallow and stony soils.	Fairly well suited for grazing or forestry, not arable.
VIII	2260	40.7	Highly erodible gullies, badlands, barren mountain tops and rock outcrops.	Suited only for wildlife, recreation and permanent snow covered as protection of water supplies.



Map 1.4 Land Capability of Himachal Pradesh

1.2.4 Climate:

Himachal Pradesh exhibits considerable variation in the distribution of rainfall and temperature due to the varying aspects and altitudes. Precipitation declines from west to east and south to north. The average annual rainfall of Himachal is 1111 mm, varying from about 450 mm in Lahaul & Spiti to over 3,400 mm in Dharamsala, the district headquarters of Kangra. About 70% of this precipitation is received from July to September. Winter precipitation as snow is received at elevations above 1800 m. An average of 3 m of snow is experienced from December to March at elevations above 3000 m. The reaches above 4500 m above msl remain under almost perpetual snow. District-wise figures of rainfall in Himachal Pradesh are given in table-1.2.

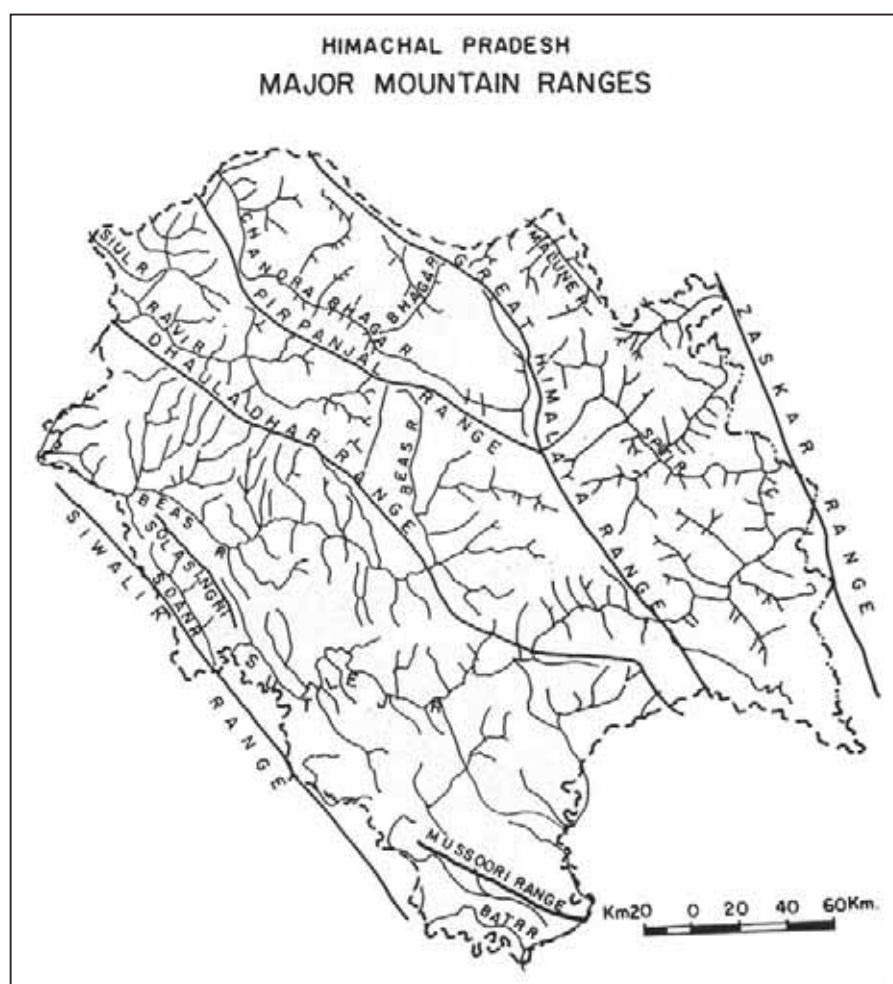
Temperatures decrease from west to east. Whereas January is the coldest month, the highest temperature is recorded during the month of June.

The relative humidity is usually high in the months of July, August and September and varies between 76 and 95 percent. Presence of dense forests sometimes causes high humidity at some places even during the months of December and January. There are three marked seasons in Himachal Pradesh. These are:-

Table 1.2: District Wise Trends in Rainfall (Rainfall in millimeters)

S.No.	District	1999	2000	2001	2002	2003
1.	Bilaspur	1469.2	894.1	1083.3	1049.9	1069.1
2.	Chamba	2223.1	1414.2	936.5	1269.7	1969.6
3.	Hamirpur	1273.3	1320.7	1314.0	1104.6	1292.0
4.	Kangra	1905.6	1353.4	1818.4	1101.5	1679.4
5.	Kinnaur	412.6	548.5	432.6	742.2	239.6
6.	Kullu	1272.2	1088.0	922.0	733.4	947.8
7.	Lahaul-Spiti	467.6	484.8	336.1	382.8	554.4
8.	Mandi	1958.3	1397.6	1471.0	1083.5	1476.8
9.	Shimla	842.3	907.6	761.8	1103.2	977.1
10.	Sirmor	1394.4	1217.6	1351.1	1187.9	1356.5
11.	Solan	1182.9	937.4	856.5	908.9	856.7
12.	Una	1009.6	869.6	1446.7	1345.2	1661.1
	Average for H.P.	1277.6	1052.4	1067.5	984.8	1,131.7

[Source: Directorate of Land Records, Himachal Pradesh]

**Map 1.5 Major Mountain Ranges**

- a) Summer Season (April to June)
- b) Rainy Season (July to September)
- c) Winter Season (October to March)

Based on regional variations in rainfall, temperature and humidity, the State can be divided into the following five climatic zones:

- (a) Sub-tropical Zone (below 900 m)
- (b) Warm Temperate Zone (900 m to 1800 m)
- (c) Cool Temperate Zone (1800 m to 2400 m)
- (d) Cold High Mountain Zone (2400 m to 4000 m)
- (e) Snowy Frigid Zone (above 4000 m)

1.2.4 Land Use:

The entire land resource in the state is owned by the Government, communities and private individuals.

The reported area up to the year 1994-95 was 34024 km² and it had increased to 45318 km² by 1999-2000 and to 45418 km² by 2001-02. There has been an increase of 11294 km² in the reported area which is mainly due to the completion of settlement operations in the districts of Kinnaur, Shimla and parts of Lahaul and Spiti. In Kinnaur there has been an increase of 3766 km². This district has 11.8 percent of the total geographical area and the reported area has increased from 7.3 percent in 1994-95 to 13.8 percent in the year 1999-2000 and 13.7 percent by the year 2001-02. In Lahaul and Spiti district the increase in the reported area has been 7055 km² from the reported area of 2156 km² to 9111 km² in the year 1999-2000 and 2001-02. It has therefore increased from 6.5 percent in 1994-95 to 20.4 percent in the year 1999-2000 and 20 percent in the year 2001-02. Settlement work has been completed in Kinnaur district and the reported area is now 6237 km² which is 316 km² less than the total geographical area. There seems to be some mistake somewhere which needs to be looked into and reconciled by the settlement office Shimla in consultation with Survey of India. In Lahaul and Spiti district, settlement has been completed in Spiti sub division but the Lahaul sub-division is yet to be settled. An area of 4582 km² is yet to be surveyed in Lahaul Sub-division. In Shimla district the reported area has increased from 4477 km² in 1994-95 to 4926 km² in 1999-2000 and 5070 km² in 2001-02. Thus only a 61 km² area remains to be surveyed in this district for which the work is going on.

Land use is also a function of, and directly related to, anthropogenic factors. Per capita land holding in the State is less than one hectare *but, excluding unculturable lands, and lands under forest, the per capita land holding is only about 0.1 hac* Pressures on the limited land resource are apparently increasing by the day and the land use is, therefore, likely to undergo further changes and shifts from one to the other type as the human demands on this resource increase.

Table 1.3: Status of Land use (Area in Hectares)

Landuse Classification	1966-67	1994-95	1999-2000
Forests	636096	1049039	1094209
Barren and Un-culturable Land	109383	149388	856911
Area put to non-agricultural Uses	117483	198669	30219
Permanent Pastures and other Grazing Lands	1163402	1193602	1471536
Land under Miscellaneous Tree Crops and Groves	39716	48634	64161
Culturable Waste Lands	176760	118126	119413
Other Fallow Lands	2630	20695	15714
Current Fallow	65759	55938	56233
Net Area Sown	535107	568338	551457
Total Area	2906336	3402429	4531828

a) Shifts in Land Use Pattern:

Since man began leading a settled life, landuse has undergone a corresponding change. Space is required for housing, agriculture and various other activities related to man's day to day needs. Areas from wilderness – be they tree lands, scrubs or grasslands – were brought under agriculture and settlements. The process of shift in landuse has been on for centuries and its pace is decided by the development of new technologies and quantum of shifts in the life styles of populations and their requirements at any given time and place. In many countries, clearing of forests for agriculture was an established government policy. In India also, forest colonies were officially encouraged just after independence. According to the statistics of the Ministry of Agriculture, Government of India, by 1950-51, 2.6 million hectares of forest lands had already been diverted for cultivation in the country.

Landuse scene in Himachal Pradesh has been no different. Lands where there were no trees at the turn of the last century have been brought under tree cover and many slopes reported to have dense tree cover have been denuded over the same period. Large manmade lakes now dot the landscape as a result of construction of dams across major rivers, submerging lands in the upstream areas. Construction of roads, electric transmission lines and development of necessary infrastructure for increased human settlements have all contributed to change in landuse.

b) Status of Forest Lands in Himachal Pradesh:

Total land area classified as forest as per records of the Forest Department was 35.5 lakh hectares in the year 1966-67 (SER-HP, 2000) although less than one third of this area was actually surveyed, settled and entered in the revenue records as forests in that year. The legal status of this 'forest' land as per forest records has remained the same over the years. Due to some diversion from this land for infrastructure development, the total forest area is now 35.4 lakh hectares, constituting 63.60% of the total geographical area of the state (SFR, 1999). However,

this area includes, besides dense and open forests, large tracts of degraded and unculturable lands, alpine meadows and other grasslands, as well as areas under perpetual snow. The total forest area under actual tree cover accounts for only 13,082 km² and constitutes 23.50% of the geographical area (SFR, 1999). It is encouraging to note that a net increase of 561 km² in the actual forest tree cover has been registered in the state's latest assessment (1999) over the last assessment (1997), indicating that afforestation efforts have started showing results. Most of this actual forest tree cover is in the reserve forests and demarcated protected forests having settled boundaries. *The definition is now "Tree covered area" and includes ALL tree cover including orchards and tea estates.*

The figures relating to the total geographical area classified as forests as per forest records need verification on the ground by quickly completing the revenue settlement of the remaining areas. The exact extent and status of this land can be arrived at only when the survey and settlement operations are over. Boundaries of forests, except for those of reserve forests and demarcated protected forests, have not been defined on the ground due to the land survey by revenue authorities being still in progress. At many places private tree lands adjoin the forests. In the absence of defined boundaries, encroachments in these un-demarcated forest lands are known to have taken place in many areas, primarily for cultivation. Eviction of these encroachments is very difficult due to settlement problems and the intricate legal procedure involved. Periodic regularization of encroachment by the government only encourages further encroachments as the cardinal principle of justice related to "possession" gets further strengthened in the minds of the people. The total extent of encroachments on forests is very difficult to assess in the absence of settled boundaries.

Forest land, constituting about two thirds of the total geographical area of the state, is also needed for diversion for various state sponsored developmental activities and infrastructure building. The major share of this diversion is on account of hydroelectric projects and related activities including the laying of transmission lines. Development of communication network including construction of roads and setting up of major industry, particularly limestone based, need other areas to shift to landuse from forests.

With the increasing pressures on forest lands and problems related to their management, it has become inevitable that the available forest resource be managed intensively to fulfill the demands for the various goods and services expected from forests.

c) Status of Cultivated Lands:

Himachal Pradesh is an agrarian state with the rural population accounting for 90.21% of the total population. An area of 10.14 lakh hectare is reported to be under cultivation as per records of Agriculture Department. However, as per revenue records based on survey and settlement up to 1995-96 (Table-1.3 above), the total net sown area in the state is only 5.57 lakh hectare. Even after taking into account areas under Culturable Waste Lands, fallows other than current fallows and the fallow lands the total adds up to only 7.59 lakh hectare. With the total number of land holdings in the state estimated at 8.44 lakh, the average size of land holding thus works out

to a little above one hectare. Of these, holdings of less than one hectare account for more than 60% of the total and only about one percent of the holdings are bigger than ten hectares. With the increase in population over the years and the change in life style, many joint families have split thus increasing the number of smaller land holdings. The trend is unhealthy, as the smaller holdings are unable to sustain the needs of the family. The small farmer has, therefore, to look for other avenues for income generation. Many a time one has even to abandon the land in favour of some other employment opportunity.

With the total geographical area of the state fixed and total area under forests and unculturable lands known, the shift towards net area sown officially can only be from fallow lands and Culturable Wastes. However, linking remote areas in the state by network of roads has opened up these areas for cultivation. Encroachments on forest lands have also taken place in these areas. The lands are first cleared of bushes, raked up and brought under cultivation of local millet crops or cash crops like potatoes. Slowly the ownership is established over these areas, trees girdled and removed. Fruit trees are then planted and an orchard established. This process is very damaging to the environment, as the maximum returns are desired from the encroached land without corresponding input. Land is tilled without constructing terraces, resulting in erosion of topsoil and reduced fertility of the soil. Since the areas still remain undemarcated, only guesses can be made about such encroachments.

Change in land use on another level is in the shape of bringing more areas under intensive agriculture and raising more than one crop per year, raising cash crops as alternative to agricultural crops, or bringing land under orchards or tree farms. These shifts from one type of land use to another are linked to the development of infrastructure – mainly construction of roads linking even the remote localities to the main towns, provision of irrigation and development of modern agricultural technologies. All these trends have been witnessed in the state in the recent past.

Traditional agriculture is still practiced over the major area under cultivation. The area under the major cereal crops in the state viz. wheat, rice, maize and barley, actually registered an increase from 6.50 lakh hectares during 1966-67 to 7.77 lakh hectares during 1995-96. Production of these food crops also increased from 6.58 mt to 13.18 mt during the same period. These figures reveal that the intensity of agriculture and productivity has also increased over the years. The area under rainfed crops, like pulses, registered a decline from 0.62 lakh hectares during 1966-67 to 0.36 lakh hectares during 1994-95. Similarly the area under minor millets and pseudo cereals has also declined from 0.69 lakh hectares to 0.18 lakh hectares during the same period. This change in land use pattern can be explained by extension of irrigation facilities, availability of improved seeds for major cereal crops and change in food habits of the people, who now have switched over to major cereals from minor cereals and pseudo cereals as their main diet.

The area under fruit trees and vegetables has also increased from 0.92 lakh hectares in 1980-81 to 1.96 lakh hectares in 1995-96 (Department of Horticulture, 1997). This increase in the area under horticulture has been prompted by the suitability of the state for this purpose and the much higher returns from horticulture produce. An example of changed economy due to switching over

to apple cultivation in the higher hills of the state is manifested in recognition of the 'Kiari' village in Kotkhai, Shimla, as the village with the highest per capita income in Asia for the year 1999. Increases in the area under horticulture has been largely at the expense of agriculture. However, private tree lands, particularly in the higher hills, have also been cleared of trees and brought under horticulture. At many places encroachments in the forests have also taken place and such lands put under fruit trees.

Conducive climatic conditions make the state ideal for growing off-season vegetables under natural conditions with low irrigation input. Large tracts of land in the lower hills have been diverted from agriculture to growing of vegetables such as tomatoes, capsicum, cucumber and ginger. Similarly, in the high hills, land under vegetables such as cabbage, carrots, cauliflower, peas and potatoes is increasing every year.

Floriculture has also, of late, emerged as a cash crop option yielding very high returns and a high potential for export. The climate in the state has been found to be suitable for growing flowers such as carnations, gladioli, chrysanthemums and lilies. Since this venture needs very high investment and is of a highly intensive nature, not much land has been brought under floriculture as yet. As per estimates by the Horticulture Department, about 50 hectare has already been brought under floriculture and this is increasing at the rate of ten percent per year.

1.3. Natural Resources:

1.3.1 Minerals:

The state has deposits of a variety of minerals: salt, gypsum, limestone, barite, clay, mica, iron, pyrites, slate and lead. Limestone is the most heavily quarried mineral of the state and provides raw material for the three major cement plants and a number of small units in the state. Most of the limestone, slate and other quarrying is open cast and causes substantial degradation of the land due to depositing of overburden.

1.3.2 Water Resources:

The state's water resources owe their existence to good precipitation during winter and during monsoon season. These resources include glaciers, perennial streams draining into rivers, water bodies including natural lakes and manmade reservoirs, innumerable water springs and large stocks of sub-soil water. Water resources of the state have a major bearing on making the state a very rich repository of biodiversity.

(a) The River Systems:

The state is drained by nine major river systems. Catchment areas of these rivers are given in the table below:

Table 1.4: Catchment Area of Major Rivers

S. No.	Name of River System	Area of Catchment (in Km ²)	Area in percentage
1	Sutlej	20,398	30.69%
2	Beas	13,663	24.50%
3	Chenab	7,850	14.20%
4	Yamuna	5,872	10.60%
5	Ravi	5,528	09.90%
6	Indus	1,450	02.60%
7	Markanda	360	00.60%
8	Ganga	290	00.50%
9	Ghaggar	262	00.50%
	Total	55,673	100.00

[Source: Forests of Himachal Pradesh, 1993]

As is apparent from the details above, that more than 95% of the state's area is drained by five river systems, i.e. the Sutlej, Beas, Chenab, Yamuna and Ravi. Details of these river systems are as under:

(i) The Sutlej: This is the largest river system of Himachal Pradesh with a total catchment area of 20,398 km² spread over the districts of Lahaul & Spiti, Kinnaur, Shimla, Solan and Bilaspur. Originating in Tibet, the river flows from east to west, enters the state at Shipki (6,608 m) in Kinnaur. It is joined by its various right bank tributaries including the Spiti, the Ropa, the Kasang, the Mulgaon, the Yul, the Wanger and the Throng in Kinnaur. The Tirung, the Gayanthing, the Duling, the Baspa, the Solding, the Manglad and the Nogli streams form some of its left bank tributaries. Before entering the Punjab plains, it cuts a gorge in Naina Devi Dhar. A big dam across this gorge near Bhakra village has been constructed which has created a huge reservoir called the Govindsagar in the district of Bilaspur. With a basin threshold of 500 km², the Sutlej river basin gets divided into eleven subbasins.

**Map 1.6 Drainage & River Basins**

(ii) The Beas: Known as 'Vipasa' in ancient scriptures, the Beas is the second most important river of Himachal Pradesh and has a catchment area of 13,663 km². It originates at Beas Kund

near the Rohtang pass and is fed by several tributaries including the Parbati, the Hurla, the Sainj, the Tirthan, the Uhl, the Sakeri, the Luni, the Awa, the Banganga, the Manuni, the Guj and the Chaki. It flows from north to south-west over a distance of 286 km in Himachal Pradesh. With a basin threshold of 500 km², the Beas river basin gets divided into seventeen subbasins.

(iii) The Chenab: Also known as Chandrabhaga, is the largest river of the state in terms of water volume. Its catchment area is about 7850 km². Chandra and Bhaga originate from the opposite sides of Baralacha-la, at an elevation of 4891 m in Lahaul. Chandra from the south-east and the Bhaga from the north-west join at Tandi (2286 m) to form the Chenab. It enters the Pangti valley of Chamba district a little beyond Bhujind and leaves the state at Sasari nala to enter Jammu & Kashmir. There are no traces of human habitations along the banks of this river as it passes through mountains laden with eternal snow. With a basin threshold of 500 km², the Chenab river basin gets divided into seven subbasins.

(iv) The Yamuna: The south-eastern part of Himachal is drained by various tributaries of the Yamuna such as the Tons, the Pabbar and the Giri. The Tons, through its tributary Rupen, drains the Dodra-Kwar area. The Pabbar originates from Chandar Nan lake on the Chaural peak in Rohru and the Giri originates from Giri-Ganga near the Kuper peak in Jubbal. The Yamuna river system drains a total of about 5,872 km² in the state.

(v) The Ravi: Known as 'Parsuni' in Vedic literature, the Ravi River originates from an amphitheatre-like basin called Bara Bangal, which is a branch of the Dhauladhar range. The catchment area of the Ravi in the state is 5,528 km². It flows westward through a trough separating the Pir Panjal from the Dhauladhar range and then turns southwards cutting a deep gorge through the Dhauladhar range. It flows through Chamba district for about 130 km before leaving the state at Kheri. During its course, several tributaries such as Chirchind nala on the left-bank and the Budhill, the Tundah, the Burjeri, the Saho and the Siul on the right-bank join it. Chamba town is situated on its right bank. With a basin threshold of 500 km², the Beas river basin gets divided into five subbasins.

(b) The Water Bodies:

Besides the extensive river systems, the hills and valleys of the state are dotted with numerous water bodies including natural lakes and man made reservoirs. Some of the important natural lakes are Ghadasaru, Khajjiar, Lama, Manimahesh, Mahakali (Chamba); Dal, Kaveri (Kangra); Kumserwali, Prashar, Rewalsar, Kuntbhyo, Kalasar, Sukhasar (Mandi); Bharigu, Sareolsar, Mantalai (Kullu); Chandertal, Surajtal (Lahaul & Spiti); Chandranahan, Karali, Bradasar (Shimla); Nako (Kinnaur); Renuka, Suketi (Sirmour).

The major man made reservoirs in the State include Govindsagar (Bilaspur), Pongdam (Kangra) and Pandoh (Mandi).

Whereas most of these lakes form very important places of pilgrimage and witness a throng of visitors during festive seasons, these also form unique aquatic ecosystems harbouring rich faunal and floral diversity. All the man made reservoirs, especially the Pongdam, have attained the distinction of acting as their winter home to a large variety of migratory birds.

(c) Springs:

Perennial fresh water springs are another very important source of water in the State, especially for drinking purposes. Besides these fresh water springs, there are many hot water springs in the state and those at Manikaran in the Parvati valley, Vashistha near Manali, Tatapani in Shimla, Jeori, Tapri and some other places are known for their curative powers, mythical legends and invigorating contents. The devotees conduct various rituals at these springs and make offerings to ancestral spirits and Gods. Each one of these is associated with sages of ancient time who meditated at these sites according to written and oral records and folklore.

(d) Other Sources:

Besides the natural water sources, rainwater is also harvested in the state in the village ponds dug and maintained for the purpose. This water helps to tide over the pinch period water requirements during dry months and act as a good source of water for livestock.

‘Khatries’ – the horizontal tunnels bored into the mountain slopes to tap water accumulated in the mountain folds, form an important source of water in the water scarce district of Hamirpur and Mandi.

Sub-soil water is also tapped in the State through bore wells and open wells. These wells form the mainstay of irrigation in the districts of Una, Sirmour, Solan and Kangra. Of late the State government has also installed more than 10,000 hand pumps in the state to augment the drinking water availability to the people.

1.3.3 Issues:

The various water sources in the state are tapped to fulfill the water requirements of the human and livestock populations, for various development works and other day today requirements and for irrigation. The state has the estimated potential to generate 20,000 MW of hydroelectric power. Various rivers and streams have been dammed for harnessing this vast hydroelectric power potential, for irrigation and for providing water to various habitations. Water has been diverted from the streams through ‘kuhls’ and ground water is being exploited for irrigation purposes. A huge deficit in the water availability to various human habitations and for irrigation purposes exists in the state. Efforts are on to augment this water supply. Efforts are also being made to harvest the maximum possible hydro-electric potential of the state. The result is diversion of more and more water from the natural sources causing the sources to dry below the harvesting point. The effects of this tapping of water sources on the biodiversity are yet to be studied.

Forests:

The recorded forest area of the state is 3.54 million hectare, which constitutes 63.60% of the total geographical area of the state. Not all this forest area is, however, under tree cover and also includes natural scrub forests, pastures/ alpine pastures and areas under permanent snow.

The tree cover (dense forests and open forests) is limited to 13,082 km² and accounts for 23.50% of the geographical area of the State (SFR, 1999). The actual forest tree cover has shown an increase of 561 km² over the last assessment made during 1997 even as the total of 440 km² of dense forests have degraded to open forests over the same period. The permanent pastures including the alpine meadows that form a very important and stable ecosystem cover more than 12,000 km² and constitute about 21% of the geographical area of the state. Various kinds of natural scrub forests cover an area of 566 km² and constitute another one percent of the geographical area of the state. Both the alpine meadows and the scrub forests provide a habitat to a variety of very important medicinal flora of the state.

Given the wide altitudinal and climatic range in the state, a vast variety of forests are met with at different altitudes and in different physiographic zones. A fair idea about this diversity of forest types can be had from the table 1.5.

The forests are a very important natural resource of the state. They not only help in maintaining the ecological stability of the fragile landscape, form the basis of rich biodiversity of the state and keep the perennial watercourses flowing, but also provide various life supporting infrastructure to the local communities and revenue to the State Government.

The forests of Himachal Pradesh have an estimated growing stock of 10.26 crore m³ and more than 4.5 lakh m³ of timber is harvested every year in the form of salvage and to meet the demand of rights holders. As per one estimate timber worth Rs. 60 crore is allocated to the rights holders at a nominal cost every year (HPFSR, 2000). All green commercial harvesting of timber from the state's forests has been suspended since 1984. An estimated 35 lakh mt of fuel wood and 150 lakh mt of green fodder is required per year in the state. A major part of this demand is met from the forests of the state. The forests also contribute an estimated annual income of Rs. 25 crore to the rural communities in the shape of minor forest produce. An estimated 48 lakh man days worth of employment is also generated on account of various forestry related works every year. Apart from these direct consumptive benefits, the forestry resources also have many non-consumptive and indirect benefits to the people of the state in the shape of ecotourism potential, watershed and climatic values and as reservoirs of biodiversity.

The forests are managed as per prescriptions of periodic government approved 'Working Plans' prepared by specially designated forest officers. Of late, principles of community participation in the forest management have also been made an integral part of Working Plans. The State Government and the State Forest Department have launched various schemes to involve local people in management of the forests. Efforts are afoot to involve the Panchayati Raj Institutions in forest management.

People of the State have traditionally been following one or the other model of agro-forestry in their fields. This practice was very useful in so far as major part of the fuel and fodder requirement of the people was met from these fields. However, with intensification of agriculture, these traditional practices have suffered. Various community forestry, social forestry and farm forestry schemes have also been launched to inform people of their traditional practices and to motivate

Table 1.5: Diversity of Forest Types

S. No.	Major Forest Group	Classification Code	Forest Type
1.	Tropical Moist Deciduous Forests	3C/ C2a	Moist Shiwalik Sal forest
		3C/ C2b	Moist Bhabar Sal forest
2.	Tropical Dry Deciduous Forests	5B/ C1a	Dry Shiwalik Sal forest
		5B/ C2	Northern Dry Mixed Deciduous forest
		5B/ C2/ DS ₁	Dry Deciduous Scrub
		5B/ E9	Dry Bamboo Brakes
		5B/ 1S ₂	Khair Sissoo Forests
3.	Subtropical Pine Forests	9C1	Himalayan subtropical Pine forests
		9DS ₁	Himalayan subtropical scrub
		9DS ₂	Subtropical <i>Euphorbia</i> scrub
4.	Subtropical Dry-Evergreen Forests	10C1	Subtropical dry evergreen forest
		10DS ₁	<i>Dodonaea</i> scrub
5.	Himalayan Moist Temperate Forests	12/ C1a	Lower Western Himalayan Ban Oak forests
		12/ C1b	Lower Western Himalayan Mohru Oak forests
		12/C1c	Lower Western Himalayan moist Deodar forests
		12/C1d	Lower Western Himalayan mixed coniferous forests
		12/C1e	Lower Western Himalayan moist temperate deciduous forests
		12/C2a	Upper Western Himalayan Kharsu Oak forests
		12/C2b	West Himalayan upper Oak/ Fir forest
		12/DS1	Montane bamboo brakes
		12/DS2	Himalayan temperate parklands
6.	Himalayan Dry Temperate Forest	13/C1	Dry broad leaved and coniferous forest (<i>Q. ilex- P. gerardiana</i>)
		13/C2a	Dry temperate coniferous – Neoza pine forests
		13/C2b	Dry temperate coniferous – dry deodar forests
		13/C4	West Himalayan high-level dry blue pine forest
		13/C5	West Himalayan dry Juniper forest
7.	Sub-alpine Forest	14/C1a	West Himalayan sub-alpine Fir forest
		14/C1b	West Himalayan sub-alpine Birch/ Fir forest
		14/DS1	Sub-alpine pastures
8.	Moist Alpine Scrub	15/C1	Birch/ Rhododendron scrub forest
		15/C2	Deciduous alpine scrub
		15/E1	Dwarf Rhododendron scrub
		15/C3	Alpine pastures
9.	Dry Alpine Scrub	16/C1	Dry alpine scrub
		16/E1	Dwarf Juniper scrub

[Source: Champion H. G. and S. K. Seth (1968): A Revised Survey of Forest Types of India. GOI]

them to take up tree planting on marginal lands so that pressures on the forests for fuel and fodder can be reduced.

1.3.4 Social Setup:

Population Highlights:

As per the 2001 census report, the human population of the state stood at 60, 77,248 showing a decadal growth of 17.53%. Even though the population has increased by 9, 06,371 in absolute numbers between 1991 and 2001, the growth rate has shown a definite down trend as compared to the decadal population growth rate of 20.59% between 1981 and 1991. Population figures for the state since 1951 are as per table 1.6 below:

Table 1.6: Population Growth and Density since 1952

Year	Population	Decadal Growth	Density per Km ²
1951	23,85,981	-	43
1961	28,12,463	17.87	51
1971	34,60,434	23.04	62
1981	42,80,818	23.71	77
1991	51,70,877	20.79	93
2001	60,77,248	17.53	109

Himachal Pradesh has the highest percentage of rural population (90.21%) in the country residing in more than twenty thousand villages across the state. However, this population is concentrated in the middle and lower belts of the state with Hamirpur district having the highest population density of 369 per km². On the other hand the districts of Lahaul & Spiti and Kinnaur have a population density of a mere two and thirteen per km² respectively. The growth of the urban population in the State has, however, been more than the growth of rural population and has increased by more than 1% over the last decade.

The sex ratio in the State is 970 females per thousand males and the literacy rate stands at 77.13% with the literacy rate for males being 86.02% and for females 68.08%.

The major sociological population groups in the state include the 'Rajputs and Brahmins', the 'Scheduled Tribes' and the 'Scheduled Castes'. The Rajputs and Brahmins own most of the agricultural land and form the most affluent and influential social group in the village community. The Scheduled Castes in the state are believed to be 'aborigines of the hills' and have traditionally been dependent upon vocations such as cobblery, carpentry, black smithy, tailoring, basket weaving and so on. Only recently, some of the Scheduled Castes have taken to agriculture after allotment of land to them under the state's 'Nautor' policy. The Scheduled Tribes include the *gaddis*, the *gujjars* and the *bhots* and their main concentration is in the districts of Sirmour,

Chamba, Kinnaur and Lahaul & Spiti. The tribal communities are mainly engaged in animal husbandry with many of them practicing migratory grazing. The very nature of their vocation has contributed to the lower literacy rate in these communities.

1.3.5 Livelihoods:

The predominantly rural population of the state is primarily dependent on agriculture based economy for livelihood. Almost every family owns land and is engaged in agriculture, horticulture and/ or raising of cash crops like vegetables and flowers. The state has over the years gained prominence as the Orchard State of the country and for growing off-season vegetables and floriculture. However, the average land holding is small, less than hectare per family, and the fields are too small to lend themselves to mechanization. Moreover, most of the agriculture is of subsistence type and depends upon the climatic conditions for good yield. All these conditions make the agriculture-based economy inadequate to fulfill the total livelihood requirements of the majority of the families.

Animal husbandry is another important vocation for the people of the state. Almost every family rears livestock for their day to day requirements, for agricultural purposes and for cash income. The state has a cattle population matching that of the human population. With small land holdings, it is not possible to set aside agriculture land for raising fodder crops and, therefore, the livestock is mainly dependent upon the natural resources, mainly forests, for sustenance. Buffaloes, sheep and goats kept by the tribal communities of the state are traditionally subjected to transhumance every year for sustenance.

The economically vulnerable groups including the scheduled tribes and the schedule castes have high dependence on the forest resources. Collection and trade of forest produce, mainly the high value temperate medicinal plants forms an important vocation providing cash income to these rural communities. In many of the rural areas, the entire household is engaged in the collection of medicinal plants. Tandon (1996) has estimated that an average of Rs. 14,000/- per household is earned from this vocation every year. However, most of the forest produce is traded in raw form to the local traders fetching a price for the villagers barely equal to the minimum daily wages. People are also dependent on the forests for their fuel wood, timber and fodder requirements.

1.3.6 State Domestic Product:

State Domestic Product (S.D.P.) or state income is the most important indicator for measuring the economic growth of the state. According to the estimates, the total state domestic product at 1993 prices increased to Rs. 9879 crore in 2004-05 from Rs 9185 crore in 2003-04, thereby registering a growth of 7.6% at constant prices. The total state domestic product of the Pradesh at current prices is estimated at Rs 20093 crore in 2004-05 as against Rs 18062 crore in 2003-04, thereby registering an increase of 11.2 percent.

Gross State Domestic Product

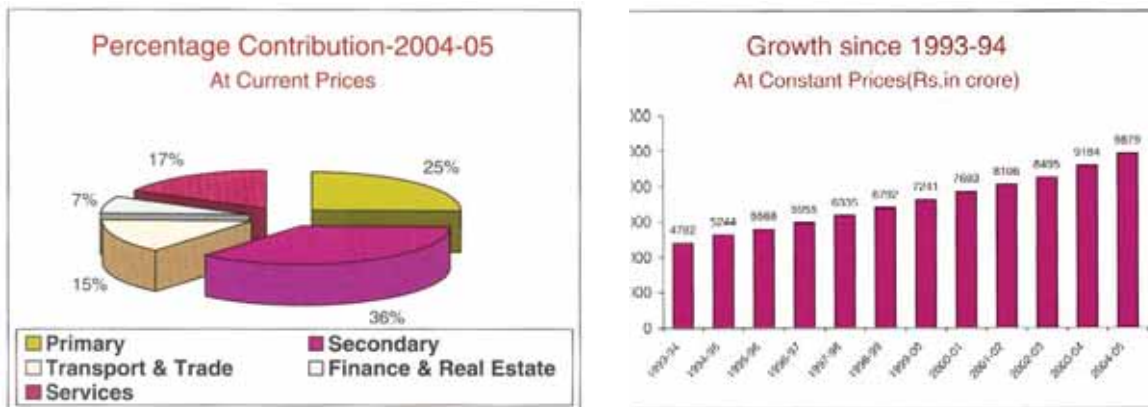


Fig. 1.2
[Source: Economic Survey of H.P.]

1.3.7 Per Capita Income:

According to the quick estimates based on 1993-94 series, the per capita income of Himachal Pradesh at current prices in 2004-05 stood at 27486. This shows an increase of 9.7 % over 2003-04 (Rs 25059).

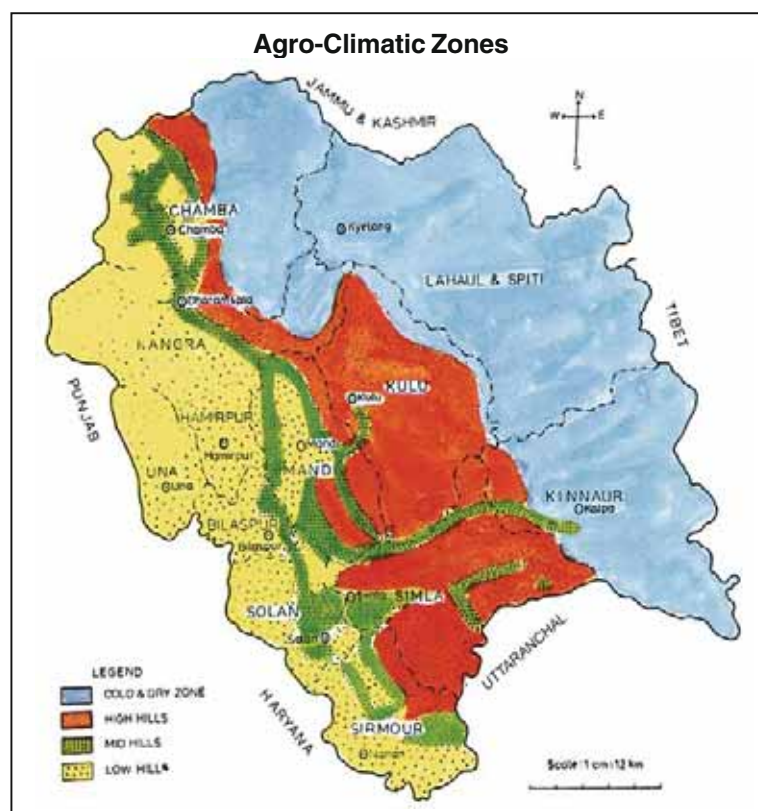
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AGRICULTURE AND ENVIRONMENT

Chapter 2a

Agriculture and Environment

Agriculture is the largest occupation and source of livelihood to most people in Himachal Pradesh, about 66.71% of the total population. The topography of the state is largely hills where cultivation is mainly done on terraces. The cultivation in hills is subjected to soil erosion since crop cultivation is practised on 5% to over 30% slopes. This also affects soil fertility status and changes in pH values as well. Cultivation is mainly (80.9%) rain dependent. The size of holdings of less than one or one hectare covers 61.5% farming community. The small and marginal farmers put together account for 82.1% and cover an area of 43%. The medium farmers with holdings ranging from two hectare to ten hectare cover an area of 47.2%. Approximately 80% of all holdings fall in the category of small and marginal farmers. The agricultural work force is 34.41% of the total population, of which 63.25% are cultivators. The ratio of agricultural labourers to total workers forms only 2.66% as per 1991 census.



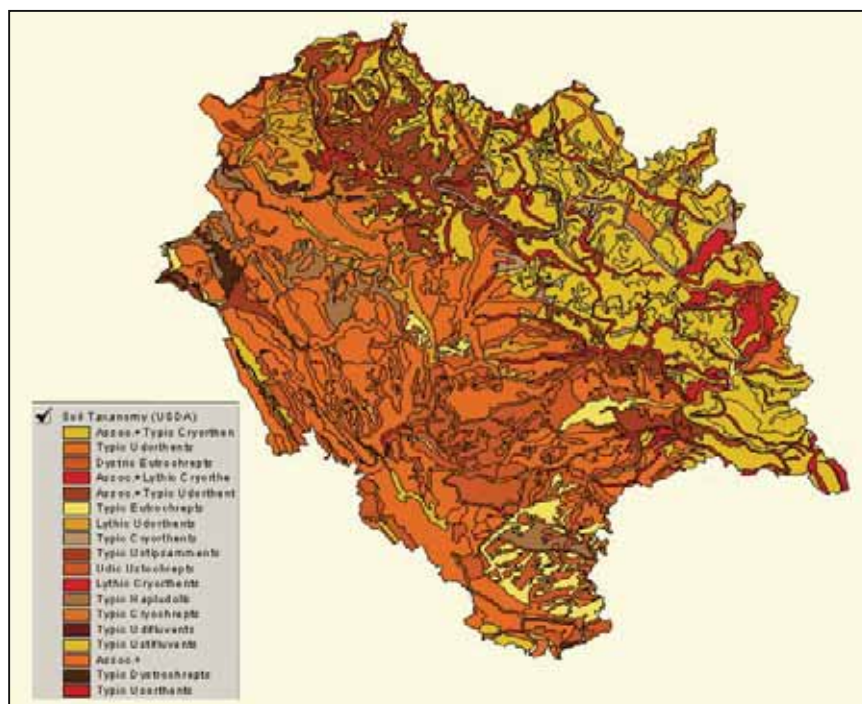
Map 1.7 Agro-Climatic Zones

[Source: Department of Agriculture]

2.1 State:

The State of Himachal Pradesh is constituted of ten agro-ecological zones. This indicates a vast potential for growing diverse crop plant species. There are (i) highly fertile valleys intercepting hills

and mountains, (ii) subtropical sub mountainous hill areas, (iii) mid hills, (iv) high hills with high rainfall, (v) high hills with scanty rainfall, and (vi) cold desert high mountains. In high hills characterized by temperate climate, the crops are grown mainly in the summer months. This offers opportunities for growing cash crops such as vegetables in off-season for supply to markets in the plains areas. Moreover temperate vegetables and fruits can be other options of growing.



Map 1.8 Soil Layer Map

[Source : Water Resources Management for H.P.]

In Himachal Pradesh, the net cultivated area is only 17.2% of the total area. The cropping intensity is 170.9% in 2000-2001 period. New opportunities emerging for cultivation include flowers, medicinal and aromatic plants and new fruits like kiwi and hazel nut.

In the past, diversity in agriculture had been such that it fitted well in the prevailing agro-ecological conditions. For instance, cultivation, of crops and varieties with good tolerance of drought conditions in the rain fed agriculture ensured minimum production levels. Truly these were low yielding but were tolerant to particular soil conditions, insect-pest incidences, disease epidemics and climatic adversities and thus were rare complete crop failures.

At presently, high yielding varieties demand high input, better crop protection and good agronomic management to deliver in accordance with their potential. Moreover, some crops or varieties not finding favour with the changed life style of people have gone out of cultivation. The agriculture in hills is and will remain the mainstay of 66.7% of people in the years to come. The challenges in agriculture to meet food demands and increase livelihood scope to people have raised several issues.

Soil Unit	Area (ha)	Description
1.	213.9 (3.8)	Rock outcrops covered with glaciers associated with shallow excessively drained sandy - skeletal soils with sandy surface, severe erosion and strong stoniness Lythic Cryorthents.
2.	29.3 (0.5)	Shallow E3 excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness; Lythic Cryorthents associated with rock outcrops.
3.	16.0 (0.3)	Shallow excessively drained loamy - skeletal calcareous soils very steep slopes with loamy surface, severe erosion and moderate stoniness; Lythic Cryorthents Associated with Rock outcrops.
4.	24.7 (0.4)	Rock outcrops and valley glaciers associated with shallow excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness Lythic Cryorthents.
5.	174.8 (3.1)	Mountain and valley glaciers and rock outcrops associated with medium deep excessively drained sandy - skeletal soils very steep slopes with sandy surface, severe erosion and moderate stoniness. Typic Cryorthents.
6.	235.6 (4.2)	Rock outcrops associated with medium deep excessively drained loamy - skeletal calcareous soils very steep slopes with loamy surface, severe erosion and moderate stoniness. Typic Cryorthents.
7.	340.1 (6.1)	Rock outcrops associated with shallow excessively drained loamy - skeletal soils very - steep slopes with loamy surface, severe erosion and moderate stoniness. Typic Cryorthents.
8.	450.2 (8.1)	Rock outcrops associated with medium deep excessively drained loamy - skeletal calcareous soil steep slopes with loamy surface, severe erosion and strong stoniness. Typic Cryorthents.
9.	299.8 (5.4)	Rock outcrops associated with deep well drained mesic loamy-skeletal soils very steep slopes with loamy surface, severe erosion and strong stoniness. Typic Udorthents.
10.	97.2 (1.7)	Rock outcrops associated with shallow somewhat excessively drained coarse-loamy calcareous soils steep slopes with loamy surface, severe erosion and strong stoniness. Lythic Cryorthents.

2.2 Major Challenge in H.P. Agriculture:

Agriculture in the State of Himachal Pradesh though it has made good headway yet faces several challenges in the absence of scientifically sound policy guidelines since 1948 onwards when the state had its own Department of Agriculture. For instance the workers of the agriculture department laid much stress on using high yielding varieties (HYVs) and use of fertilizers and pesticides resulting in loss of area under crops like gram, mash, bean, mung, horse gram (Kultha) etc. and highly drought resistant crop varieties such as Rohru dhan, Ridley wheat and there was significant reduction in diversity at crop and variety levels. The major challenges in agriculture are discussed below.

2.2.1 Pressures:

(a) Land Fragmentation and Size of Holdings Leading to Unremunerative Agriculture:

Agriculture has an important place in the economy of state being the single largest industry, and as main occupation of people. According to the Economic Survey Report it provides direct employment to 69% of the total workers of the state. About 20.1% of the total Gross State Domestic Product (GSDP) comes from agriculture and its allied sectors. The average holding size in the state is 1.2 hectare. The Agricultural Census Report of 1995-96 reveals that 84.5% of the total holdings are of small and marginal farmers. About 14.9% of holdings are owned by medium farmers and only 0.6% are large farmers.

Table 2.7: Distribution of Land Holdings

Size of Holdings (ha)	Category of Farmers	% of Holdings	% Area of Holdings	Average Size of Holding (ha)
Below 1.0	Marginal	64.4	23.0	0.4
1.0 to 2.0	Small	20.1	24.1	1.4
2.0 to 4.0	Semi Medium	11.0	25.6	2.7
4.0 to 10.0	Medium	3.9	19.5	5.7
Above 10.0	Large	0.6	7.8	15.6

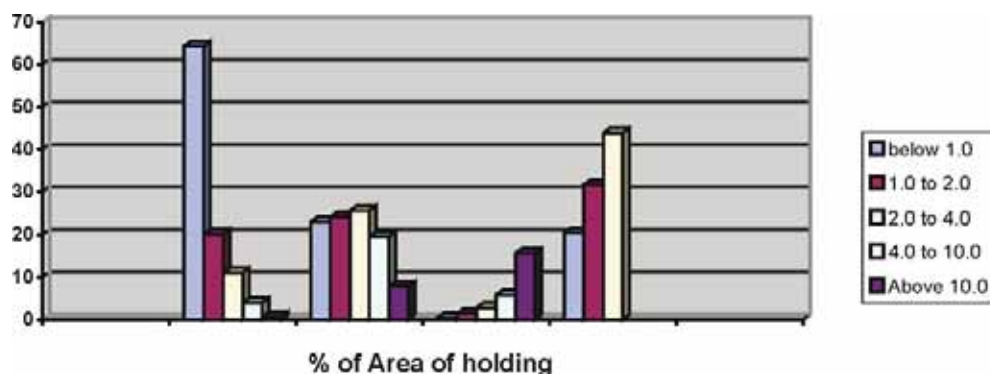


Fig. 1.3 Distributions of Land Holdings

The small holdings have become non-profitable due to high input costs in the present situation. This is because holdings of less than one hectare account for more than half (64.5%) of the total. This is driving away rural people to search for alternate occupations. The problem will be further aggravated owing to progressive fragmentation of holdings on the basis of the law of inheritance in operation.

(b) Agriculture as Constrained Source of Livelihood:

Hill agriculture is under serious threat as source of livelihood to the rural community until and unless it is backed up by a scientifically designed strategic policy frame work. As stated earlier

69% of the total working force of the state gets direct employment in agriculture, hence there is urgency to give a serious thought to this large chunk of people in order to provide the necessary boost to the economy of the state.

In economic transitional phase, the society is also undergoing changes. Joint family systems are becoming nuclear families and consequently working hands in agriculture are severely reduced. The size of holdings are small and modern high input agricultural technologies create economic stress on cultivators. This is more so when the needs of farming families cross the subsistence boundary and require them to have money to spend on children's education, clothing, health care, and other amenities such as TV, radio, telephone and fridge etc. Furthermore, vagaries of weather sometimes cause lower production, and market unremunerative prices increase the desperation of farmers. The percentage of people below the poverty level varies from 19 to 61.7 in different districts, the highest being in Chamba and lowest in Una and Kullu. The average poverty level for the state is 27.6% according to a survey report of 1998-99.

(c) No Systematic Resource Survey and Planning in Agriculture:

The development in the agricultural sector requires a systematic resource survey followed by planning all over the state. This should have been the first step to leap forward. This required knowledge of soil type, soil fertility, slope condition, water availability for irrigation, areas afflicted by severe frosts, floods weather conditions, occurrence of wild relatives of crops, hill aspect, crops well suited and vegetation type. Lacking resource knowledge in a particular area it is difficult to plan for profitable agriculture. Market access or market facilities also become an important factor to fetch better prices of agricultural produce. In a certain year, a good tomato crop was raised in Mandi in and around Rewalsar, but they could not find a market for the produce. There was no proper planning, hence farmers ultimately suffered losses.

People Concern

It was highlighted during the meetings organized at district level that traditional crops like Til, Black grams, Cotton, pulses, Kathi, Kodra and desi masur etc. were grown in the region but now these are not grown in the region. The traditional variety of wheat, maize and paddy is being replaced by hybrid varieties. It was pointed out that the traditional varieties of the crops were tolerant to the diseases as well as to pests. The hybrid varieties are not tolerant to the diseases and require a massive amount of pesticides to grow healthy crops. The black paddy which was grown earlier was very tolerant to the diseases whereas the hybrid replacement needs a good amount of pesticides.

2.2.2 Impacts:

2.2.2.1 Loss of Agro-biodiversity and Narrow Crop base:

The transition of traditional agriculture to modern in the absence of suitable policy guidelines has caused severe erosion of genetic resources in the past couple of years. Some crops have become rare or even completely gone out of cultivation. Similarly a large number of crop land races has

been lost on account of their replacement by high yielding varieties (HYVs). Some crop plant species are under threat of becoming lost. The major features of these crops and varieties were their adaptation to soil, weather adversities and incidences of diseases and pests. The HYVs produce a good crop under favourable conditions but fail miserably if there are adversities of above mentioned types. Crops that have disappeared from the farmers' fields include *Eleusine coracana* (Marua, Mandal), *Setaria italica* (Kangani), *Panicum miliaceum* (Cheena) and other crops such as grain amaranth, grain chenopods, buckwheat, barley (Hulled and hull less) Kinnauri Matar, Kulth are under severe threat. Pulse production in the state has gone down (27% to 41%) to a great extent in recent past. The narrowing down of the crop base in agriculture may be suitable for commercial crops but it never insures human food and nutrition.

2.2.2.2 Shift in Cropping Patterns:

According to a report published in 2000, the field studies in districts of Bilaspur, Hamirpur, Kangra, Sirmour, Shimla and Solan reported that, with the provision of irrigation, there are clear cut shifts in the cropping pattern. The major shift is from cereal crops to vegetable crops. In addition to this, multiple cropping has been introduced in irrigated areas. This is evident from table 2.8.

Table 2.8: Seasonwise Shift in Cropping Patterns

S.No.	Traditional Crop	% area	Replacing Crop	% area	Trends in Shift
(a) Kharif Season					
1.	Maize	65	Vegetable	10	Area reduced to 55% in the mid hill zone.
2.	Paddy	20	Vegetable	5	Yield of paddy crop increased by about 75% to 100%
3.	Pulses	5	—	5	No change in area because these are generally grown under non-irrigated conditions
4.	Vegetables	5	Vegetable	18	Considerable increase in area Crops grown include tomato, beans, capsicum, aubergine, ginger.
5.	Cereals	5	Green forage	7	The increase in area was due and soybean to replacement of cereals again. The area under soybean has increased.
(b) Rabi Season					
1.	Wheat	75	Vegetables	10	Potato, peas, aubergine are becoming popular.
2.	Barley	8	Pea	3	Barley cultivation in traditional areas may be considerably reduced.

contd. ...

S.No.	Traditional Crop	% area	Replacing Crop	% area	Trends in Shift
3.	Rape seed and mustard	2	Toria	3	Small increase in area may further rise as a catch crop.
4.	Vegetables	3	Vegetables	18	The replacing crops are mainly due to the rise in area under cabbage, cauliflower, radish and peas.
5.	Gram and Lentil	8	Gram and lentil	2	Area decreasing
6.	Fodder Berseem	4	Fodder Berseem	6	Area is increasing because pastures abandoned.

The replacing crops are generally cash crops and have become a predominant factor in small farm management to earn cash in order to meet their input requirements and family money needs. However in certain situations this trend may be detrimental to meet food demands.

2.2.2.3 Heavy Reliance on Higher Energy Input:

The advanced countries are already facing uneconomical energy input in agriculture. Something similar is happening here. There is an increase in the crossbred bull population to the extent of 84.6%, whereas the indigenous bull population declined by 22%. The crossbred bulls are unsuitable for use as draught animals for ploughing. There is evidently little preference for the use of draught cattle where it is possible to hire and to use tractor for land preparation and crop sowing. The use of higher energy in agriculture is on the rise. It is mainly in the form of tractors, diesel pumping sets electric pumping sets and threshers. Table 2.9 depicts the situation about rise in the number of energy input implements.

Table 2.9: Energy based Agricultural Implements

S.No.	Implement type	Number		
		1982	1987	1992
1.	Bullock carts	3403	4722	1128
2.	Cane crushers	2961	1413	1878
3.	Tractors	936	1319	3466
4.	Oil engines	1177	2358	1299
5.	Electric Pump sets	585	934	1222
6.	Threshers	—	—	19221

The census data reveals that the population of bullocks has declined to 7, 26,467 in 1992 from 8, 15,753 in 1987. On the other hand the number of tractors has increased four times from 1000 in 1987 to 4000 in 1997.

2.2.2.4 Rainfed Nature of Agriculture:

Rainfall is a crucial factor for the success of crop production. In Himachal Pradesh 81.3% of the area is still not irrigated and is totally rain dependent. The abnormal pattern of rainfall over the past few years has caused great fluctuations in crop production.

Table 2.10: Foodgrain Production (in 000 tonnes)

Crop	1999-2000	2000-2001	2001-2002	2002-2003
Rice	120.37	124.89	137.42	85.65
Maize	681.42	683.64	768.20	479.21
Ragi	4.44	4.16	4.69	4.05
Wheat	583.30	251.32	637.32	495.56
Barley	32.50	21.41	34.68	30.61
Gram	1.53	1.49	1.11	1.01
Other Pulses	15.17	18.15	9.45	7.92
Food grain				
Total	1446.14	1112.12	1598.92	1110.86

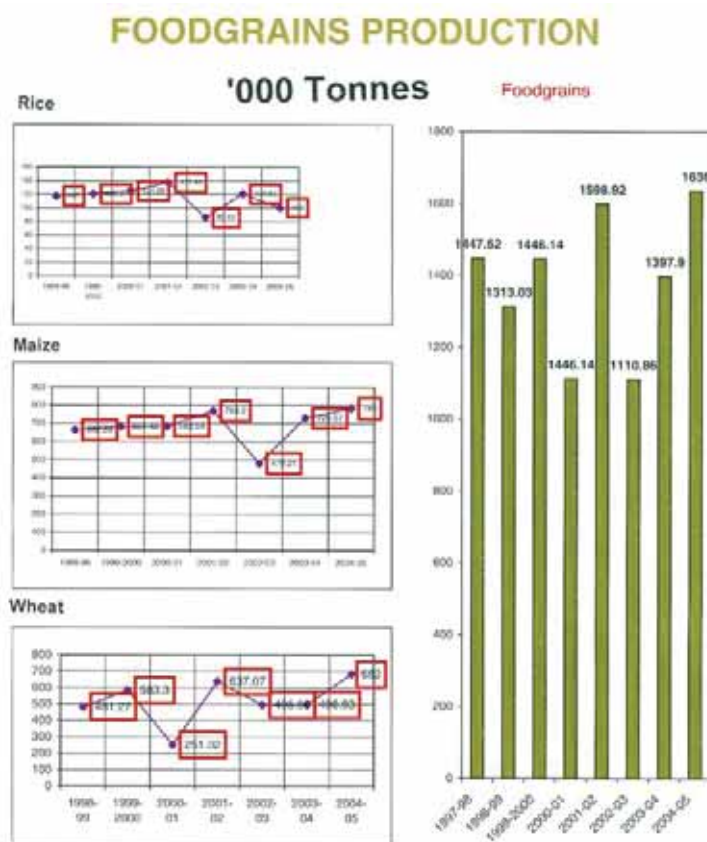


Fig. 1.4. Foodgrain Production

The performance of crops is directly related to rainfall received during the crop season. The rainfall has shown variation in different districts, in some it was in excess whereas in others deficient.

Table 2.11: Average Rainfall in different Districts (in millimeters)

S.No.	District	1999	2000	2001	2002	2003
1.	Bilaspur	1469.2	894.1	1083.3	1049.9	1069.1
2.	Chamba	2223.1	1414.2	936.5	1269.7	1969.6
3.	Hamirpur	1273.3	1320.7	1314.0	1104.6	1292.0
4.	Kangra	1905.6	1353.4	1818.4	1101.5	1679.4
5.	Kinnaur	412.6	548.5	432.6	742.2	239.6
6.	Kullu	1272.2	1088.0	922.0	733.4	947.8
7.	Lahaul-Spiti	467.6	484.8	336.1	382.8	554.4
8.	Mandi	1958.3	1397.6	1471.0	1083.5	1476.8
9.	Shimla	842.3	907.6	761.8	1103.2	977.1
10.	Sirmour	1394.4	1217.6	1351.1	1187.9	1356.5
11.	Solan	1182.9	937.4	856.5	908.9	856.7
12.	Una	1009.6	869.6	1446.7	1345.2	1661.1
	Average for H.P.	1277.6	1052.4	1067.5	984.8	1,131.7



Map 1.9 Rain Gauge Location Map

The cultivated area in HP is 5.83 lakh hectares of which 98000 hectares are irrigated which is about 22.6%. Of this 7.14% is irrigated by canals, 7.14% by tube wells and 85.71% by other sources like kuhls, check dams and lift irrigation. The change from rainfall to irrigated conditions is required to insure employment, livelihood and food security in the state.

2.2.2.5 Indiscriminate Use of Chemicals in Agriculture

Widely used chemicals in agriculture include chemical fertilizers (NPK), chemical pesticides, fungicides, and herbicides or weedicides. These are playing havoc because of their indiscriminate use, excessive quantities and substandard quality or quantity. For pesticides, toxicity level is hardly taken care of. Substandard fungicides and pesticides are on sale because of their cheap rates and are used by farmers in large amounts.

The use of fertilizers has increased production in the state to a great extent since the late fifties and early sixties when fertilizer use was introduced to Himachal Pradesh. Then onwards the use of fertilizers has been constantly increasing. The consumption of fertilizers in 1985-86 was 23,664 tonnes increased to 46,808 tonnes in 2003-04. That is, the consumption has almost doubled. The trend in the use of fertilizers is depicted in the table below.

Table 2.12: Consumption of Fertilizers (in metric tonnes)

Year	Nitrogenous	Phosphorus	Potash	Total
	N	P	K	NPK
1997-98	27002	4382	3468	34852
1998-99	29140	5219	4198	38557
1999-2000	27593	5762	3988	37343
2000-01	24418	6540	4594	35552
2001-02	27503	7043	5610	40156
2002-03	25645	7916	6160	39721
2003-04	30909	8706	7193	46808

Regarding the use of fertilizers, three serious concerns have been brought out. These are (i) unbalanced use, (ii) excessive use of urea or other nitrogenous fertilizers, and (iii) reduced application of FYM. Report on input survey 1991-92 revealed that urea was the most widely used nitrogenous fertilizer in respect of nonirrigated areas in the state and it is same situation in irrigated lands. Thus, urea is used to the maximum by all types of farmers irrespective of their holding sizes. Super Phosphate is used in small area and potash sources are rarely used, though fertilizer mixture (15N:15P:15k) is used on about 20% of the area yet the users were mainly marginal and small farmers under both irrigated and rain fed conditions of farming. Table 2.12 clearly shows the excessive use of nitrogenous fertilizers being almost three times than more phosphorus and potash fertilizers.

In comparison to fertilizers, the use of FYM or compost organic manures is progressively decreasing because of the fact that service class farmers having nucleus families are hardly engaged in rearing cattle or domestic animals.

Table 2.13: Consumption of Pesticides

Year	Quantity of Pesticides (M.T)
1977-78	50.63
1990-91	97.50
1995-96	260.00

The use of pesticides has shown a sharp rise particularly in vegetable crops. There is also more use of herbicides or weedicides. The use of pesticides brings in two concerns (i) Sub standard or outdated pesticides act as booster and not as killer and (ii) Toxic residual effects remain unnoticed.

2.2.2.6 Threat from Rogue Plants and Animals Damaging Crops:

In recent years, crop growing has faced a serious, threat from rogues. These are *Ageratum conyzoides* (Neela Phulnu), *Parthenium hysterophorus* (Congress Grass) among plants and wild boar, monkeys among animals. Their populations have increased tremendously but no data has been available on them. Their control is at present difficult.

2.2.2.7 Large Gaps in Research Achievements:

The present scenario in agricultural research is not presenting a satisfactory picture, since there remain large gaps in the experimental and farmer's field yields as shown below.

Table 2.14: Yield Gap Analysis

Crop	Yield in q		
	Research Plots	Farmers Plots	State Average
Maize	53.6	35.3	20.5
Wheat	35.9	33.0	14.7
Paddy	56.2	51.0	12.5
Black gram	10.5	7.8	3.7
Sesame	7.5	6.4	1.2
Rapeseed & Mustard	13.0	9.3	2.7
Linseed	11.0	9.5	3.2

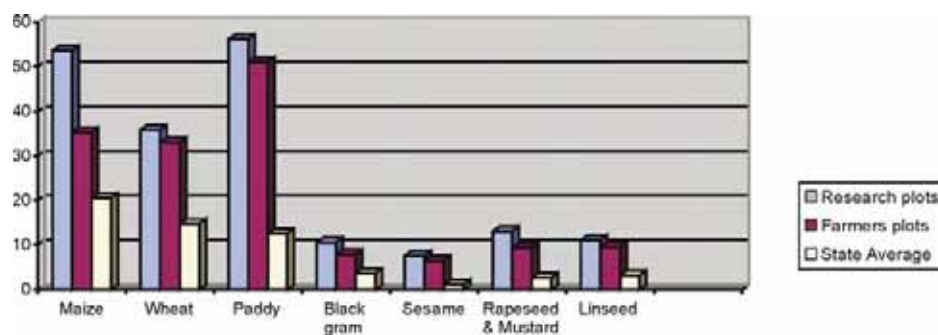


Fig. 1.5 Yield Gap Analysis

Another important point to be noted is that the research farms use high inputs and there are hardly any serious attempts to evolve crop varieties suited to rain fed or drought prone areas which is at present not less than 80%. Moreover there is a need to regulate the seed supply of high yielding varieties and the quality standards must be strictly enforced so that farmers do not

suffer, Research thrusts have since been confined to major crops, thus millet and pseudocereals are under threat of loss.

2.2.2.8 Untapped Potential of Varied Agro-ecological Sub Zones:

The State of Himachal has been divided into ten agro-ecological zones by the National Bureau of Soil Survey and Land use planning (NBSSLUP, Nagpur) on the basis of data on rainfall, temperature, Soil characteristics and available crop duration. These sub zones offer ample opportunities to plan for growing cereal crops, millets, pseudo cereals, pulses, oil seeds, vegetables, flowers, fruits, nuts, medicinal and aromatic plants. Condiments like ginger, turmeric, Onion, garlic, red chillies etc. are another group of plants which hold promise. Specialty crops such as tea, kala jira, hops, Stevia, Saffron etc. also need special efforts if small and marginal farmers have to continue to earn their livelihood from farming.

2.2.2.9 Unexploited Organic Farm Produce:

Himachal hills hold a vast potential for pursuing organic farming in the years to come. Still there is a vast area where fertilizers are not easily available or where farmers prefer to use FYM only on account of the cost factor. In hills where cultivation is done on terraces below large forests, the leaf humus is carried by the rainwater to the fields and this natural process occurs uninterruptedly enriching the land with humus. The growing demand for organic fruits, vegetables and medicines opens up new avenues of production and marketing for farmers in these Himalayan hills. These may even find market in countries abroad. However lot of research and policy level effort is needed for its success. This may have to be linked to the eco-friendly tourism concept by encouraging people to serve local organic produce in fresh bracing climate for health.

People Concern

Lanatan, Ageratum, Congress grass is overpowering the traditional grasses and vegetation in the lower regions of the State. Due to this not only fodder problem is arising but these weeds are also source of the diseases such as allergies and respiratory problems. These are even harmful for wild animal habitations.

2.2.2.10 Problematic Market Access:

The hill farmers are generally very hard working and can achieve results if given correct training. However, the biggest deterrent has been the problems of access to the market for getting remunerative prices for their farm produce. The farmers are exploited by wholesale traders who take advantage of their limited capacity to hold small quantities of produce and their pressing need for cash soon after the farm harvest. There remains a large gap between the produce procurement price and the consumer price.

2.2.2.11 Lopsided Policy Issues:

Policy framework of a state act is the major guiding factor to affect necessary infrastructure changes leading to the prosperity of people. Agriculture in the state of Himachal Pradesh has

been subjected to lopsided policy issues since the inception of an independent agriculture department. This is reflected in laying more stress on use of chemical fertilizers without making substantial efforts in developing irrigation means. Many subsistence crops are today facing the threat of extinction. These are Kangani, Mandua, Cheena, grain amaranth, grain chenopod, buckwheat, naked barley, indigenous dal matar, gram, black gram and kultha. This is because neither were efforts made to support them price were nor could their supply be regulated through a public distribution system (PDS). Moreover unlike other states where these do not grow, the research support to their production and consumption is still poor. From sustainable food production and livelihood point of view, the mixed farming and mixed cropping is advantageous in comparison with the raising of pure crop stands. However, the recent trend from the government is in favour of pure crop stands which may be useful to the commercial crop growing but not to a sustainable food supply.

2.2.2.12 Inadequacy of Soil and Water Conservation Programmes:

Agriculture in the Himachal hills is practised on 5% to over 30% slopes coupled with heavy rainfall resulting in severe soil erosion. Almost all areas in the state are subject to sheet erosion but the foothills and valleys are subject to the formation of severe gullies. The upper fertile soil is drained away and the underlying layers slowly become unfit for cultivation. The intensity of soil erosion ranges from 14.7% to 24%.

The least effort has been made so far to conserve of water in streams, rivers or rivulets. Inundation of forest areas and lack of vegetation cover in catchment areas is increasing the problems of low productivity of soils as well as observation of natural water sources.

2.2.2.13 Environmental Issues in Agriculture:

Ecological imbalance caused by faulty human interventions leads directly to the destruction of the production base and living environment. The environmental concerns in the field of agriculture are mainly due to conversion of forest lands to agricultural lands; rivers, rivulets and streams erode the adjoining agricultural lands; on sloping lands runoff water, if unchecked, causes shortage of ground water sources; application of chemical pesticides pollutes water and fresh harvests, and there occurs inadvertent introduction of new weeds as admixtures which may be harmful to animal or human health.

Pesticides cause pollution at two levels, firstly during handling, storage and application in the field, secondly at the stage of produce processing. One major source of pollution is the residual effect in vegetables and grains. Some pesticides are washed by rainwater and then enter subsurface water. If milch or meat animals are fed by the polluted fodder it may gain entry into the human body when their milk or meat is consumed.

2.3 Emerging Trends in Agriculture:

Indian agriculture in general and hill agriculture in particular has undergone a big transformation in over the past five decades. Conspicuous changes have occurred in cropping patterns, fruit

orchards have replaced traditional cereal farming and the cultivation of cash crops gained lot of significance and so on. The bullock cultivation is being replaced by the use of tractor cultivation. Threshing of crop harvests, in traditional agriculture, was a tedious job involving several days hard work, now it has been much facilitated and the duration reduced. Usage of chemical fertilizers, pesticides, herbicides, hormones etc. has gone very high. Many old crops and traditional varieties have been replaced. New crops are being used to diversify crop cultivation. Mixed farming is also changing in character. Mixed cropping is fading away. Inputs have increased to a great extent which are causing a financial burden on small and marginal farmers. Farmers have become more conscious about using the available water resources of which earlier they were ignorant. It is, therefore, pertinent to look into them critically.

2.3.1 Replacement of Traditional Crop Germplasm by High Yielding Varieties:

Modernization of agriculture has changed the crop wealth. Crop germplasm diversity is comprised of:

- (i) Obsolete varieties, land races and phased out varieties, and
- (ii) Crop plant species in cereals, pulses, oil seeds, pseudo cereals, millets, vegetables, spices and condiments and diversity in agro-ecological zones and subzones.

Traditional cultivation was rich in germplasm because food and nutritional security in agriculture is directly related to diversity of crops and varieties. However, the modernization process in agriculture has changed the nature of traditional agriculture. For the past many years, there has been emphasis on the use of high yielding varieties (HYVs) only in cereal crops, and drought hardy but less palatable crops have been ignored. In many areas these are no longer found in cultivation and the new generation is unaware of their utility in cultivation for food. The HYVs in general, are designed to respond to good agronomic packages and high input whereas the traditional crop varieties had the ability to adapt to poor agronomic condition and low input. The latter always produced harvestable crops in spite of all adversities. The HYVs produce high yields under favourable conditions but fail miserably under unfavourable conditions.

2.3.2 Research Thrusts and Government Support Confined to Major Food Crops:

A wide food base is the key to food and nutritional security. This principle is not being followed in planning research programmes. Moreover, the government policy on providing the support price is limited to major food crop. Crops adapted to poor fertile soils and tolerant to moisture stress were widely prevalent in hilly areas of the Himalaya. These include millet such as *Eleusine coracana* (ragi, Mandua), *Setaria italica* (Koni, Kangani), *Panicum miliaceum* (cheena), *Paspalum scrobiculatum* (Kodo,



Amaranth

Courtesy: NBPGR Phagli, Shimla

Kodra) and pseudo-cereals like grain chenopod, grain amaranth, buckwheat (phaphra, ogal). These crops were consumed largely in the hills. Grain amaranth is rich in the essential amino acid Lysine which in maize is causing deficiency disease in high maize consuming areas. These crops have usually received less attention of the research scientists as well as having government's apathy; consequently they are fading away in modern agriculture. Their nutritional significance is given in the table below.

Table 2.15: Average Composition of Pseudo-Cereals in Composition to Major Cereals (1100g) Source USDA Data

Name of crop	Food energy (kcal)	Moisture %	Protein (g)	Carbo-hydrate (mg)	Fat (g)	Ca (mg)	Iron	P (mg)
Buckwheat	335	11.0	13.5	7.4	72.9	114	13.2	282
Amaranth (grains)	391	9.3	15.3	7.1	63.1	490	22.4	453
Maize	385	12.0	9.2	3.9	73.7	20	-	256
Rye	334	11.0	12.1	1.7	73.4	38	-	376
Wheat	333	12.0	13.3	2.0	71.0	41	10.5	372

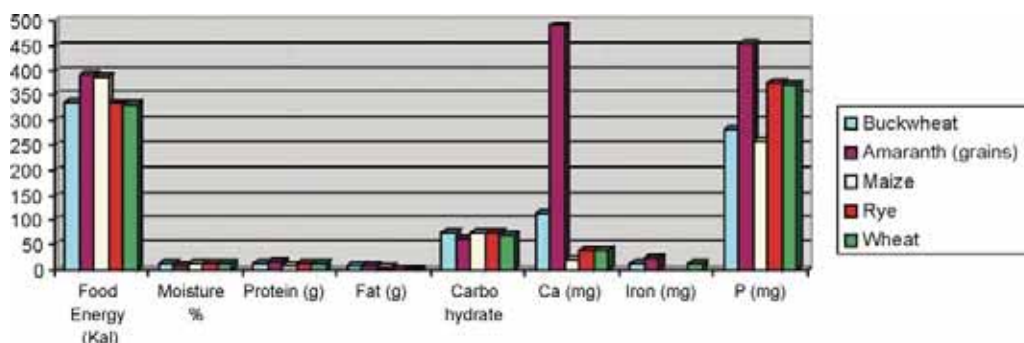


Fig. 1.6 Average Composition of Pseudo-Cereals

For balanced human growth and health, at least 45 chemical compounds and elements are believed to be needed. Each of these essential nutrients is believed to be needed to be present in diets. The absence of any of these leads to illness and eventually to death. No single food offers all 45 nutrients.

2.3.3 High Input Modern Agriculture:

The practices of modern agriculture related to crop growing are becoming increasingly high input. The cost of crop production has risen tremendously in recent years. These inputs include cost of seed, cost of pesticides, cost of fertilizers and herbicides or weedicides, wages for labourers, cost for use of tractor for field preparation if bullocks are not used, and cost of crop threshing by threshers. In traditional agriculture, own seed was used but in the modern agriculture, hybrid seeds have to be purchased, also new crop varieties are being introduced at short intervals and

farmers incur high costs on them. For instance the cost of a daily paid labourer increased from Rs. 34.78 in 1993-94 to Rs. 80.91 in 2000-2001.

2.3.4 Energy Inputs Rising in Crop Growing:

The modernization of agriculture has increased the energy input to a great extent. This has happened mainly because the joint family system in rural areas is fast breaking into the nucleus family system. Consequently the working hands from the family are much reduced. This has two repercussions, firstly rearing of bullocks for agriculture is becoming increasingly difficult and secondly, the land holding size is being reduced to uneconomic levels, that is, it is reduced to small marginal farm lands. It is also resulting in using tractors for cultivation. Over the last five decades, the energy input in the form of tractor cultivation, tube well irrigation, use of crop threshers, diesel engines or electric engines and power sprayer's seed sowing drills. has increased manifold. The data on energy input in agriculture in Himachal, lacking. However the following data present the trend in a broad sense.

Table 2.16: Number of Agricultural Implements Using Any Form of Energy

Type of Implement	Agricultural Census			
	1982	1987	1992	2001
1. Plough	6,23,761	7,99,207	7,10,349	5,25,973
2. Bullock carts	3,403	4,722	1,128	1,128
3. Cane crushers	2,961	1,413	1,878	1,361
4. Tractors	936	1,319	3,466	2,565
5. Power oper threshers	-	-	19,221	15,660
6. Combine harvester	-	-	-	334
7. Maize sheller	-	-	-	3,561
8. Reaper	-	-	-	3,933
9. Power op. sprayer/duster	-	-	-	1,791
10. Diesel engine pumpset	-	-	-	1,299
11. Electric pump set	-	-	-	1,222

2.3.5 Awareness on Cash Crop Growing:

Recently it is frequently found in almost all districts that awareness about the inclusion of cash crops in the prevalent cropping systems is rising. This is natural as the cash money has attracted the attention of most farmers in order to meet their liabilities for the family. The children's education, medical and health care, entertainment means (e.g. radio, TV, cassette player), Phone/Mobile, vehicles, clothes require cash money. Important cash crops in the Himachal hills are potato, tomato, capsicum, green pea, cabbage, cauliflower, ginger, red chillies, hops, tea, onion, garlic, taro, radish. In certain areas flower cultivation, especially for supply as cut flowers, is picking up fast. The growing of off season vegetables in certain areas is an attractive option. The cultivation of medicinal and aromatic plants is also receiving the attention of some farmers. Some of such

plants are kuth, pushkarmul, mentha, scented geranium, scented rose and stevia. Data on few cash crops are shown below.

Table 2.17: Production of some Cash Crops in Metric Tons

Crop	1996-97	1997-98	1998-99	1999-2000	2000-2001
Potato	1,49,416	1,22,653	1,53,303	1,82,543	1,91,645
Ginger	2373	2590	2631	3116	22600
Garlic	825	742	700	680	862
Total	1,52,614	1,25,985	1,56,634	1,86,339	2,15,107

2.3.6 Vanishing Traditional Mixed Cropping and Mixed Farming:

In traditional agriculture the predominance of mixed cropping and mixed farming was based on the principles of sustenance. Sustainable agriculture involved all features of mixed cropping and mixed farming. Mixed cropping may not be a suitable option for commercial farms but otherwise it is the use of resources to the best extent. For example, wheat plus gram was the common trend in the rabi season. Gram, being a legume, fixed nitrogen and benefited the wheat crop as well. Similarly maize and beans or cow pea enjoyed symbiotic relationships. Mixed farming denotes the inclusion of animal husbandry with crop husbandry, that is, crop growing farmers invariably reared domestic cattle, sheep, goats, pigs, poultry birds, honey bees and fish. This provided organic manure for fields and crop residues were utilized as feed. In recent years, farmers are adapting the components of mixed farming such as mushroom culture, apiculture and dairying to supplement the farm income.

2.3.7 Increasing Adoption of High Yielding Varieties (HYVs) and Hybrid (F1) Seeds:

The adoption of high yielding varieties has ushered in an era of food self sufficiency in the Himachal hills where earlier farmers suffered frequent food shortages. People are now well aware of HYVs seeds and generally keep track of new arrivals that are newly released varieties. Similarly F1 hybrid seeds are also attracting the attention of farmers. The hybrid of seeds several crops such as maize, aubergine, *Capsicum annuum*, cucumber and tomato are becoming popular. These hybrid seeds produce higher yields, and the quality of produce is far superior. Table 2.18 shows the trend of adoption of high yielding varieties in Himachal.

Table 2.18: Area under High Yielding Varieties ('000 ha.)

Year	Maize	Paddy	Wheat
1998-99	191.69	80.55	378.26
1999-2000	193.74	74.31	366.52
2000-01	219.68	73.83	329.77
2001-02	212.33	62.68	376.72
2002-03	192.10	64.73	313.23

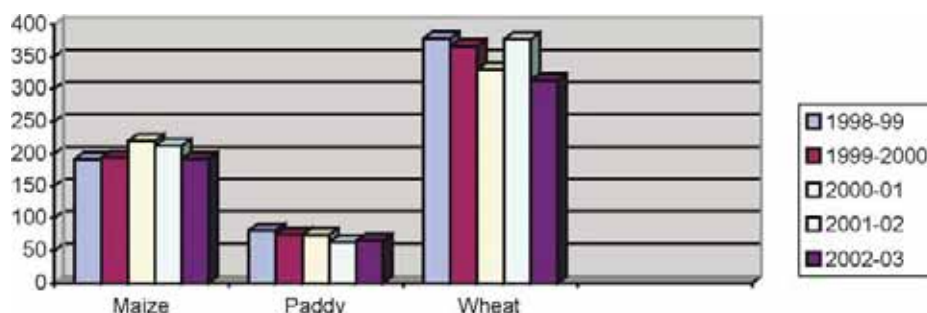


Fig. 1.7 Area Under High Yielding Varieties

2.3.8 Change in Traditional Cropping Patterns:

Traditional cropping patterns in Himachal comprised of a large number of crops, some of which were grown as pure stands whereas others were grown mixed with other crops. Besides main cereals (wheat, maize and paddy), these included small millets such as mandua, Kangani, cheena, Kodon, pseudocereals (grain amaranth, grain chenopod, buckwheat (ogal and phaphra), grain cannabis), among pulses (Kultha, spiti local pea) and naked barley. However, due to modernization of agriculture these crops are depleting fast from the cultivation and are being replaced by high value crops like green pod pea, cabbage, cauliflower, capsicum, tomato and potato. Recently some European temperate vegetables such as broccoli, celery, asparagus and red cabbage also have been introduced in the hills. The area under traditional crops has registered a change in which they are being replaced by high value crop species such as vegetables (off season), cut flowers (e.g. gladioli, carnation, alisteria) medicinal and aromatic plants (Kuth, Pushkarmul, Mentha, scented geranium, Tagetis minima). The general trend is shown in the table below.



French Bean
Courtesy: NBPGR
Phagli, Shimla

Table 2.19: Change in Area Under Traditional Cropping Patterns

Crop	1997-98	1998-99	1999-2000	2000-2001	% Change
Paddy	86,178	82,125	80,221	81,519	-5.41
Wheat	3,77,343	3,79,718	3,70,587	3,62,680	-3.89
Barley	27,693	57,752	25,901	25,643	-7.40
Maize	3,11,861	3,00,976	2,99,906	2,98,052	-4.43
Gram	2,379	1,908	1,691	1,403	-41.02
Green gram	396	362	342	288	-27.27
Masur	1,474	1,168	1,061	993	-32.63
Total Pulses	35,930	33,849	32,556	31,093	-13.47
Fruits	54,504	55,664	56,474	58,458	+7.25
Peas	4,589	4,845	5,046	5,510	+20.07
Dry fruits	1,025	1,124	1,248	1,449	+41.37
Vegetables (Aubergine, Tomato, Bhindi)	3,738	4,382	4,546	4,734	+26.64

The cropping intensity has risen to 191.9 percent in the district of Bilaspur closely followed by the district Hamirpur. It ranged from 103% to 191-9% for various districts during the period 2000-2001 as shown below.

Table 2.20: Cropping Intensity During the last Five Years

District	1996-97	1997-98	1998-99	1999-2000	2000-2001
Bilaspur	191.3	192.8	188.9	190.6	191.9
Chamba	140.8	156.5	168.2	152.1	146.5
Hamirpur	190.7	196.7	196.5	195.9	191.7
Kangra	182.7	186.9	187.7	187.3	184.0
Kinnaur	125.8	131.1	124.2	116.1	123.0
Kullu	177.6	172.4	167.0	157.3	179.7
Lahaul-Spiti	104.4	102.4	104.3	102.9	103.1
Mandi	172.6	179.6	187.8	188.3	183.3
Shimla	144.6	150.6	147.5	141.6	129.6
Sirmour	183.1	185.8	184.2	186.1	183.3
Solan	158.8	166.5	165.0	163.1	163.3
Una	179.3	186.7	179.7	176.2	172.3
State Avg.	170.6	176.0	176.6	173.5	170.9

2.3.9 Organic Farming viz-à-viz Traditional Hill Agriculture:

Organic farming has become the talk of the day especially in European and American countries having experienced the ills of chemicals in agriculture. Organic farming refers to agricultural production systems used to produce food and fibre organically. The system does not use chemical pesticides, weedicides and fertilizers. Traditionally hill agriculture was entirely organic in nature. It was only during the modernization phase of agriculture that farmers learnt the use of chemical fertilizers, pesticides and weedicides. In recent years, there is wide interest in organically produced foods in India. The hills of Himachal have become an important feeder of markets in the plains especially in respect of vegetables (Seasonal and off Season) and fruits. There is thus a need to revive the organic nature of farming in the hills.

2.3.10 Threatened Agro-forestry Components:

The agro-forestry systems traditionally were maintained in the hills for the supply of green fodder for domestic animals in lean winter months, fuel wood, fruits and timber wood as well. However in recent years in order to boost crop production to replace the cut trees the farming lands are becoming naked. There is a need to have a fresh look at this issue when the greenery of the Himachal hills is already in the red. A very common species, *Grewia optiva* (Biuhal) is thought a very useful agro forestry species in lower and mid hill elevations, as it is considered to cause allelopathic effects on crops growing underneath it.

2.3.11 Conversion of Agricultural Lands to Fruit Orchards:

During the early phase of development in Himachal Pradesh, much government level effort has gone into planting of fruit orchards at elevations beyond 2500 metres. The main fruits grown in Himachal hills include apple, pear, peach, apricot, plum, walnut, almond, mango, orange, Kiwi, pecan nut. The land under agricultural crops has been used to plant the orchards and so much so that in certain areas the crop cultivation is reduced to an insignificant level. This process has caused replacement of certain crops, namely grain amaranth, buckwheat, beans. There has been a continuous increase in the area under all kinds of fruits. The area under fruit orchards in 1970-71 was barely 44,329 hectares which increased to 1,95,684 hectares in 1995-96. the area under fruit cultivation was only 792 hectares in 1951-52. This area is expected to rise to 2.5 lakh hectares in 2004-05.

2.4 Major Causes of Decline in Agro-Eco Environment:

Recent years have witnessed wide protests about the decline of environment in the agro-ecological condition the world over. This has much significance with regard to human and animal health, because it has direct influence on life.

These influences may be noticed in terms of food and nutritional scarcity, residual toxicity in fruits, vegetables and grains, loss of certain widely adopted crop species and varieties, decline of organic matter in the soil, accumulation of harmful substances in the soil, entry of invasive weed species harmful to health decline in useful soil micro flora, destruction of useful pollution of surface and groundwater and presence of toxic substances in milk and other produce. All these concerns may generally be ascribed to the following major causes.

People Concerns

Destruction of crops by the Monkeys as well as by the Pigs because of ban on hunting and release of Monkeys by the authorities was highlighted during the district level meetings. The Monkeys are destroying many crops of the area and some of the farmers even preferred not to sow their fields because they get no returns. Similarly with the ban on hunting the population of pigs has increased manifolds and they are coming towards the fields and destroying the crops. It was highlighted that a policy in this regard is very essential.

2.4.1 Defective Policy Perceptions in Agriculture:

The process of modernization and development has proceeded in the absence of appropriate policy perceptions at least in the field of agriculture. The glaring example of this is the blind pursuance of the introduction of high yielding varieties (HYVs) for replacing well adapted land races and traditional crops which had and inbuilt mechanism for growing on marginal and poor fertility soils, drought conditions due to the rainfed nature of agriculture and resistance to diseases and pests. Furthermore, the indiscriminate and excessive use of chemical fertilizers, such as urea, has made soil unfit for growing legumes for their detrimental effect on nodulation bacteria. Applications ignored the long-term effects accruing from the immediate gains of fertilizers and pesticides.

2.4.2 Uneducated Traditional Farmers:

Lack of education and understanding of farmers has been instrumental in wrong and unbalanced applications lack of chemical fertilizers and lack of farm yard manure (FYM). They did not have adequate knowledge about the use and preparation of compost manure. The use of inferior quality or low dosage pesticides resulted in the evolution of new strains of crop insect-pests and diseases. The small and marginal farmers reveal that traditional varieties or crops could do better under adverse conditions than high yielding varieties or crops bred for better conditions. In certain pockets in the hills pulses were of high quality and could have generated good income to farmers under prevailing conditions when pulse prices are soaring.

2.4.3 Poor Vision of Research Planners:

Research planning for the hills of Himachal Pradesh needed prior considerations such as resource crunch to small and marginal farmers, rainfed nature of crop growing, agro-climatic or agro-ecological potentials, communication systems in the hills, and market access. The research outcomes are hardly able to fulfill these criteria. In other words, the research results must show feasibility from farmer's field and should be within the reach of overage farmers who constitute the majority. The package of practices for crops has generally been designed for optimum conditions only. The cost of cultivation has been largely ignored and no published information is available. The promotion of new crops such as kiwi has been faulty in the sense people have not been informed about its use or market avenues and consequently many enthusiastic farmers end in despair when face with queries on use and wise marketing.

2.4.4 Resource Poverty and Access:

As pointed out earlier 69% of the population is directly employed in agriculture with 84.5% farmers having holding sizes ranging from 0.4ha to 1.4ha and are termed as marginal small farmers. Furthermore, another category of medium farmers, with holdings of 2.0 to 4.0 ha constitute 11.0% of the population. Keeping this in view, the majority of people in Himachal suffer scarcity of resources and that too when about 80% of the total cultivated area in the state is rainfed. Resource scarcity prevents their investing liberally in agriculture and taking full advantage of modern agriculture. The access of farmers to various resource centres is also poor because of the corrupt bureaucratic system in government offices. As a result only a few clever people able to take the advantage of various schemes and programmes.

2.4.5 Indiscriminate and Wide Spread use of Chemicals:

The advancement in agriculture has no doubt been due to the adoption of new varieties, chemicals, and agronomic practices by the farmers. The problem has arisen recently because of extensive and wrong application of chemical pesticides which leave residual toxic effects on food articles. Besides which the chemicals are washed by rainwater and taken to water sources as well as absorbed by fodder and feed sources. From all these sources the residues enter the body of animals and human beings when they are fed with contaminated food items. The consumption

of chemical fertilizers has gone up from 2000 metric tons in 1966-1967 to 34000 metric tons. in 1995-96.

It has been found that 70% of the vegetables sold in the market today are contaminated with pesticides and the toxic residues contained in them are higher than the safe limits. For instance onion contained toxic residues in over 92% samples, lady's finger (Bhindi) contained in 78% samples, potato and tomato had residues in over 51% samples, and 74% samples of aubergine, 62% samples of cabbage, 58% samples of cauliflower and 48% samples of spinach contained toxic residues in the market which enter in our bodies every day. In one study even it was found that sixteen sample of flour from the branded companies contained toxic residues of DDT, Aldrin and lindane beyond safe limits. The chemical load in fruits may also be found, as fruits like apple receive a heavy schedule of sprays in the orchards.

2.4.6 Reduction of Working Hands in Nucleus Farming Families:

The joint family system in India had ensured require the labour to work in agriculture. In recent years, when western influences began dominating the scene of Indian society, the joint family system is breaking fast into nucleus families (parents plus one or two children) and in this situation, children, unlike earlier times, are engaged in school education and for agricultural work only one or two adults are available. The hired labour costs are high and it could only be possible to engage labourers when earnings come from other sources. The government rate is Rs 80/- per day. This single factor compels farming families to change their agricultural land to some long-term usage such as a fruit orchard, timber tree cultivation or to grow some high value crops such as flowers, medicine and aromatic plants and vegetable crops so as to earn immediate larger profits to pay the hired labour for better resource inputs.

2.4.7 Destruction (unmindful) of Agro-forestry Component and Surrounding Green Cover:

The agro forestry has been practised in the hills since time immemorial. This is because it meets the daily requirements of fuel wood, fodder, timber and fibre. Besides it keeps the surrounding atmosphere clean. The unmindful destruction of surrounding forests has created new environmental problems such as shift in weather conditions, low rainfall, drying of perennial water sources, gully erosion, lowering of soil organic matter which used to come to farm fields through run off water. Due to non availability of wild fruits to wildlife these have become aggressive to nearby village life and farm crops.

2.4.8 Timidity of Extension Workers:

As has been said earlier the uneducated farming community does not understand the significance of long-term investment in agriculture. That is why they are fascinated by quick gains which may otherwise be harmful in the long run. This was to be overcome by an extension workforce engaged in community blocks. However, they had lagged behind in discharge of this duty. The very spirit of service for the upliftment of the rural masses was never reflected over five decades which carried the huge plan budgets. Farmers are now becoming aware of the ill effects of

chemical fertilizers, pesticides and herbicides. People have lost hold of their best produce in times before transition. For example, in certain areas the black gram crop had the highest quality and now it is not even grown in those areas. In certain areas bullock cultivation is replaced by tractor. As a consequence the availability of FYM or compost manure is much reduced and green manuring has not been practised, causing serious damage from chemical fertilizers on the soil and plants growing there.

2.5 Responses:

2.5.1 Technologies/Alternatives Available:

Eco-friendly agricultural practices are necessary in order to protect our environment and to keep it safe for the health of farming families and for millions of others who daily consume the produce. Such practices were traditionally inherited in the hill agriculture. However, due to recent trends in modernization of agriculture, some practices have become alarming to the environment. These are the application of chemical pesticides, fungicides, antibiotics, acaricides, nematicides, herbicides, NPK fertilizers, use of dust powders such as DDT, BHC, Sevin for treating stored grains or cellphos fumigation. The other pollutants are tractors replacing bullock cultivation, diesel pumps or gensets. Removal of many tree species from agro-forestry systems was another damaging factor because these tree species had great influence on the environment. For example mango trees in rural areas purify the environment through their leaves which contain antibacterial and antiviral substances. Similarly winds from pine trees and deodars environmental purification give network of roads connecting villages and the growing number of vehicles is also increasing pollution. The following technologies/alternatives will be useful to protect the environment in rural areas.

2.5.2 Organic Farming or Biodynamic Agriculture:

The advanced western countries have already experienced the ill effects of using chemicals in agriculture and are now advocating the concept of organic farming. But organic farming is not new to India especially in the hills of Himalaya. They followed biodynamic agriculture concept. In organic farming generally micronutrients are not given due attention, and hence in the long run their deficiency may occur. Biodynamic agriculture, on the other hand is based on sound principles of soil biotechnology and microbiology. Pfeffer (1984) has defined “Biodynamic agriculture as working with energies, which create and maintain life.” In this system, energies from the cosmos, earth, cow and plants are systematically and synergistically harnessed. This is done through the steps given below:

1. To apply zodiac principles to the process of cosmic integration; that is to say, the moon constellations in seed sowing and harvesting of crops.
2. To apply biodynamic methods for compost preparation and field sprays.
3. Use of vermicompost, vermi-wash.

4. Use of bone meal and wood ash.
5. Use of plant-extract, cakes to manage soil and plant pests.
6. Use of cow urine mixed with some plant chemicals, such as menthol or alone to control plant diseases and pests.
7. *Equisetum arvense* has been used to control fungal diseases successfully.
8. *Melia azadirach* (Drek) is used like Neem to control pests in the form an extract.
9. Plants like *Lantana camara* can be used to control insect pests or as a mosquito repellent.
10. Use of cow pat pit or liquid manure or compost heap methods provide sufficient nutrients to the growing crops.

2.5.3 Increasing Green Cover on Hills:

According to the National Forest Policy of 1988, at least two-thirds (i.e. 66%) of geographical area should be under forest greenery in hill states like Himachal Pradesh, but there exists only 22% of the geographical area under forest cover. The decline in forest cover has been responsible for low and erratic rain and snow, floods, heavy rains and land slides, gully formation. Good grass cover on hill slopes prevents soil erosion. The thick forests and snow glaciers are responsible for the slow release of water to the rivers and streams in the hills perennially.

2.5.4 Significance of Agro-forestry in Hill Agriculture:

The agro-forestry systems have been an essential component in the traditional farming systems. However in the present time without realizing its significance farmers are removing fast the tree components from their farming lands because of small damage done by birds, shade etc. This has encouraged the damage by rodents, wild beasts and insect- pests. Birds were also feeding on insect-pests.

2.5.5 Use of Bullocks as Draught Animals:

The use of bullocks for ploughing and other purposes in agriculture has distinct advantages. It is a renewable energy source, provides manure, consumes grass and crop wastes and has no damaging influence on environment.

2.5.6 Rain Water Harvesting for Agriculture:

Sloping lands in the hills make the provision of irrigation difficult. The best possible way to bring a greater area under irrigation is to resort to rain water harvesting by constructing irrigation ponds which should be lined with thick polythene sheeting to check the seepage water losses. The water from these ponds is usable during winter or the rabi season. For the cultivation of high value crops like vegetables, flowers they will be highly desirable.

2.5.7 Enhancing Crop and Varietal Diversity for Sustainable Crop Harvests:

It is widely realized now that the loss of biodiversity in agriculture in the hills is responsible for crop failures in adverse years. The sustainability in crop production was attained in the hills through diversification of crop species and growing a large number of varieties of each crop. The small millets tolerate drought much better than cereal crops. In rice there were varieties, e.g. Rahru, Rohda, which were growing mixed with the maize crop without any standing water. More varieties provide the chance for at least a few to do well under bad weather conditions.

2.5.8 Mixed Farming and Mixed Cropping - Better Choice:

Mixed farming offers much scope to earn a good income through agriculture at least on small and marginal farms. Mixed farming involves animal husbandry, dairy, apiculture (bee-keeping), pisciculture, sericulture, floriculture, olericulture mushroom growing and the cultivation of medicinal and aromatic plants. Mixed cropping utilizes the available farm resources to the maximum possible level and provides good returns to the grower.

2.6 Recommendations for Sustainable and Eco-Friendly Food Harvests:

According to the Economic Survey Report 2003-2004 (H.P.State), the economic growth of the state is predominantly governed by agriculture and its allied activities.

1. Soil, water and plant genetic resources constitute the foundation upon which agriculture and food security are based. Of these, the least understood and the most undervalued are plant genetic resources (PGR). They are also the resources most dependent upon the care of human beings and they are more threatened today than any time previously. Plant genetic resources for food and agriculture consist of the diversity of the genetic material contained in traditional varieties, land races, obsolete varieties, modern cultivars as well as the wild relatives of crops and other related wild species that can be used for food, feed for domestic animals, fibre, clothing, shelter, wood, timber and energy.

Historically, plant genetic resources have contributed to stability in agro-ecosystems and provided the crucial raw material for the development of modern varieties. They remain the foundation of evolution in crops which has allowed crops to adapt to a myriad environments and uses and which will allow them to respond to the new challenges of the time ahead. Therefore the conservation of plant genetic resources should receive priority attention of planners. The chief cause of the loss of genetic diversity has been the spread of modern commercial agriculture.

2. Soil health is basic to human health as it provides the variety of foods that we eat. The worldwide experience now teaches us to use organic culture for healthy foods from the soil. More appropriately biodynamic agriculture is the need of the hour. The energies from the cosmos, mother earth, mother cow and plants must be systematically and synergistically harnessed.

3. Genetic diversity in agriculture minimizes the losses to farmers and provides the foundation to sustainability in production. Moreover, cereal crops provide a large proportion of our total food requirements. However, when food energy supplies are analysed, a much greater number and types of crops emerge as significant. These include millets, sorghum, potato, pseudo cereals (grain amaranth, grain chenopod, buckwheat), beans and soybean. In any case, they receive much less attention or investment in terms of research and development. These crops are also important suppliers of dietary constituents such as proteins, fats, vitamins and minerals. These, therefore, need to be given a Place in the public Distribution System (PDS) by the state or central government.
4. The use of renewable energy sources should receive top priority in agriculture. There should be adequate investment for the design and development of implements and equipment using renewable energy. For example, panchakkis (Gharats), water lifting pumps, bullock drawn implements, solar cookers, Gobergas cooking, water heaters with solar panels and solar crop driers.
5. The state government must invest in the research and development of biopesticides, biofungicides, biocompost, and better production of bone meal. Simultaneously, the extension workers must be trained adequately to teach farmers the benefits and use of such newly developed products. This must be done immediately, since the organic produce market is expanding and the hills supply large quantities of off-season vegetables fruits and which should find a remunerative price market.
6. For economic growth and the prosperity of the people of Himachal Pradesh, there is tremendous scope to enhance the cropping intensity beyond 170 percent by introducing new crop plant species, such as exotic temperate vegetables, flowers, medicinal and aromatic plants either for fresh supply or for quality seed production. The other important areas which need attention are reviving the concept of mixed farming and mixed cropping in order to make best use of the available resources. The districts showing low cropping intensity need to be stepped up.
7. Irrigation and Rainwater Harvesting in the hills, the use of canals is not possible because the slope of cultivatable land varies from 5% to 30%. The Kuhals are the most popular mode of irrigation. However these need government's intervention for efficient management and use. Only 23.5% of the total available groundwater potential has been need in the low hills and valleys, and only 1.5% of the total water resource potential is being used in the high land regions at present. So far only 18.4% of the net area is irrigated in the state. The total geographical area of Himachal is 55.67 lakh hectares, of which only 5.83 lakh hectares are under cultivation and only 98000 hectares are the net irrigated area. That means still 80% or more of the area is rainfed and, if the state economy has to be strengthened, irrigation must be given top priority in planning. The rain harvesting would be an excellent option for the hills which will provide cheap irrigation water for growing rabi crops and will also reduce soil erosion through runoff water.
8. Develop Vision for Research on Crop Diversification for ten Agro-ecological sub zones in order to harness their potential in the correct perspective of genetic resources, soil and water resources.

To save rural farming from untoward circumstances, it is urgently required that the new technologies/alternatives are immediately put into operation. Some of these include adoption of organic or biodynamic agriculture, increasing green cover, adding more irrigated areas or adopting rain harvest technology, saving biodiversity character in crops, and laying due emphasis on mixed farming and mixed cropping.

There is no scope for neglecting the issues raised earlier in the context of agriculture if the state has to forge ahead in development as a strong viable economy. The action and will power of governance must be visible to earn credibility.

Table 2.21: Status of the Environment in Agriculture (2001-2004)

S.No.	Issues	Trends	Causes	Indicator	Value	Technologies/ Alternatives Available
1.	Progressive Fragmentation of Agricultural Farmlands.	Non-subsistence farming and increase in unemployment.	(a) 5% rise in unemployment during 1999 to 2003 and 105% increase from 1990 taken as base year. (b) Inheritance laws promote further fragmentation.	Migration of rural people in search of job to urban areas 6% increase recorded and 64.5% holdings with average size of 0.4 ha.	Low output from agriculture total food grain production from 1451.8 in 1999-2000 came down to 1112.1 (000' MT) in 2000-01.	(1) Promotion of agro based small scale industries in rural areas. (2) Growing of low volume and high value crops.
2.	Livelihood in Agriculture 69% total working force employed in agriculture.	Urbanisation continued to grow increase in urban population from 6.99% in 1971 to 8.69% in 1991 to 32.6% in 2001.	(a) Uneconomic farming. (b) Lack of awareness and adoption of mixed farming (dairy, apiary poultry, pisciculture) (c) Absentee landlords	(i) Reduction in village artisans. (ii) Growing problem of agricultural labourers.	(a) Rising labour cost. (b) Low use of diverse climatic seasons.	(1) Promotion agro based cottage or small scale industries. (2) Mixed farming needs to be made popular
3.	Eroding agro biodiversity and narrow food base.	(a) Few crop varieties occupying large acreage. (b) Shrinking cereal, vegetable, fruit food bases in rural areas too.	(a) Increase in disease and pest epidemics. (b) Crop failures in adverse climate. (c) Nutrient deficiencies in people. (d) Replacement by HYVs.	(i) High yield harvests during good seasons but many crop failures. (ii) Disappearance of small millets and traditional crops.	Germplasm well adapted to adverse conditions lost.	(1) Need to broaden food base to promote rural health care. (2) Revival of traditional food crops and inclusion in PDS.
4.	Lack of resource survey	High input modern agriculture	(a) Sustainable agriproduction could not be	All areas in different agro ecological	Planned expenditure could not keep pace with it	—————

S.No.	Issues	Trends	Causes	Indicator	Value	Technologies/ Alternatives Available
	and resource use planning.	emerging fast requiring more money and energy input.	achieved. (b) Food insufficiency forces to seek other jobs.	conditions have not recorded rise in production.	output.	
5.	Emergence of market-driven cropping patterns	Scientifically backed cropping patterns, need to be translated in the field.	Soil productivity declining.	(1) Low yields of crops fruits and vegetables. (2) Upto 18% area increase under vegetables and fruits.	Temporary rise in income.	Cropping patterns need to use agro-ecological and soil fertility status as basis.
6.	Rainfed hill agriculture	Increase in irrigated areas and drought tolerant crop growing.	(a) Frequent failure of crops. (b) Price rise of food grains, vegetables	Fluctuation in yields and consumer price.	State economy heavily depends on agri products.	Use of mulch, organic manures, drought tolerant varieties and crops.
7.	Indiscriminate use of chemicals.	(a) Imbalance of soil-available nutrients. (b) Loss of useful microbial flora.	(i) Fertility and moisture problems (ii) Unsuitability of legume crops growing.	(a) Area decreased from 8% to mere 2% under gram and lentil. (b) Rise of fertilizer and pesticides consumption.	(i) Price rise in pulses from around Rs.20/kg to Rs.30-40/kg. (ii) Pollution of potable water and edibles.	Use of organic manures and biopesticides.
8.	Soil and water conservation.	(a) Formation of gully lands. (b) Loss of soil fertility. (c) Growing flood menace.	(i) Silting of hydroelectric dam lakes. (ii) Reduction in cultivable area.	(a) Reduction of projected dam life. (b) Decline in agricultural production (c) Harvest failures due to drought spells.	Huge monetary loss likely.	(a) Soil conservation measures. (b) Increasing vegetation green cover.
9.	Maintenance of traditional mixed cropping and mixed farming.	(a) Growing of monocrops is on increase which is good for commercial but not for sustainable farming. (b) Crop husbandry and animal husbandry tradition declining.	(i) Use of resources is best with mixed cropping and mixed farming. (ii) Farm income higher by combining other husbandries.	(i) Decline in farm income. (ii) Self sufficiency is difficult. (iii) Rise in the cost of organic manures such as compost.	Has tremendous impact on farm income and employment.	—————

S.No.	Issues	Trends	Causes	Indicator	Value	Technologies/ Alternatives Available
10.	Under exploitation of environmental niches or hill varied agroecological conditions.	(a) Off season growing of vegetable and flowers in initial stage. (b) Seed production in vegetables and flowers almost negligible. (c) Medicinal and aromatic plant cultivation need to be a component in mixed cropping.	(i) Correct identification high value or market demand crops needs be done. (ii) Loss awareness among farmers. (iii) Marketing and legislative problems hinder further progress.	Lack of seed companies and processing units in various parts.	Most potent way to state economy.	—————
11.	Wide gap in yield of research plot and that of farmer fields.	(a) Research under best available conditions. (b) Small size of research plots.	(i) High input and high energy use. (ii) Farmer's conditions ignored while planning research objectives.	HYVs successful only under favourable growing conditions.	Economic development of farmers depends on narrowing down of this gap.	Low input breeding of varieties needs be given due consideration.
12.	Organic farming traditional hill agriculture.	(a) Production and use of biofertilizers and biopesticides need a boost. (b) Awareness about animal husbandry with crop husbandry will be highly beneficial.	(i) Chemical fertilizers and pesticides major cause of pollution of food articles and water. (ii) Production of organic food crops are essentially eco-friendly.	Low toxic residues in edible fruits vegetables, grains.	High market demand for organically produced foods in internal and foreign markets.	(a) Use of biofertilizers, biopesticides, manure, vermicompost. (b) Green manuring, growing of legumes in crop rotation and use of cow urine and neem oil as biopesticides will be useful.

* * * * *

HORTICULTURE AND ENVIRONMENT

Horticulture in Relation to the Environment

Nature has bestowed Himachal Pradesh with a wide range of agro-climatic conditions that are conducive for cultivation of large variety of horticultural crops, such as fruits, vegetables, ornamental plants and herbs. Almost all the fruits are being grown in the state. Some are on a commercial scale while others are limited.

In addition to fruits, vegetable and flowers cultivation can be exploited for off season supplies to the plains, while mushroom cultivation can be taken up even by the landless for augmenting their income. Similarly, bee keeping is a necessary adjunct to the horticulture industry, which besides providing pollinating agents for improvement of fruit set and productivity, also results in the production of economic apiculture products like honey and beeswax. The horticulture industry has a great role in the amelioration of the rural economy of the state through:

1. Utilization of the available resources.
2. Enriching the soil and maintaining ITS soil fertility.
3. Soil conservation.
4. Providing green cover to the soil and checking the soil erosion.
5. Use of wasteland and marginal land.
6. Providing shelter to animals and birds.
7. Source of food for birds and animals.
8. Generation of sources for cash income to rural people.
9. Generation of employment opportunities in pre and post harvest activities.
10. Supply of nutritive foods like fruits, vegetables, nuts and honey.
11. Satisfying the aesthetic needs of the people.
12. Development of a sustainable system of permanent agriculture in the hill areas.
13. Helping other ancillary industries.

2.1 State:

(a) Fruits:

At present more than thirty types of fruit species are being grown in the state: maybe on a large or small scale but they are available within the state. Most important are – apple, apricot, peach, pear, plum, almond, walnut, pecan nut, mandarin, sweet orange, Kagzi lime, hill lemon, mango, guava, papaya, litchi, kiwi fruit, olive and strawberry.



Kiwi Fruit Courtesy: NBPGR Phagli, Shimla

(b) Fruit Zones:

So far as the cultivation of these fruits is concerned, the state is broadly divided into four agro-climatic zones given below:

Table 2(a).22: Fruit Zones of Himachal Pradesh

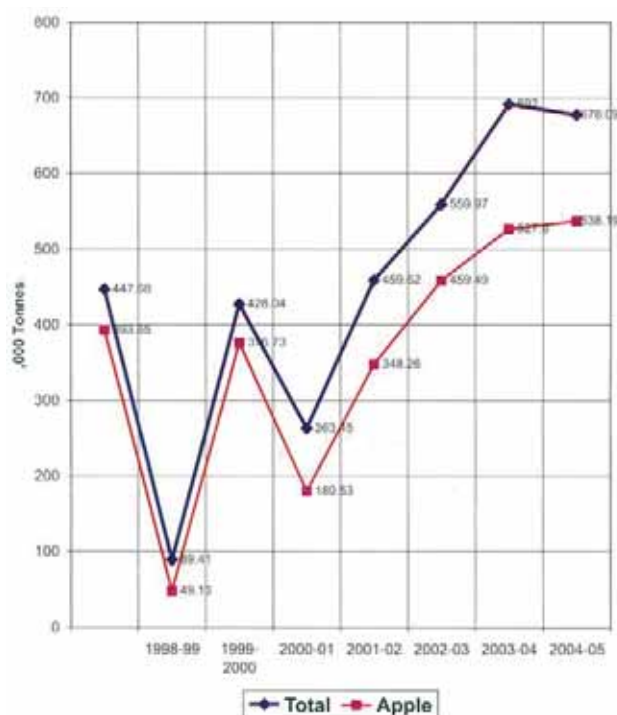
S.No.	Description of Zone	Elevation range amsl	Rainfall (cm)	Suitable fruit crops
1	Low hill and valley areas near the plains	365-914	60 - 100	Mango, litchi, guava, loquat, citrus, fig, papaya, grapes, jackfruit, banana, low chilling varieties of plum, peach and pear, strawberry
2	Mid hills (sub temperate)	915 -1523	90 -100	Stone fruits (peach, plum, apricot, almond), persimmon, pear, pomegranate, pecan nut, walnut, kiwi fruit, strawberry.
3	High hills and valleys in the interiors (temperate)	1524 - 2742	90-100	Apple, pear, cherry, almond, walnut, chestnut, hazelnut, strawberry
4	Cold and dry zone (dry temperate)	2743 -3656	24-40	Apple, grapes, prunes, drying type of apricot, almond, chilgoza, pistachio, walnut, hazel-nut

(c) Area Under Fruits:

In the initial stages of development the area in the state was 752 ha in 1952, which has gone up to 182,441 ha. in 2004. The area under different fruits being grown in the state is given as under:

Table 2(a).23: Area (ha) under Fruits in Himachal Pradesh

NAME OF FRUIT	1970-71	1980-81	1990-91	1998-99	1999-2000	2000-01	2001-02	2003-04
A. Temperate Fruits								
(a) Apples	26735	43331	62828	85631	88673	90347	92820	84112
(b) Other temperate fruits	7563	17464	28483	31925	32400	32801	33161	24378
(c) Nuts and dry fruits	1745	6892	13154	16061	16396	16619	16956	10939
Sub Total (A)	36043	67687	104465	133617	137469	139767	142937	119429
B. Sub-Tropical Fruits								
(a) Citrus fruits	5495	14471	36005	38711	39138	39627	40174	20261
(b) Other sub tropical fruits	2791	10267	22880	34912	36344	37832	39924	42751
Sub Total (B)	8286	24738	58885	73623	75482	77459	80098	63012
GRAND TOTAL	44329	92425	163330	207240	212951	217226	223035	182441



[Source: Economic Survey of Himachal Pradesh]

Fig. 1.8 Fruit Production

Fruit production in Himachal Pradesh has witnessed significant progress during the last five decades. The fruit production of 1200 mt in the year, 1950-1951, has now increased to 5,59,977 t in the year 2003-04. The data in the Table 2(a).24 below show the patterns of production of different fruits in the state.

Table 2(a).24: Fruit Production in Himachal Pradesh (t)

NAME OF FRUIT	1980-81	1990-91	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
A Temperate Fruits								
(a) Apples	118013	342071	393653	49129	376736	180528	348263	459492
(b) Other temperate fruits	9264	14934	17974	17901	20450	29236	63026	40652
(c) Nuts and dry fruits	1782	3105	3025	1895	2755	2911	3256	3570
Sub Total (A)	129059	360110	414702	68925	399941	212675	414545	503714
B. Sub-Tropical Fruits								
(a) Citrus fruits	4400	12100	13111	9257	11068	20465	16027	28121
(b) Other sub tropical fruits	6369	13604	19871	11233	17040	30306	29051	28142
Sub Total (B)	10769	26204	31982	20490	28108	50771	45078	56263
GRAND TOTAL	139828	386314	446684	89415	428049	263446	459623	559977

(d) General Horticulture Scene:

Persimon, Courtesy: NBPGR Phagli, Shimla Phagli, Shimla

The government of Himachal Pradesh is aware of the potential for developing of horticulture in the state and treats horticulture as a priority area in the development plans. It is matter of great satisfaction that as a result of the pragmatic policies adopted by the state government and the unequivocal adoption of development programmes by the farmers, the state has achieved a transformation in the horticulture sector over the last fifty years. The total area under fruits, which was

only 792 ha in 1950, has increased to 2.23 lakh ha during 2001-02. Similarly, the fruit production has also increased from 1200 mt in 1950 to 5.6 lakh ton during 2003-04. The horticulture industry of the state is now contributing about Rs. 777 crores per annum to the Gross Domestic Product of the state. The development of horticulture in the state has generated many employment opportunities not only at the farm level but also in other related activities, such as post-harvest management operations of packing, grading, transportation, processing, marketing, etc. It has been estimated that about 900 lakh man-days of employment are generated in the fruit production activities alone. Every year about 35000 trucks are required for the transportation of fruits from the state to various fruit markets in the country. Besides fruits, the horticulture industry of the state also produces 3236 ton of mushrooms, 946 ton of honey, floriculture products worth about Rs. 4.5 crore and 40 ton hops worth about Rs. 48.00 lakh.



Apricot

Courtesy: NBPGR Phagli, Shimla

Table 2(a).25: General Horticulture Scene

1	Cultivable area (1997-98)	6.15 lakh ha.
2	Per capita cultivable area	0.10 ha.
3	Total number of operational holdings (1995-96)	8,62,897
4	Area under horticulture crops (2001-02)	2.23 lakh ha
5	Total fruit production (2003-04)	5.6 lakh t
6	Total vegetable production (2003-04)	6.50 lakh t
7	Apple production (2003-04)	4.59 lakh t
8	Total number of orchards (1989-90)	4.64 lakh
9	Small and marginal orchardists (1989-90)	96%
10	Average size of land holdings (general)	1.20 ha.
11	Average size of land holdings (marginal farmers)	0.40 ha.
12	Total irrigated area	1,02,617 ha.
13	Percentage of irrigated area to total cultivable area (1997-98)	16.75%

The state is producing barely 1% of the total fruit production of 415.07 lakh t (1995-1996) in India. The temperate fruit industry is older than the sub-tropical fruit industry in Himachal Pradesh and contributes about 90 % of the total output of the fruit industry in the state, against the share of 10% for the sub tropical fruits. The reason for the low level of production in sub-tropical fruits is that the plantations of these fruit trees are still young and most plantations have not reached the bearing stage.

Apple dominates the fruit production in the state and contributes about 82 % of the total. The time series data exhibit erratic patterns of annual fruit production in the state. The main reason for this is that fruit cultivation in Himachal Pradesh is done mainly under rainfed conditions. Moreover, the weather vagaries like hailstorms, frost, drought and heavy rains, etc., act as limiting factors in fruit production.

(e) Use of Pesticides:

Non-judicious use of pesticides for the control of insects, pests and diseases in horticultural crops has led to:

1. Pests that have developed resistance to the chemicals used.
2. Pesticides have entered into the plant body and the soil.
3. Through produce from the plants, like the fruits, vegetables and other products from them, pesticides have entered into the human and animal bodies, which is a threat to living beings.

Under the present set up, use of pesticides for the control of various diseases and pests in horticultural crops is a must. One may get some compounds, which are named as herbal or organic in nature, for the control of pests yet their suitability for these crops and their availability is not assured. Untill there are some sensible arrangements for the control of pathogens and pests by alternative means, we have to depend on the present system of control.

Consumption of pesticides in the state since 1995 is given in the table below:

Table 2(a).26: Consumption of Pesticides

Year	Pesticides (t)
1995-96	203.17
1996-97	243.46
1997-98	244.50
1998-99	192.50
1999-2000	234.62
2000-2001	248.60
2001-02	677.00
2002-03	417.01

(f) Moisture Conservation:

In Himachal Pradesh fruit production in general is carried on under rainfed conditions and almost no irrigation is given to orchards. In the higher hills and mid hills, there is no arrangement for irrigation as there are no permanent sources for supplying water to fruit trees. In some areas, particularly in valley areas, life-saving irrigation is possible.

For raising flowers and ornamental plants, there is some facility for irrigation, but that is limited to valley areas only. Mulching is being practised in many areas. Water harvesting technology has also been adopted by growers. According to available statistics, the total area under cultivation is 6.15 lakh hectares, and out of this 1,02,617 hectares is under irrigation while 5,12,383 hectares is rainfed.

(g) Soil Conservation:

Plantations made in the past are mostly on the gentle slopes, and the trees have small or large basins depending upon the availability of space. Almost the area near the tree trunks and basins are being used for grasses or for other agricultural purposes, thus, there seems to be no danger of soil erosion in the orchards. Moreover, growers are aware of the soil erosion by water in such areas and they protect their trees from it. It is only the natural calamities that cause soil erosion near the orchards.

(h) Organic Horticulture:

Organically grown produce is considered good for health. It fetches better prices in and outside the country. There is a great need to follow the traditional method of organic farming. Much organic material in and around the orchards is being wasted for want of awareness about the use of this product. Vermi compost, Green Manure and the like practices need to be followed.

(i) Institutional Support:

Realizing the importance of horticulture in the economic development of the state, the Government of Himachal Pradesh has taken elaborate steps for the development of institutional infrastructure for ensuring the availability of necessary technical knowledge and other facilities to the farmers in the field of horticulture. The government created a separate Department of Horticulture during the year 1970 for the development of horticulture along scientific lines and the dissemination of the latest knowledge in horticulture to inform the fruit growers of the state. The Himachal Pradesh Agro Industries Corporation was established in the year 1971 for providing agro-industrial support to the horticulture industry while a specialized organization, namely, the Himachal Pradesh Horticulture Produce Marketing and Processing Corporation (HPMC) was established in 1975 for taking care of harvest management and the processing needs of the industry. A separate university, with the name of Dr. Y.S. Parmar University of Horticulture and Forestry at Nauni, Solan, was established in the year 1985 for providing research, education and development support to horticulture. Another organization, the Himachal Pradesh Agro Packaging Industries Limited,

for the supply of packaging material to the horticulture industry was established at Gumma, (Kotkhai), Shimla. Besides these several other organizations, namely, Himachal Pradesh Cooperative Marketing Federation (HIMFED), HP State Cooperative Bank, State Cooperative Agriculture and Rural Development Bank and Himachal Pradesh Agriculture Marketing Board, have also been established in Himachal Pradesh, to provide the necessary support to the horticulture industry in respect the credit and marketing requirements.

(j) Horticulture Development Activities:

The State Department of Horticulture at present has the mandate for carrying out activities relating to the production and postharvest management of fruit crops, commercial floriculture, apiculture, mushroom cultivation and hops in Himachal Pradesh. The State Government has recently decided to include the mandate of developing medicinal and aromatic plants under the purview of the department. The vegetable cultivation, though an integral part of horticulture, is however, now managed under the control of the State Department of Agriculture.

Activities relating to the development of horticulture taken care of by the State Department of Horticulture are given below:

(k) Area Expansion:

Every year around 6000-7000 hectares are being brought under fruit plantation all over the state for which 15 to 20 lakh fruit plants of different species are distributed amongst, the farmers.

(l) Production and Supply of Elite Planting Material:

Production and supply of planting material is arranged through 112 progeny-cum-demonstration orchards and nurseries and 629 private nurseries. The state is self-sufficient in the production and supply of most temperate fruit plants but is deficient in planting material for mango, citrus and other sub-tropical fruits, some nuts particularly grafted walnuts, pecan nuts, kiwi fruits, cherry and spur type of apples. Various programmes have been initiated for increasing the production of the plant material for these fruits in Himachal Pradesh. Two plant tissue laboratories, one each in the public and private sectors, have been established for the rapid propagation of the fruit plants, wherever the protocol are available. To supply improved planting material and root stocks, the State Department of Horticulture has imported root stocks of apple, pear, plum and cherry, which are being multiplied in the P.C.D.Os of the state.

(m) Introduction to Improved Plant Material:

The Department of Horticulture has been making efforts from the seventh Five-Year Plan for the introduction of the improved varieties of fruits from the advanced countries as well as the other states of India for i) improving the quality and the productivity of fruit crops ii) diversification in crop production and iii) improving the economic viability of fruit farms.

(n) Extension and Advisory Services:

- i) For advisory services in fruit plant nutrition, three plant tissue analysis laboratories have been established at Shimla, Kullu and Dharamsala in which around 14500 plant tissue samples are analyzed annually for the diagnosis of the nutritional disorders and suggesting fertilizer application practices. This has helped the orchardists to make judicious use of chemical fertilizers.
- ii) The supply of pesticides is arranged through 226 sales outlets established in the fruit growing areas by the department. Every year around 2.25 lakh hectare area is covered under plant protection activities and the pesticides (technical grade material) are distributed to the farmers every year. A Biological Control Laboratory to decrease chemical use in pest control has also been established at Shimla.
- iii) The horticulture extension services have been strengthened to grass root level. In addition, the programmes relating to the farmer's training, demonstrations, fruit shows, exhibitions, seminars and workshops are also organized for the dissemination of the technical know how to the farmers.

(i) Ancillary Horticulture Activities

- a) **Bee Keeping-** For the development of bee keeping, 37 bee keeping stations have been established all over the state for providing technical know how to the farmers in the commercial bee keeping. About 1075 bee colonies are maintained in these stations for multiplication and supply to the farmers. Two bee breeding multiplication centers have also been promoted in the private sector. AG- marking laboratories for honey have been established one at Hatkoti (Shimla District) and other at Chaitru (Kangra District).
- b) **Floriculture-** For the promotion of floriculture, seven floriculture nurseries have been established at various places for the multiplication and supply of floriculture planting material. One Model Floriculture Centre has been established at Mahog Bag Chail (Solan) to serve as a training centre in commercial floriculture.
- c) **Mushroom Cultivation-** For the development of mushroom cultivation, the Department of Horticulture has established four mushroom compost manufacturing units at Solan, Palampur and Baijnath (Kangra), and Bajaura (Kullu) respectively. In addition, about twenty mushroom compost manufacturing units are operating in the private sector.

(ii) Introduction of New Technologies

The Department of Horticulture, Himachal Pradesh, is also taking steps to introduce essential new technologies the development of horticulture. Introduction of technologies like micro irrigation, protected cover cultivation, use of bio-fertilizers in horticulture, improved horticulture tools, implements and machinery, and field diagnostic facilities for diagnosing pathological and nutritional disorders are being promoted.

(o) Incentives and Subsidies:

The State Department of Horticulture also provides various incentives in the form of assistance to the various categories of farmers for helping them in taking to horticulture, under its different programmes such as the centrally sponsored scheme for integrated development of horticulture through the Horticulture Technology Mission, Schedule Caste Component, Tribal Development, Special Central Assistance Drought and Natural Calamities Relief and State sector schemes.

(p) Strengths:

The major strengths of the fruit industry in Himachal Pradesh are as follows:

1. Comparative advantage in producing almost all kinds of horticultural crops - Temperate to Sub Tropical - due to diverse agro-climatic conditions available in the state.
2. Comparative advantage in the production of some horticultural crops particularly sub-tropical fruit crops for out of season marketing, because of the cooler climate, the maturity of many fruits is about a month later than similar fruits produced in the plains.
3. Vast domestic market for hill fruits due to paucity of areas for the production of such fruits in the country.
4. Fairly well developed institutional framework for the development of horticulture in the form of research, extension, credit, marketing, processing and communication infrastructure.
5. Near to the main distributing wholesale market at Delhi.
6. Use of pesticides is limited to only a few orchards. Quantity used is not alarming. Pesticide residues found in the fruits grown in the state is for below the lowest level recommended for human consumption.
7. Organic horticulture is practised in about 90% of the area under fruits.
8. For the packaging of the fruit produce, forest wealth is not used now and has been replaced by CFB cartoons or plastic crates.

2.2 Pressures:

1. Lack of irrigation facilities due to lack of water resources.
2. Small and scattered landholdings.
3. Horticulture production is done mainly on marginal land with low soil productivity.
4. Lack of microclimatic approach for the development of plantations of various fruit species and varieties in different areas.
5. Widespread natural calamities such as drought, hail storms frost.

6. Serious gaps in the application of advanced horticultural technologies for increasing horticultural production and improving quality and productivity.
7. High pressure on land use for purposes such as cereal crop production and fodder production because of lack of land veer capita per capita land.
8. Lack of scope for the mechanization of the horticulture industry for timely execution of various operations and savings in labour costs.
9. Difficulty in technology dissemination due to difficult terrain, hostile climate, poor communication facilities and sparsely located population.
10. Lack of suitable markets within the state resulting in dependence upon distant markets in the country.
11. High post-harvest losses due to :
 - (a) Lack of modern post-harvest management system.
 - (b) Very high temperature differentials in the produce in areas and the consuming markets, especially for temperate fruits, during the marketing period.
 - (c) Highly perishable nature of most temperate fruits causing severe post-harvest losses during transport.
 - (d) Orchards located from the main roads necessitating manual/animal transportation of the produce.
12. High cost of marketing mainly because of high costs transportation.
13. Lack of organized system of marketing through co-operatives and packing houses.
14. Lack of bargaining power with the individual growers due to small volume of produce.
15. Inadequate availability of market intelligence to the farmers resulting in imbalance in distribution of produce in different markets.
16. Lack of media support to the horticulture industry for increasing the demand and consumption of fresh and processed fruits of Himachal origin in the consuming markets.
17. Lack of reliable database both in respect of horticultural production and marketing.
18. Concentration of current efforts for the commercial production of only a few fruit crops like apple, peach, plum, mango, citrus.
19. Concentration on domestic markets resulting in lack of quality consciousness amongst the growers.

2.3 Impacts:

1. Likely increase in competition from foreign producers in the fruit trade, even in the domestic market after the World Trade Order becomes fully effective.
2. Likely increase in the inter-state competition for marketing of horticulture produce as other hilly states develop an interest in horticulture.

3. Likely change in the policy of the Central/State Governments for reduction in import duties and subsidies/support price for horticultural produce as a sequel to the global trading regime.
4. Increased demand on the country's forest resources for horticultural packaging due to increased horticultural production, if alternative systems of packaging are not immediately developed.
5. Likely adverse effect on the horticulture industry due to changing environment as a result of global warming and the greenhouse effect.

2.4 Responses:

1. Ample opportunities for the diversification of horticulture industry through introduction of high value fruit crops which have so far remained un-exploited due to different constraints, e.g., nut crops (walnut, pecan nut, hazelnut), cherry, red strains of pear, Kiwi fruit, small fruits (berries), oil yielding fruit crops like olive and aonla, pomegranate and fig.
2. Opportunities for the accelerated production of fruit crops dry land, rainfed areas by employing newly adapted technologies such as "in situ" plantation of mango in the low hill regions.
3. Opportunities for the improvement of productivity and quality of fruit crops already under cultivation by introducing improved/standardized technologies.
4. Although in the foreseeable future, the domestic market will continue to be the main focus of the horticulture industry of H.P. yet opportunities do exist for exploring the market in the adjoining countries of SAARC, West Asian region and Middle East countries for the future export of Himachal fruits.
5. As the levels of pesticide use in Himachal fruit industry are minimal are compared to those in other countries, opportunities exist for developing the organic production of fruits in suitable areas for export marketing simply by affecting some changes in existing production technologies.
6. The general increase in income levels and improvement in the standard of living of the population in the country, increasing awareness about the nutritional value of fruits as protective foods and increasing foreign tourist traffic into the country has resulted in an increased demand for fruits. This trend is likely to continue in the foreseeable future thereby expanding the market demands for hill fruits.
7. There is wide scope for the value addition of horticultural commodities produced in Himachal Pradesh, through diversification of the existing processing industry because of the wide range of fruits and vegetables available for processing.
8. There are opportunities for industry-linked horticulture production through suitable forward and backward link such as production for processing both for domestic and export markets.
9. Opportunities exist for value addition in the horticulture industry through adopting efficient post-harvest management, packing and storage technologies for improving shelf life, reducing losses and increasing the marketing season/period in the year.

2.5 Future Strategies:

The main thrust of future strategies for the development of horticulture in Himachal Pradesh will comprise measures for the improvement of productivity in existing horticulture plantations; improving the quality of horticulture produce; diversification of the horticulture industry, value addition of horticulture produce through improved post-harvest management practices; diversification in the processing industry through the production of high value products such as fruit based alcoholic beverages: fruit wines and ciders, dehydrated fruit products, and market promotion through branding and advertising.

The nursery production programme needs to be modernized for the production of virus-free certified planting material on suitable rootstock. The planting density of fruit orchards will require new orientation from the present low-density plantation to medium and high density plantations to obtain higher productivity of high quality fruits per unit area.

Introducing new fruit species and fruit cultivars suitable for cultivation in the state will diversify the state's fruit industry. As a result of extensive field trials, new fruit crops such as olive, pomegranate, fig, pistachio nut, pecan nut, hazel nut, strawberry and Chinese gooseberry (Kiwi fruit), are potential fruit crops which could form an important component of the product mix of the state's fruit industry in the coming years. The cultivation of small fruits like berries and currants will also be encouraged.

The development of horticulture in the wastelands will be promoted for the production of fruits like walnut, hazel nut, apricot, olive and aonla. The use of "*in situ*" plantation technique be promoted for the development of mango plantations in sub-tropical areas of the state.

Plant protection programmes in future years will be based on minimal use of pesticides with emphasis on the Integrated Pest Management and biological control of the pests and diseases of horticulture crops. Technical advances made by the country in Information Technology will be used for the dissemination of technical knowledge in horticulture and the collection and dissemination of market information.

Water management practices in the orchards will improve by adopting scientific water harvesting practices, water conservation through mulching and other agronomic practices and also with scientific water application techniques like micro irrigation.

Priority will given to programmes relating to the creation of post-harvest management infrastructure like grading and packing houses, cold storages, pre cooling systems cold chain and preferably under the cooperative and public sectors.

The processing sector will diversified to introduce value added products like fruit wines, ciders, dehydrated fruit products, fruit toffees and health products. The use of media publicity for the popularization of the fresh and processed fruits of Himachal origin be encouraged.

The **ultimate objective** of the future strategy for horticulture is to develop this activity as an environment-friendly enterprise with the three-dimensional objective of economic development, environmental conservation and the development of tourism in the State.

BIODIVERSITY AND ENVIRONMENT

Biodiversity and Environment

Introduction:

Biodiversity, or biological diversity, is the variability within and between all micro-organisms; plants and animals both wild and domesticated, and the ecological system in which they co-exist. It starts with genes and manifests itself as organisms, species, populations and communities which ultimately lead to the formation of ecosystems, landscape and ultimately biosphere. Biodiversity provides the fundamental base to mountain region agriculture and to the economic systems. It is, indeed, the ultimate basis for local self sufficiency and a global asset bringing benefits to people in many more ways than we realize.

Himachal Pradesh, the beautiful landscape, lush green forests, bubbling streams, emerald meadows, enchanting lakes, eternal snows, ethnic communities and colourful people, is located in the North Western Himalayas. Himachal Pradesh, like any other mountainous region, is a vast repository of plants and animal ecosystems embodying profuse variation at intra and inter-species levels. Out of a total 45,000 plant species found in the country, as many as 3295 species (7.32%) are reported in Himachal Pradesh and out of 77,450 species of animals Himachal Pradesh harbours 5,721 species, amounting to about 7.4% of Indian fauna. This shows richness of faunal resources of the state considering its small geographical area, which is only about 1.7% of the country. Invertebrates constitute 88.4% (5,055 species) and vertebrates 11.6% (666 species) of the Himachal fauna.



Rhododendron arboreum

Many species of flora and fauna may well be threatened in Himachal Pradesh. The percentage of threatened species in the fragile mountainous region has been observed comparatively much higher in the state because of the dependence of the local people on biological resources for their livelihoods. The survival of valuable species of animals and birds, medicinal herbs, aquatic and domesticated flora and fauna survival is at risk because of continuous and unscientific extraction and hunting in their habitats. The situation is fast deteriorating owing to indiscriminate spraying of the highly toxic insecticides/fungicides in agriculture and horticulture fields. The introduction of exotic species the state is threatening the existence of soil and aquatic species, disturbing the ecosystems in the state.



Taxus baccata

The forest wealth of the state consists of diversified flora comprising higher plants, ferns, mosses, fungi and lichens. Coniferous forest dominates the mid and high hills with oaks in depressions. In the foothills forests are dry deciduous with Sal as the predominant species. In dry localities Chir pine occur as the dominant species.

The state is rich in medicinal herbal plants and people in some villages are dependent on the medicinal herbs for their livelihood. By the regular extraction of medicinal plants from the forests and Alpine pastures nearly sixty species of medicinal importance in the state now fall under the category of endangered species as per the IUCN criteria.



Picrorhiza kurroa

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



Western Tragopan

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

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



Himalayan Monal

The faunal and floral biodiversity of the state is as follows:

3.1 State

(a) FAUNAL DIVERSITY

Table 3.27: Faunal Distribution in Biomes

I Subtropical Biome:	
Animals	Rhesus monkey, Nilgai, Sambhar, Chital, Barking deer, Ghoral, Wild boar, Himalayan black bear, Indian crested porcupine, Jackal, Red fox, Jungle cat, Leopard cat.
Avifauna	Red jungle fowl, Indian peafowl, Pheasants, Chukor, Golden backed woodpecker, Laughing and Whistling thrushes, White cheeked Bulbul, Black partridge.
Reptiles	Common rat snake, Cobra, Russell's viper, Krait, Python, Monitor lizards.
II Temperate Biome:	
Animals	Ghoral, Barking deer, Musk deer, Himalayan tahr, Leopard, Himalayan black bear and Brown bear, Stone marten, Yellow throated marten, Himalayan weasel, Asiatic jackal, Langur, Rhesus monkey.
Avifauna	Thrushes, White whiskered Bulbul, Nuthatch, Jays, Monal, Kaleej, Himalayan bearded vulture, Himalayan pied woodpecker.
III Alpine Biome:	
Animals	Snow leopard, Lynx, Bharal, Ibex, Musk deer, Mouse hare, Long tailed marmot.
Avifauna	Monal, Snow cock, Snow pigeon, Red billed chough, lark, Tibetan snow grouse, Tibetan snow finch.
IV Cold Desert Biome:	
Animals	Bharal, Ibex, Lynx, Snow leopard, and Marmot.
Avifauna	Monal, Koklas, Chukor

Table 3.28: Protected, Endangered and Vulnerable Fauna

Terrestrial	Avifauna	Vermin
Protected		
(a) Bharal	(a) Baz	(a) Common Crow
(b) Clawless Otter	(b) Black-necked Crane	(b) Fruit Bat
(c) Caracal	(c) Black Partridge	(c) Mice
(d) Fishing Cat	(d) Cheer Pheasant	(d) Rats
(e) Himalayan Brown Bear	(e) Forest Spotted Owlet	
(f) Himalayan Tahr	(f) Hawks	
(g) Himalayan Ibex	(g) Hornbill	
(h) Tibetan Wolf	(h) Kalij Pheasant	
(i) Kashmir Stag	(i) Koklas Pheasant	
(j) Leopard Cat	(j) Lammergeier	
(k) Leopard	(k) Large Whistling Teal	

Terrestrial	Avifauna	Vermin
(l) Lynx (m) Markhor (n) Musk Deer (o) Nayan (p) Pangolin (q) Serrow (r) Snow Leopard (s) Tibetan Fox (t) Tibetan wild Ass (v) Tibetan Wolf (w) Wild Yak	(l) Monal Pheasants (m) Mountain Quail (n) Osprey (o) Peafowl (p) Western Tragopan	
Endangered Butterflies Freak, Scarce Siren, Golden Emperor, Broadbanded Sailor, Banded Apollo, Ladakh Banded Apollo, Pale Jezebel Reptiles Common Indian Monitor, Yellow Monitor, Indian Rock Python Birds Cheer Pheasant, Monal Pheasants, Mountain Quail, Snow Cock, Tragopan, Himalayan Bearded Vulture, Himalayan Golden Eagle, Lagger Falcon Animals Himalayan Brown Bear, Snow Leopard, Himalayan Lynx, Kashmir Stag, Himalayan Ibex, Himalayan Tahr.		
Vulnerable Reptiles Indian Flap-Shelled Turtle Birds Fish eating Eagle, Koklash Pheasant, Indian Peafowl Animals Musk Deer, Wild Yak, Serrow, Nayan, Tibetan Wolf, Blue Sheep, Indian Pangolin, Small-clawed Otter, Leopard Cat.		

Source: H.P. Forest Statistics, 1996 and Red Data Book on Indian Animals

Table 3.29: Fish Faunal Diversity

1. <i>Notopterus lecepede</i>	12. <i>D. (Brachydanio) rerio</i> (Hamilton)
2. <i>Notopterus notopterus</i> (Pallas)	13. <i>Esomus daniricus</i> (Hamilton)
3. <i>Salmo gairdenerii gairdenerii</i> (Richardson)	14. <i>Rasbora daniconius</i> (Hamilton)
4. <i>S. trutta fario</i> (Lian.)	15. <i>S. bacaila</i> (Hamilton)
5. <i>Barilius barila</i> (Hamilton)	16. <i>Hypothalmichthys molitrix</i> (Val)
6. <i>B. bendelisis bendelisis</i> (Hamilton)	17. <i>Cyprinus carpio communis</i> (Lian.)
7. <i>B. barna</i> (Hamilton)	18. <i>C. carpio specularis</i> (Lian.)
8. <i>B. vagra vagra</i> (Hamilton)	19. <i>Carrasius auratus</i> Linn.
9. <i>B. sharca</i> (Hamilton)	20. <i>Catla catla</i> (Hamilton)
10. <i>Raimas bola</i> (Hamilton)	21. <i>Cirrhina mrigala</i> (Hamilton)
11. <i>Danio (danio) devario</i> (Hamilton)	22. <i>C. reba</i> (Hamilton)

23. <i>Labeo boga</i> (Hamilton)	54. <i>N. punjabensis</i> (Hora)
24. <i>L. calbasu</i> (Hamilton)	55. <i>N. stoliczkae</i> (Steindchner)
25. <i>L. dero</i> (Hamilton)	56. <i>Amblyceps mangois</i> (Hamilton)
26. <i>L. dyocheilus</i> (McClelland)	57. <i>Mystus (Mystus) bleekri</i> (Day)
27. <i>L. bata</i> (Hamilton)	58. <i>M. (Mystus) vittatus</i> (Bloch)
28. <i>L. pangusia</i> (Hamilton)	59. <i>Wallago attu</i> (Hamilton)
29. <i>L. rohita</i> (Hamilton)	60. <i>Clupisoma garua</i> (Hamilton)
30. <i>Osteobromis cotio cotio</i> (Hamilton)	61. <i>Bagarius bagarius</i> (Hamilton)
31. <i>Puntius chola</i> (Hamilton)	62. <i>Glyptothorax brevipinnis brevipinnis</i>
32. <i>P. chonchonius</i> (Hamilton)	63. <i>G. garhwali</i> (Tilak)
33. <i>P.sarana sarana</i> (Hamilton)	64. <i>Glyptothorax conirostris</i> (Steind)
34. <i>P. ticto ticto</i> (Hamilton)	65. <i>G. pectinopterus</i> (Hamilton)
35. <i>P. wagenii</i> (Day)	66. <i>G.stoliczkae</i> (Steind)
36. <i>Tor gray</i>	67. <i>G. gracilis</i> (Gunther)
37. <i>Tor putitora</i> (Hamilton)	68. <i>G. horai</i> (Shaw and Shebbeare)
38. <i>Tor tor</i> (Hamilton)	69. <i>G. kashmirensis</i> (Hora)
39. <i>Crossocheilus latius punjabensis</i> (Mukerji)	70. <i>G. telchitta telchitta</i> (Hamilton)
40. <i>Crossocheilus latius latius</i> (Hamilton)	71. <i>Pseudochenesis sulcatus</i>
41. <i>Garra gotyla</i> (Gray)	72. <i>Glyptosternum reticulatum</i> (McClelland)
42. <i>Schizothorax richardsonii</i> Gray	73. <i>Glyptosternum</i> (McClelland)
43. <i>Biota dario</i> (Hora)	74. <i>Xenentodon regan</i>
44. <i>B. birdi</i> (Chaudhri)	75. <i>Xenentodon cancila</i> (Hamilton)
45. <i>B. lohachata</i> (Chaudhri)	76. <i>Channa striatus</i> (Hamilton)
46. <i>B. rostrata</i> (Gunther)	77. <i>C. marulius</i> (Hamilton)
47. <i>Noemacheilus botia</i> (Hamilton)	78. <i>C. punctatus</i> (Bloch)
48. <i>N. botia aeurus</i> (Hamilton)	79. <i>C. orientalis</i> (Schn.)
49. <i>N. corica</i> (Hamilton)	80. <i>Nandus nandus</i> (Ham.)
50. <i>N. kangrae</i> (Menon)	81. <i>Chanda baculis</i>
51. <i>N. neilgheriensis</i> (Menon)	82. <i>Mastacembalus armatus</i> (Lacepede)
52. <i>N. rupecola rupecola</i>	83. <i>Mastacembalus scopell</i>
53. <i>N. montanus</i> (McClelland)	

(b) FLORAL DIVERSITY**I. Sub-Tropical Zone:****Table 3.30: Floral Diversity**

Sr. No.	Botanical Name	English Name	Local Name
1	<i>Apluda mutica</i>	Apluda	-
2	<i>Arthraxon spp</i>	-	-
3	<i>Arundinella nepalensis</i>	Arundinella	Bhangrola
4	<i>Arundinella setosa</i>	Arundinella	-
5	<i>Atylosia scarabaeoides</i>	-	Ban kulthi
6	<i>Bothriochloa pertusa</i>	-	-
7	<i>Bothriochloa intermedia</i>	-	-
8	<i>Cymbopogon jwarancusa</i>	-	-
9	<i>Cymbopogon martinii</i>	Citronella grass	Makora
10	<i>Cynodon dactylon</i>	Bermuda	Doob
11	<i>Chrysopogon gryllus</i>	-	Chota Dholu
12	<i>Chrysopogon fulvus</i>	-	Bara Dholu
13	<i>Dichanthium annulatum</i>	-	Marval
14	<i>Desmodium sp</i>	-	-
15	<i>Digitaria marginata</i>	-	-
16	<i>Digitaria longi flora</i>	-	-
17	<i>Eulaliopsis binata</i>	-	-
18	<i>Eragrostis curvula</i>	Lane grass	-
19	<i>Heteropogon contortus</i>	Spear grass Kumbri/	Kumbri/ Lamb
20	<i>Imperata cylindrica</i>	-	Chhiz
21	<i>Medicago polymorpha</i>	-	Khukhani
22	<i>Medicago denticulata</i>	-	-
23	<i>Penniselum orientale</i>	-	Barijhan
24	<i>Paspalum scrobiculatum</i>	-	-
25	<i>Paspalum orbicular</i>	-	Kodri
26	<i>Phaseolus sp</i>	-	-
27	<i>Poa annacra</i>	-	-
28	<i>Sorghum halepense</i>	Johnson grass	Bara Bru
29	<i>Sorghum nitidum</i>	-	Chota Bru
30	<i>Saccharum spontaneum</i>	-	Kash
31	<i>Saccharum bengalensis</i>	-	Munya
32	<i>Setaria glauca</i>	-	Cheti jhan
33	<i>Themeda anathera</i>	-	Lungi

II. Humid Sub-Temperate Zone:

Sr. No.	Botanical Name	English Name	Local Name
1	<i>Arundinella setosa</i>	Arundinella	-
2	<i>Agrostis canina</i>	-	-
3	<i>Agropyron longearistatum</i>	Wheat grass	-
4	<i>Agropyron semicstatum</i>	Wheat grass	-
5	<i>Arthraxon sp</i>	-	-
6	<i>Bothriochloa intermedia</i>	-	-
7	<i>Bromus catharticus</i>	Brome grass	-
8	<i>Cymbopogon gryllus</i>	-	Chota dholu
9	<i>Cymbopogon echinulatus</i>	-	-
10	<i>Cymbopogon jwvarancusa</i>	-	-
11	<i>Chrysopogon martinii</i>	-	Makore
12	<i>Cynodon dactylon</i>	Bermuda grass	Doob
13	<i>Chlris montana</i>	-	-
14	<i>Digitaria sp</i>	-	-
15	<i>Danthonia jacquemontii</i>	-	-
16	<i>Dactylis glomerata</i>	Cock spoot	Orchard grass
17	<i>Festuca kashmiriana</i>	Feswe grass	-
18	<i>Festuca arundinacea</i>	Feswa grass	-
19	<i>Heteropogon contortus</i>	Spern grass	Lamb/ Kumri
20	<i>Koeleria cristata</i>	-	-
21	<i>Lolium perenne</i>	Rye grass	-
22	<i>Lotus corniculatus</i>	Bridsfoot trefoil	-
23	<i>Microstegium ciliatum</i>	-	-
24	<i>Muhlenbergia duthieana</i>	-	-
25	<i>Medicago falcata</i>	Lucerne (Yellow Flower)	-
26	<i>Medicago denticulata</i>	-	-
27	<i>Onobrychis vicifolia</i>	Sain join	-
28	<i>Phleum pratense</i>	Timothy grass	-
29	<i>Pennisetum orientale</i>	-	Barijhan
30	<i>Poa bulbosa</i>	Blue grass	-
31	<i>Poa pratensis</i>	Kentucky blue grass	-
32	<i>Poa annua</i>	-	-
33	<i>Phaseolus sp</i>	-	-
34	<i>Stipa concinna</i>	-	-
35	<i>Themeda anathera</i>	-	Alungi
36	<i>Trifolium repens</i>	Winter clover	-
37	<i>Trifolium pratense</i>	Red clover	-

III. Dry Temperate and Alpine Zone:

Sr. No.	Botanical Name	English Name	Local Name
1	<i>Agrostis stolonifera</i>	-	-
2	<i>Agrostis canina</i>	-	-
3	<i>Agrostis alba</i>	Bant Grass	-
4	<i>Agrostis myriantha</i>	-	-
5	<i>Agropyron cognatum</i>	Wheat Grass	-
6	<i>Agropyron repens</i>	—do—	-
7	<i>Bromus oxydilon</i>	Broom Grass	-
8	<i>Bromus inermis</i>	Smooth Broom Grass	-
9	<i>Chrysopogon gryllus</i>	-	Chosta Dholu
10	<i>Dactylis glomerata</i>	Cooksfoot	Orchard grass
11	<i>Deyeuxia scabriscens</i>	-	-
12	<i>Deschempsia caespitosa</i>	-	-
13	<i>Festuca valesiaca</i>	-	-
14	<i>Helictotrichon virescens</i>	-	-
15	<i>Trisetum micans</i>	-	-
16	<i>Lolium perenne</i>	Perennial Rye Grass	-
17	<i>Phleum alpinum</i>	Timothy grass	
18	<i>Poa bulbosa</i>	Blue grass	
19	<i>Poa sterilis</i>	—do—	
20	<i>Poa alpina</i>	Kentucky Blue Grass	
21	<i>Phalaris minor</i>	-	
22	<i>Themeda anathera</i>	-	Guli danda
23	<i>Trifolium repens</i>	White clover	-
24	<i>Trifolium fragiferum</i>	Strawberry clover	-
25	<i>Trifolium pratense</i>	Red clover	-

Table 3.31: Wild Fruit Plants Diversity

Sr. No.	Scientific Name	Common/local name	Climatic conditions (Area of occurrence)
1.	<i>Aesculus indica</i>	Khanor (Horse chestnut)	High hills
2.	<i>Corylus colurna</i>	Wild Hazelnut	High hills
3.	<i>Malus spp</i>	Crab apple	High hills
4.	<i>Prunus armeniaca</i>	Chuli	High hills
5.	<i>Prunus mira</i>	Behmi	High hills
6.	<i>Prunus persica</i>	Wild peach	High hills

Sr. No.	Scientific Name	Common/local name	Climatic conditions (Area of occurrence)
7.	<i>Hippophae rhamnoides</i>	Sea buckthorn	High hills (dry temperate region)
8.	<i>Artocarpus lacucha</i>	Dehu	Low hills
9.	<i>Mangifera indica</i>	Wild mango	Low hills
10.	<i>Terminalia bellirica</i>	Bahera	Low hills
11.	<i>Terminalia chebula</i>	Harar	Low hills
12.	<i>Zizyphus spp.</i>	Ber	Low hills
13.	<i>Morus laevigata</i>	Wild mulberry	Low/ mid hills
14.	<i>Aegle marmelos</i>	Bel	Low/mid hills
15.	<i>Carissa spinarum</i>	Wild Karonda	Low/mid hills
16.	<i>Citrus limon</i>	Hill lemon	Low/mid hills
17.	<i>Ficus palmata</i>	Wild Fig (Anjir)	Low/mid hills
18.	<i>Ficus roxburghii</i>	Timal	Low/mid hills
19.	<i>Musa spp.</i>	Hill banana	Low/mid hills
20.	<i>Diospyros lotus</i>	Amlook	Mid hills
21.	<i>Punica granatum</i>	Wild pomegranate	Mid hills
22.	<i>Berberis aristata</i>	Kashmal (Indian barberry)	Mid hills
23.	<i>Cordia obliqua</i>	Lassura	Mid hills
24.	<i>Debregeasia hypoleuca</i>	Siarru	Mid hills
25.	<i>Emblica officinalis</i>	Wild aonla	Mid hills
26.	<i>Flacourtia sapida</i>	Kangu	Mid hills
27.	<i>Fragaria indica</i>	Wild strawberry	Mid hills
28.	<i>Murraya koenigii</i>	Gandhellu	Mid hills
29.	<i>Phoenix sylvestris</i>	Wild date palm	Mid hills
30.	<i>Pyrus serotina</i>	Zarenth	Mid hills
31.	<i>Rubus ellipticus</i>	Akhae	Mid hills
32.	<i>Rubus niveus</i>	Akhae	Mid hills
33.	<i>Syzygium spp</i>	Wild jamun	Mid hills
34.	<i>Vitis himalayana</i>	Wild grapes	Mid hills
35.	<i>Vitis lanata</i>	Wild grapes	Mid hills
36.	<i>Elaeagnus umbellata</i>	Ghain	Mid/high hills
37.	<i>Myrica nagi</i>	Kaphal	Mid/high hills
38.	<i>Pyrus pashia</i>	Kainth	Mid/high hills
39.	<i>Olea cuspidata</i>	Wild olive	Mid-high hills

Table 3.32: Agricultural Crop Diversity
Diversity in Grass Species

Crop Species	English Name	Local Name in H.P.
<i>Allium cepa</i>	Onion	Pyaz
<i>Amaranthus hypochondriacus</i>	Amaranth	Chaulai
<i>A. caudatus</i> <i>A. cruentus</i>	Amaranth Amaranth	Chuwa/Marcha/ Ramdana Chaulai
<i>Avena sativa</i>	Oat	Jai
<i>Brassica campestris</i>	Rape	Toria
<i>Brassica juncea</i>	Indian Mustard	Sarson
<i>Cajanus cajan</i>	Pigeon Pea	Tur
<i>Cannabis sativa</i>	Hemp	Bhang Beej
<i>Chenopodium album</i>	Pig-Weed, Goose foot	Bethu, Bathu,
<i>Glycine max</i>	Soybean	Bhatt
<i>Colocasia esculenta</i>	Taro, Dasheen	Pindalu, Kuchain, Kachalu
<i>Echinochloa frumentacea</i>	Barnyard millet	Jhangora
<i>Eleusine coracana</i>	Finger millet	Koda
<i>Fagopyrum esculentum</i>	Buckwheat	Oggal
<i>Fagopyrum tataricum</i>	Buckwheat	Phapher
<i>Hibiscus cannabinus</i>	Kenaf, Jute	Buili
<i>Hordeum himalayens</i>	Nacked barley	O-wa-jau
<i>Hordeum vulgare</i>	Barley	Jau
<i>Lens esculenta</i>	Lentil	Masoor
<i>Macrotyloma uniflorum</i>	Horsegram	Gahat, Kultha
<i>Oryza sativa</i>	Paddy	Chawal, Dhan
<i>Panicum miliaceum</i>	Hog-millet	Cheena/Bhangna
<i>Perilla frutescens</i>	Perilla	Bhangjeera
<i>Phaseolus vulgaris</i>	Kidney bean	Rajmah
<i>Pisum sativum</i>	Pea	Matar, Dal Matar
<i>Sesamum indicum</i>	Sesame	Til
<i>Setaria italica</i>	Foxtail millet	Kauni, Kangni
<i>Solanum tuberosum</i>	Potato	Aloo
<i>Sorghum vulgare</i>	Pearl millet	Junyali, Jawar
<i>Triticum aestivum</i>	Wheat	Gehun
<i>Vigna aconitifolia</i>	Mat bean	Bhringa, Moth
<i>V. angularis</i>	Adjuki bean	Rains, Riuns
<i>Phaseolus mungo</i>	Black gram	Urad, Mah
<i>P. radiata</i>	Green gram	Mung
<i>V. umbellata</i>	Rice bean	Bhotia
<i>Zea mays</i>	Maize	Mungri, Makki, Kukdi
<i>Zingiber officinale</i>	Ginger	Adrak

Source: Consultant's Study Analysis

IV. Important Temperate and Sub-tropical Fruits and Vegetables Diversity:

Table 3.33: Fruit Plants

Botanical Name	English/Common Name
<i>Malus pumila</i> (Syn. <i>Pyrus malus</i>)	Apple
<i>Malus auccata</i>	Crab apple
<i>Prunus domestica</i>	Plum
<i>P. persica</i>	Peach, Aaru
<i>P. armeniaca</i>	Apricot, Khumani, Zardalu
<i>P. avium</i>	Cherry (sweet)
<i>P. cerasus</i>	Cherry (sour)
<i>P. amygdalus</i>	Almond
<i>Juglans regia</i>	Walnut
<i>Corylus colurna</i>	Hazelnut (wild)
<i>Carya pecan</i> (Marsh.) Engl. and Graebn.	Pecan nut (introduced)
<i>Castanea vulgaris</i>	Chestnut (wild and cultivated)
<i>Pinus gerardiana</i>	Chilgoza, Neoza (wild)
<i>Pyrus communis</i>	Pear, Nashpati
<i>Cydonia vulgaris</i>	Quince, Beehdana
<i>Olea europaea</i>	Olive, Zaitoon (introduced)
<i>Citrus reticulata</i>	Orange
<i>C. sinensis</i>	Malta
<i>C. limon</i>	Kagzi Nimbu
<i>C. aurantifolia</i>	Galgol
<i>Citrus</i> sp.	Kinnow
<i>Litchi chinensis</i>	Litchi
<i>Artocarpus heterophyllus</i>	Jackfruit, Kat-hal
<i>Punica granatum</i>	Pomegranate (Pomegranate), Daru, Anar
<i>Mangifera indica</i>	Mango
<i>Psidium guajava</i>	Guava
<i>Vitis vinifera</i>	Grapes
<i>Carica papaya</i>	Papaya
<i>Actinidia deliciosa</i>	Kiwi

Table 3.34: Vegetables

Botanical Name	English/Common Name
<i>Brassica oleracea</i> var. <i>capitata</i>	Band Gobhi, Cabbage
<i>B. oleracea</i> var. <i>botrytis</i>	Phulgobhi, Cauliflower
<i>B. campestris</i> var. <i>rapa</i>	Shaljam, Turnip
<i>Raphanus sativus</i>	Muli, Radish
<i>Cucurbita moschata</i>	Pumpkin
<i>C. maxima</i>	Kadu (High Altitude)
<i>Cucumis sativus</i>	Cucumber
<i>Lagenaria siceraria</i>	Bottle gourd, Ghiya, Lauki
<i>Luffa acutangula</i>	Ridge gourd (Tori)
<i>Luffa cylindrica</i>	Sponge gourd (Ghiya Tori)
<i>Trichosanthes anguina</i>	Snake gourd
<i>Momordica charantia</i>	Bitter gourd (Karela)
<i>Benincasa hispida</i>	Petha, Ash gourd
<i>Beta vulgaris</i> var. <i>bengalensis</i>	Palak
<i>Spinacia oleracea</i>	Vilayati Palak
<i>Trigonella foenum-graecum</i>	Methi
<i>Brassica campestris</i> var. <i>cuneifolia</i>	Lai Patta
<i>B. campestris</i> var. <i>rugosa</i>	Lohi patta
<i>Chenopodium album</i>	Bathua
<i>Amaranthus dubius</i>	Chaulai
<i>A. hypochondriacus</i>	Chaulai
<i>Phytolacca acinosa</i>	Jalga
<i>Perilla frutescens</i>	Banjeera
<i>Pisum sativum</i>	Pea, Matar
<i>Phaseolus vulgaris</i>	French bean
<i>Vicia faba</i>	Bakla
<i>Vigna sinensis</i> var. <i>sesquipedalis</i>	Rongi, Asparagus bean or Yard long bean
<i>Sechium edule</i>	Cho-cho
<i>Solanum tuberosum</i>	Alu
<i>Amorphophallus campanulatus</i>	Suran, Zamikand
<i>Colocasia esculenta</i>	Arvi
<i>Lycopersicon esculentum</i>	Tamatar, Tomato
<i>Solanum melongena</i> var. <i>esculentum</i>	Baingan, Aubergine
<i>Capsicum annum</i>	Shimla mirch
<i>C. frutescens</i>	Chilli, Lal mirch
<i>Abelmoschus esculentus</i>	Bhindi, ladies finger
<i>Daucus carota</i>	Gajar, Carrot

Table 3.35: Medicinal and Aromatic Plants/ Herbs Diversity

Sr. No.	Scientific Name	Local/Common Name
1	<i>Abelmoschus moschatus</i>	Kasturi Bhindi
2	<i>Abies spectabilis</i>	Talispatra
3	<i>Abrus precatorius</i>	Gunja, Ratti
4	<i>Abutilon indicum</i>	Kanghi, Atibala
5	<i>Aconitum chasmanthum</i>	Karvi Patish
6	<i>Aconitum deinorrhizum</i>	Mohra, Vatsnabh
7	<i>Aconitum heterophyllum</i>	Milhi Patish
8	<i>Aconitum violaceum</i>	Mitha Telia
9	<i>Acorus calamus</i>	Buch
10	<i>Adhatoda vasica</i>	Baso, Basuti
11	<i>Adiantum lunulatum</i>	Dusgutli
12	<i>Aegle marmelos</i>	Bel, Bilva
13	<i>Ainseliaea aptera</i>	Sath Jalori
14	<i>Albizia lebbeck</i>	Siris, Sirin
15	<i>Allium stracheyi</i>	Jangli Piaz
16	<i>Aloe vera</i>	Dhrit Kumari
17	<i>Althaea officinalis</i>	Tukkam Khatmi
18	<i>Amaranthus spinosus</i>	Chulai
19	<i>Angelica glauca</i>	Chora
20	<i>Argemone mexicana</i>	Swaran kshiri
21	<i>Arnebia benthamii</i>	Ratanjot
22	<i>Artemisia absinthium</i>	Afsanthin, charmara
23	<i>Artemisia brevifolia</i>	Seski
24	<i>Asparagus adscendens</i>	Safed musli, Sansavi
25	<i>Atropa acuminata</i>	Belladona, Jharka
26	<i>Bacopa monnieri</i>	Brahmi
27	<i>Baliospermum montanum</i>	Danti
28	<i>Bunium persicum</i>	Kala Zira
29	<i>Barleria cristata</i>	Sairyk, Jhinti
30	<i>Bauhinia vahlii</i>	Tor
31	<i>Bauhinea Variegata</i>	Kachnar
32	<i>Berberis aristata</i>	Daruholdi, kashmal
33	<i>Berberis asiatica</i>	Kashmal
34	<i>Bergenia ligulata</i>	Pashanbhed
35	<i>Boerhavia diffusa</i>	Punanarwa, itsit
36	<i>Caesalpinia crista</i>	Latakaranj, Tarang-ghari
37	<i>Calotropis gigantea</i>	Aak

Sr. No.	Scientific Name	Local/Common Name
38	<i>Carissa spinarum</i>	Karonda, Garna
39	<i>Carum carvi</i>	Kala zira
40	<i>Cassia fistula</i>	Amaltas
41	<i>Cedrela spp.</i>	Dariphool
42	<i>Celastrus paniculatus</i>	Malkangni, Sankhiren
43	<i>Centella asiatica</i>	Mandook parni
44	<i>Centipeda orbicularis</i>	Nakchiknu
45	<i>Chenopodium botrys</i>	Bathu, Vaslak
46	<i>Cinnamomum camphora</i>	Kapur, Vriksh
47	<i>Cinnamomum tamala</i>	Tejpatra, Gurpatraj
48	<i>Cissampelos pareira</i>	Bhatindu
49	<i>Citrullus colocynthis</i>	Indrayan
50	<i>Citrus jambhiri</i>	Jhamisi, Ghamardi
51	<i>Citrus medica</i>	Kagzi nimbu
52	<i>Colebrookea luteum</i>	Surangan, Jangli kachalu
53	<i>Colebrookea oppositifolia</i>	Bindi phool
54	<i>Coleus aromaticus</i>	Pathan Bel
55	<i>Cordia myxa</i>	Lassora
56	<i>Costus speciosus</i>	Kayoo
57	<i>Crateva religiosa</i>	Varun
58	<i>Crocus sativus</i>	Kesar
59	<i>Croton tiglium</i>	Jamalgota
60	<i>Cryptolepis buchanani</i>	Krishan saribe
61	<i>Curculigo orchioidea</i>	Kali musli
62	<i>Curcuma longa</i>	Haldi
63	<i>Curcuma spp.</i>	Banhaldi
64	<i>Cuscuta reflexa</i>	Akashbel
65	<i>Cymbopogon citratus</i>	Katrin
66	<i>Cynodon dactylon</i>	Doob, Dharm
67	<i>Cyperus rotundus</i>	Nagarmotha
68	<i>Cyperus scariosus</i>	Motha
69	<i>Dactylorhiza hatagirea (Orchis sp)</i>	Salam Panya
70	<i>Datura metel</i>	Dhatura
71	<i>Desmodium gangeticum</i>	Shalparni
72	<i>Didymocarpus pedicellatus</i>	Muskarni
73	<i>Dioscorea bulbifera</i>	Bashokand, Tardi
74	<i>Digitalis purpurea</i>	Harito-patri
75	<i>Dioscorea deltoidea</i>	Shingli mingli

Sr. No.	Scientific Name	Local/Common Name
76	<i>Dolichos biflorus</i>	Kulath
77	<i>Eclipta alba</i>	Bhringraj
78	<i>Emblica officinalis</i>	Amla
79	<i>Eclipta erecta</i>	Maha bhringraj
80	<i>Ephedra gerardiana</i>	Soma, Asmania
81	<i>Ephedra spp</i>	Batchur
82	<i>Erythrina indica</i>	Paribhadra, Parair
83	<i>Euphorbia hirta</i>	Doodhli
84	<i>Euphorbia neriifolia</i>	Doodhli
85	<i>Euphorbia royleana</i>	Thor, Chhooh
86	<i>Evolvulus alsinoides</i>	Shankpushpa
87	<i>Ficus glomerata</i>	Udambar, Umre
88	<i>Ficus infectoria</i>	Palaksh, Palakhre
89	<i>Fumaria parviflora</i>	Pitpopra
90	<i>Gentiana Kurroo</i>	Karoo, Kawr
91	<i>Gerardinia heterophylla</i>	Bichubuti
92	<i>Gloriosa superba</i>	Kalihari
93	<i>Glycyrrhiza glabra</i>	Muhlathi
94	<i>Grewia tiliifolia</i>	Nagbala
95	<i>Habenaria edgeworthii</i>	Wridhi
96	<i>Habenaria intermeedia</i>	Sridhi
97	<i>Hedychium acuminatum</i>	Kapper kachri
98	<i>Hedychium spicatum</i>	Karchur, Banhaldi
99	<i>Hemidesmu indicus</i>	Anantwool
100	<i>Heracleum lanatum</i>	Patiahan
101	<i>Holarrhena antidysenterica</i>	Kutaj, Kyore
102	<i>Hypericum patulum</i>	Kharera Basanti
103	<i>Hyoscyamus niger</i>	Kurasni Ajwain
104	<i>Ichnocarpus frutescens</i>	Shwet sariva
105	<i>Inula racemosa</i>	Pushkar wool
106	<i>Jasminum grandiflorum</i>	Chameli, Malti
107	<i>Juniperus recurva</i>	Bether Patta
108	<i>Jurinea macrocephala</i>	Dhoop
109	<i>Kalanchoe spathulata</i>	Lasungharu
110	<i>Lepidium sativum</i>	Iloe
111	<i>Mallotus philippinensis</i>	Kamila, Kamal
112	<i>Malaxis acuminata</i>	Shrishbhak
113	<i>Malaxis mucifera</i>	Jiwak

Sr. No.	Scientific Name	Local/Common Name
114	<i>Melia azedarach</i>	Mahanimb, Drek
115	<i>Mentha spicata</i>	Pudina
116	<i>Momordica charantia</i>	Karela
117	<i>Morchella esculenta</i>	Ghichii
118	<i>Mucuna prurita</i>	Konch, Gajalbel
119	<i>Murraya koenigii</i>	Meetha neem, Gandla
120	<i>Nardostachys jatamansi</i>	Jatamansi, Balchora
121	<i>Nerium odorum</i>	Kaner
122	<i>Ocimum basilicum</i>	Barberi, Tulsi, Bhavari
123	<i>Ocimum sanctum</i>	Tulsi
124	<i>Oroxylum indicum</i>	Vyonak, Tatpalanga
125	<i>Oxalis corniculata</i>	Changeri
126	<i>Pueraria tuberosa</i>	Vidarikand, Saloher
127	<i>Phyllanthus niruri</i>	Bhumi Amla
128	<i>Picrorhiza kurrooa</i>	Karoo
129	<i>Piper longum</i>	Magh Papal
130	<i>Pistacia integerrima</i>	Kakarsinghi, Karkat Shringi
131	<i>Plantago ovata</i>	Isbgol
132	<i>Plumbago zeylanica</i>	Chitrak
133	<i>Podophyllum hexandrum</i>	Bankakri
134	<i>Polygonatum verticillatum</i>	Salam mishri
135	<i>Pongamia pinnata</i>	Karanj
136	<i>Potentilla dumetorum</i>	Madanphul, Rada
137	<i>Ranunculus sceleratus</i>	Jaldhaniya
138	<i>Raphanus sativus</i>	Mooli
139	<i>Rauvolfia serpentina</i>	Sarapgandha
140	<i>Rheum australe</i>	Revand chini
141	<i>Rheum emodi</i>	Rewand chini
142	<i>Rhododendron arboreum</i>	Brass
143	<i>Rhododendron campanulatum</i>	Kasmiri Patta
144	<i>Ricinus communis</i>	Arand
145	<i>Rosa moschata</i>	Kubbjak gulab
146	<i>Rubia cordifolia</i>	Majeeshth
147	<i>Rumex hastatus</i>	Khatmith
148	<i>Salvia moorcroftiana</i>	Thuth
149	<i>Sapindus mukorossi</i>	Ritha
150	<i>Saussurea costus</i>	Kuth
151	<i>Saussurea obvallata</i>	Brahm Kamal

Sr. No.	Scientific Name	Local/Common Name
152	<i>Selinum vaginatum</i>	Butkesh
153	<i>Semecarpus anacardium</i>	Bhilawa
154	<i>Sida cordifolia</i>	Baladaride
155	<i>Sisymbrium irio</i>	Khoobkalan
156	<i>Solanum indicum</i>	Brihad Kantkani
157	<i>Solanum nigrum</i>	Makoe
158	<i>Solanum xanthocarpum</i>	Choti Kantkari
159	<i>Spilanthes acmella</i>	Akarkara
160	<i>Stephania elegans</i>	Rajpatha
161	<i>Swertia chirayita</i>	Chirayta
162	<i>Syzygium cumini</i>	Jamun
163	<i>Skimmia laureola</i>	Kasturipatra
164	<i>Tagetes erecta</i>	Gatakri
165	<i>Tagetes minuta</i>	Gatakri
166	<i>Taraxacum officinale</i>	Doodhli
167	<i>Taxus baccata</i>	Barnii, Talispatra
168	<i>Terminalia arjuna</i>	Arjun
169	<i>Terminalia bellirica</i>	Vibhitka, Bahera
170	<i>Terminalia chebula</i>	Harar
171	<i>Thalictrum foliolosum</i>	Mamiri
172	<i>Thevetia nerifolia</i>	Pit kaner
173	<i>Thymus serpyllum</i>	Ban Ajwain
174	<i>Tinospora cordifolia</i>	Gloe
175	<i>Tribulus terrestris</i>	Gokshru, Bhakra
176	<i>Tylophora asthmatica</i>	Anantmool
177	<i>Uraria picta</i>	Prishn Parni
178	<i>Urginea indica</i>	Jangli Piaz
179	<i>Valeriana hardwickii</i>	Nihani
180	<i>Valeriana wallichii</i>	Mushakbala, Sugandhbele
181	<i>Vanda roxburghii</i>	Rasana
182	<i>Vernonia cinerea</i>	Sahdevi
183	<i>Viola odorata</i>	Banfsha
184	<i>Vitex negundo</i>	Nirgundi, Bana
185	<i>Withania somnifera</i>	Ashvagandha
187	<i>Zanthoxylum alatum</i>	Tajbal, Tirmir

3.2 Pressure on Biodiversity:

Biodiversity in the state is under tremendous stress owing to various developmental and social pressures. Habitats are becoming lost, degraded and fragmented. Populations of various plant and animal species are reported to be thinning every year while those of invasive species are on the increase indicating loss of natural habitat.

However, systematic efforts to bring out and highlight the biodiversity loss at ecosystem, species and genetic levels are yet to take off in the state. Tentative lists of threatened plants and animals of Himachal Pradesh have been drawn by various experts on the basis of surveys and secondary literature. However, the only exercise in this direction that could pass the scrutiny of international conventions on the subject was a CAMP (Conservation Assessment and Management Plan) Workshop on medicinal plants held at Kullu during June, 1998. In this workshop, 34 species of medicinal plants of the state were assessed as red listed following IUCN categorization. Many more workshops supported by field survey reports are required to determine the threat to various species and their habitats.

3.2.1 Destruction of Natural Habitats:

Forests and groves were the general dwellings of a variety of faunal biodiversity. Due to destruction and conversion of forests, the natural habitats of numerous types of wild animals have been affected. Local communities have had the largest claim on the natural resources around habitations, especially forests. Destruction of forests and other natural resources on which their traditional livelihood depended, is pushing most people to seek employment elsewhere. Besides agricultural land and pasture, local communities have been dependent on resources collected in the wild for construction, timber, food, fibre, fertilizer, fodder, fuel-wood and medicinal herbs/plants. These types of pressures are associated with the destruction of natural habitats.

- i) **Fuelwood Extraction:** In Himachal Pradesh about 90.21% of the population is rural and they mostly depend upon fuelwood for their day-to-day energy requirements. The annual fuelwood requirement for sixty lakh people is about 3.9 million tonnes. The manner in which the fuelwood is obtained is also highly damaging. Right holders and the resident population are supposed to collect only dry and fallen wood and twigs, or lop lower branches of permissible tree species. In practice, however, even young poles are hacked and trees are badly lopped. This severely impairs the regeneration and protective capacity of the trees and the development of the forests. Forests that are in the vicinity of habitations are the most affected. The greatest pressure is perhaps on the “Ban-Oak” trees. These are lopped for fuelwood as well as for fodder.

The entire districts of Kinnaur, Lahaul and Spiti, and Pangi and Bharmour tehsils (now sub-divisions) of Chamba districts have only rural populations. These areas are inaccessible for the greater part of the year and living conditions are extremely harsh. Temperatures drop below zero for months on end. While large areas are classified as

forest, these are mostly barren, rocky or perpetually under snow, thus not fit for afforestation. Only Bharmour Tehsil of Chamba district has a high forest cover. In Pangti and Kinnaur, the actual forest cover is only 10%, and Lahaul and Spiti are practically devoid of vegetation. Fuel wood is so scarce in the district of Lahaul and Spiti, Pooh and Pangti sub-divisions, that fuelwood has to be carried from other districts over long distances.

- ii) **Grazing in Forests:** Almost 90% of the forests of the state, other than areas taken up for regeneration and plantations, are open to grazing. Cultivation of green fodder in agricultural fields is virtually non-existent as are stall-feeding practices. The consequence is that all forest areas are openly grazed throughout the year. This continuous grazing diminishes productivity and gives rise to inferior grasses and unpalatable bushes like *Lantana* and *Ageratum* species.
- iii) **Timber Distribution Rights:** Local people have recorded rights for constructional timber at minimal rates. The ratio between these concessional rates and market rates is 1:4000 to 1:5000. Due to the division of the families, the number of rights holders is multiplying and the forests are depleting. Almost half the yield prescribed annually from the forest goes to T.D rights holders. As whole standing trees are marked to the individual rights holders, it gives an entry and licence to enter the forests and provides a temptation for illicit felling.
- iv) **Encroachment in the Forest Areas:** The incidence of encroachment is alarming in the undemarcated protected forests that are without boundary pillars. As these adjoin private lands, they are prone to encroachments. At present there are about 7000 encroachment cases that involve about 17000 ha of forest area.
- v) **Green Felling:** The complete ban on green felling in the forests imposed by the government is not conducive to the development of forests, because natural regeneration is possible only when an optimum opening in the canopy is made, and the areas are closed to grazing. Therefore, felling in the nature of regeneration felling and thinning has to be carried out to induce regeneration and to remove congestion in the crops. If this not done, the mature trees die and decay in the course of time, and there would be no young growth to replace them. Thus, working plan prescriptions, which is a tool for forest management, need to be implemented.
- vi) **Forest Fires:** Forest fires cause considerable recurring and lasting damage to the forests and wildlife. Each year thousands of hectares of forest area get burnt, especially in the “Chil” belt, primarily due to negligence of the villagers. Fires are very common in the high altitude “Blue Pine” forests during November and early December. This is when the weather is very dry and winter rains are delayed.

Fires cause immense damage to the forests. The damage to the ecosystem is relatively more lasting and irreversible compared to damage to the vegetation. Although it is

difficult to quantify the damage caused, yet some of the common damages are destruction of regeneration and young poles, the drying up of trees, the retardation of increment, the burning of pine needles and humus. This exposes the soil to wind and rain leading to soil erosion. It also affects the recharging of groundwater and springs. Biodiversity is severely affected both above and below ground level. Controlled burning, clearance and maintenance of fire lines are some of the common control measures.

vii) Collection of Non-Timber Forest Produce: Villagers and farmers close to the forests traditionally collect various NTFPs, such as Anardana, Chilgoza, Guchhi and various medicinal and aromatic plants, either free or on payment of some nominal fee. Scientific exploitation of chilgoza and other minor forest produce is needed. The chilgoza or neoza pine, known botanically as *Pinus gerardiana* Wall., is a compact medium-sized tree. In Himachal Pradesh, it occurs naturally in dry temperatures zone, *i.e.* parts of Kinnaur and Chamba (Pangi) districts covering an area of about 2,060 hectares. It has been estimated that only five percent of seed bearing cones (inaccessible sites) are able to survive the greed of people and become available for natural regeneration. The cones are devoured by a large number of pests, birds, squirrels, rodents and cone borers. Severe lopping practices, browsing by sheep and goats, extraction of torchwood or fuel wood the factors detrimental to the regeneration of chilgoza trees. According to an estimate about 14 to 17 tonnes of nuts are collected annually in Kinnaur district. It is thus an important cash crop in the area but, in the absence of a definite policy, there is a big question mark on its future survival. Similar is the case with several other NTFPs which have been harvested to near-extinction in the wild.

viii) Inadequate Investment: Forestry is the biggest landuse in the state. Investment input in forestry is grossly inadequate compared to the economic benefits that are derived from forests, apart from their role in soil, water and environmental conservation. To meet the development needs, forests have always been looked upon as a source of revenue for the state. Resources extracted from the forests annually, with their values, are as follows:

- 27.6 lakh tonnes of fuelwood worth Rs. 276 crores.
- Grass and grazing worth Rs. 690 crores.
- Timber to rights holders worth Rs. 60 crores.
- Non-timber forest produce worth Rs. 25 crores and revenue to the state on account of sale of timber, resin and other products worth about Rs. 57 crores.

Despite the total value of forest produce extracted from the state annually being in the region of Rs.1000 crores, the Government investment is only Rs. 50 crores a year on average. This is insufficient keeping in view the basic requirements of forest management and the massive afforestation programmes that are required to bring 50% of the area under forest cover, according to the state's forest policy.

ix) Lack of Diversification in Forest Plantation

3.2.2 Loss of Wild Fruits and Other Natural Food Resources:

In the past, wild animals used to feed on wild fruits and other natural food resources and did not interfere with the agricultural crops generally. However, due to increases in their population and less of their natural food resources, wild animals have become more aggressive and dependent on cultivated lands and, consequently, confrontation situations have developed.

3.2.3 Hunting /Over-exploitation of Wild Animals:

Hunting of wild animals is one of the main causes for the loss and decline of wildlife in HP. As a result, several species of mammals, birds and reptiles are on the endangered list. Since 1982, the government of H.P has imposed a complete ban on the hunting and killing of wild animals in the state. However, incidents of the illegal hunting of barking deer, ghoral, wild boar, rabbits, partridges and red jungle fowl by villagers for food do occur. Some of the other poached animals include leopard, black and brown bears, musk deer, monal. Surprisingly, very few cases of hunting and poaching of wild animals are registered and prosecuted in the state. The poachers are believed to kill these animals by shooting or trapping or even by poisoning.

3.3 Impacts:

Decline in Floral and Faunal Wealth:

Table 3.36: Critically Endangered (CR)

Sr.No.	Botanical Name	Common/Local Name
1.	<i>Aconitum heterophyllum</i>	Atis
2.	<i>Arnebia benthamii</i>	Ratanjot
3.	<i>Arnebia euchroma</i>	Ratanjot
4.	<i>Atropa acuminata</i> (Syn. <i>Atropa belladonna</i>)	
5.	<i>Dactylorhiza hatagirea</i> (Syn. <i>Orchis latifolia</i>)	Salam panja
6.	<i>Malaxis muscifera</i>	Jeevak/ Rishabhik
7.	<i>Genstiana kurroo</i>	Kutki
8.	<i>Lilium polyphyllum</i>	Ksheer kakoli
9.	<i>Rauvolfia serpentina</i>	Sarpagandha
10.	<i>Saussurea gossypiphora</i>	Ghooghi
11.	<i>Saussurea obvallata</i>	Brahma kamal
12.	<i>Swertia chirayita</i> (Syn. <i>S. chirata</i>)	Chirayata

Table 3.37: Endangered (EN)

Sr.No.	Botanical Name	Common/Local Name
1.	<i>Aconitum deinorrhizum</i>	Mohra
2.	<i>Angelica glauca</i>	Chora
3.	<i>Betula utilis</i>	Bhojpatra/Bhoj
4.	<i>Datisca cannabina</i>	
5.	<i>Dioscorea deltoidea</i>	Shingli mingli
6.	<i>Ephedra gerardiana</i>	Somlata
7.	<i>Fritillaria roylei</i>	Ksheer kakoli
8.	<i>Habenaria intermedia</i>	Riddhi
9.	<i>Hyoscyamus niger</i>	Khurasani ajwain
10.	<i>Juniperus polycarpus (J. macropoda)</i>	Jau. Hauber
11.	<i>Jurinea dolomiaea (J. macrocephala)</i>	Dhoop
12.	<i>Meconopsis aculeata</i>	Patishan rooli
13.	<i>Nardostachys grandiflora (N. jatamansi)</i>	Balchharh
14.	<i>Paris polyphylla</i>	Meethi bach. Dudh bach
15.	<i>Picrorhiza kurrooa</i>	Karu, Kutki
16.	<i>Podophyllum hexandrum (P. emodi)</i>	Bankakri
17.	<i>Polygonatum cirrhifolium</i>	Salam mishri, Maha meda
18.	<i>Rheum emodi (R. australe)</i>	Revandchini
19.	<i>Rheum moorcroftianum</i>	Revandchini
20.	<i>Taxus wallichiana (T. baccata)</i>	Talishpatra
21.	<i>Zanthoxylum armatum (Z. alatum)</i>	Tirmur

Table 3.38: Vulnerable (VU)

Sr. No.	Botanical Name	Common/Local Name
1.	<i>Aconitum violaceum</i>	Mithi patish, Mitha telia
2.	<i>Allium stracheyi</i>	Jambu, Faran
3.	<i>Bergenia stracheyi</i>	Pashanbhed
4.	<i>Bunium persicum (Carum bulbocastanum)</i>	Kala Zira, Shia zira
5.	<i>Cinnamomum tamala</i>	Tejpatta
6.	<i>Colchicum luteum</i>	Suranjan kadvi
7.	<i>Didymocarpus pedicellata</i>	Pathar laung, Patharphori
8.	<i>Embelia tsjeriam-cottam</i>	Vibidang
9.	<i>Eremostachys superba</i>	Gaju mulla
10.	<i>Ferula jaeshkeana</i>	Kindal
11.	<i>Gloriosa superba</i>	Kalihari
12.	<i>Heracleum lanatum</i>	
13.	<i>Hippophae rhamnoides</i>	Sea buckthorn, Charma

Sr.No.	Botanical Name	Common/Local Name
14.	<i>Hypericum perforatum</i>	Basant, Khoontir
15.	<i>Hyssopus officinalis</i>	
16.	<i>Litsea glutinosa (L. chinensis)</i>	Maida lakari
17.	<i>Physochlaiana praealta</i>	Bajar bhang
18.	<i>Polygonatum multiflorum</i>	Salam mishri
19.	<i>Polygonatum verticillatum</i>	Salam mishri
20.	<i>Rheum spiciforme</i>	Revandchini, Chukri
21.	<i>Rheum webbianum</i>	Revandchini
22.	<i>Rhodiola heterodonta</i>	
23.	<i>Rhododendron anthopogon</i>	Talispatra
24.	<i>Rhododendron campanulatum</i>	Kashmiri patta
25.	<i>Rhododendron lepidotum</i>	Kashmiri patta
26.	<i>Roylea cinerea (R. calycina)</i>	Karvi
27.	<i>Valeriana jatamansi (V. wallichii)</i>	Mushkbala, Tagarpanth

Considering the wide diversity available in the state in different agro-climatic zones, a multipronged approach was adopted for collating the information on different facets of biodiversity; namely, state level consultative meetings, seeking responses through questionnaires from the general public and NGOs, holding public hearings, seeking responses from development departments, constitution of thematic groups, consultative process by the thematic groups through personal contacts and seeking of responses through universities.

3.4 Main Issues of Biodiversity in the State:

- Effective valuation of biodiversity especially agro-biodiversity needs proper understanding of traditional farming practices.
- No information base of traditional ecosystem in marginalized / remote areas is available.
- People are totally ignorant of the values of genetic resources available to them in the state.
- Forest fires create havoc, but no fire fighting system/ fireproof system is available for the prevention and control of fire.
- Lack of initiatives for eradication, rehabilitation and alternative use of exotic weeds namely; *Lantana camara*, *Ageratum*, *Eupatorium* and *Parthenium* in the state.
- Over grazing, soil erosion, exploitation and unlawful activities by intruders are leading to degradation of the biological resources of the state.
- Advancement of development, cement projects, hydroelectric power projects, pose a severe threat to biodiversity.
- Increase in pollution, population, use of toxic pesticides, chemical fertilizer and changing weather conditions are affecting biodiversity.

- Lack of awareness programmes for the conservation of biological resources in the state.
- Illegal hunting and poaching is one of the main causes for the loss and decline of wildlife biodiversity.
- Habitat destruction, wrong and erratic use of natural habitats, change in climatic conditions and imbalance in natural ecosystems are also causing problems to biodiversity in the state.
- Change in food habits leading to the cultivation of only a few selected cereals, pulses, oil seeds and other economic plants, is also posing a threat to the agriculture.
- Propagation of monoculture practices.
- Introduction of exotic species of flora and fauna adversely affecting the indigenous species in the state.
- Due importance has not been given to biodiversity in the extra-curricular activities of schools, colleges and training institutes.
- People are unaware of the importance and dangerous consequences of losing the biodiversity.
- Efforts for the conservation of biodiversity in the state are not optimum.
- Lack of R&D and transfer of R&D activities related to biodiversity.
- Increased sedimentation from deforestation and mining and unauthorized and indiscriminate fishing using destructive fishing methods : poisoning, electrocuting, dynamiting is threatening aquatic biodiversity.
- Biodiversity education is not an integral part of both formal and non-formal education in the state.
- Poor co-ordination amongst developmental plans, executing bodies, local communities, research and academic institutions.
- Poor control on contractors of medicinal herbs/plants; contracting and collection by outsiders is often done without the knowledge of local people.

3.5 Responses:

- The Government of Himachal Pradesh has adopted a National Forest Policy, National Conservation Strategy and National Wildlife Action Plan to tackle various biodiversity-related issues. The state government has also imposed a complete ban on the hunting of wild animals and a moratorium on the felling of trees in all protected areas.
- The State Government has taken measures for the propagation and conservation of wild biodiversity. The Department of Forest has designated a full fledged Principal Chief Conservator of Forest (Wildlife) post and an *in-situ* animal biodiversity conservation programme in Himachal Pradesh is being carried out in the Wildlife Sanctuaries (WLS) and National Parks (TNP).

- The wildlife wing of H.P. Forest Department has undertaken integrated eco-development projects in some Wildlife Sanctuaries and National Parks.
- The Forest Department has embarked upon an extensive programme for restoring degraded habitats of wild animals through large-scale plantation of different species of trees under various schemes, including social and participatory forestry.
- The Pong dam wetland is being managed by the Forest Department with a centrally assisted Intensive Management Plan for the improvement and creation of suitable habitats, nesting and roosting sites for several species of birds. The Government of Himachal Pradesh has also undertaken the ecological improvement and restoration of Renuka and Riwalsar wetlands for conservation and propagation of their biotic resources.
- The Department of Agriculture is implementing various schemes relating to soil and water conservation of agriculture land in different parts of the state. The departments of Agriculture, Horticulture, Animal Husbandry, Forest and Rural Development have undertaken integrated watershed development programmes in the state.
- The Agriculture Department is now laying emphasis on the use of chemical fertilizers and other chemicals for the management of diseases and weeds and introducing high yielding varieties.
- The Horticulture Department is popularizing horticulture as profession in the state. Besides apple cultivation off-season, ornamental plants and the cultivation of medicinal and aromatic herbs/plants are being encouraged.
- In Animal Husbandry the initiatives include providing veterinary health services, improving low milk yielding cows and buffalo breeds at Block and Panchayat level with the introduction of improved breeds such as Jersey cows, Murrah buffaloes, Merino wool sheep and Angora wool rabbits.
- To improve the commercial fishing the fishermen have taken the initiative for reservoir harvests from Gobindsagar, Chamera and Pong Dam lakes through promotion of trout farming and the development of aquaculture in running water for which the Fishfarmer Development Agency has been constituted.

The following issues of concern have emerged as an outcome of the process carried out by the State Council to learn the issues/problems (gaps) pertaining to different themes related to biodiversity, prepared by incorporating the views of academicians, technocrats, bureaucrats and participation of stakeholders from all walks of life for outlining strategies and action for conservation of biodiversity in the state which are as follows:

(a) Forestry and Wildlife:

i) Issues of Concern:

- Lack of adequate information regarding the status of wildlife and forest biodiversity in the state.

- Lack of adequate co-ordination and cross-sectoral exchange of information concerning wildlife and forest biodiversity.
- There is a general lack of expertise within the state for identifying of wild flora and fauna.
- Current conservation efforts focus only on macro flora and fauna – lower animals and plants are ignored.
- Inadequate funds for the conservation of undomesticated biodiversity.
- Inadequate involvement of stakeholders in forming policies and legislation relevant to wild biological diversity.
- Education and awareness programmes regarding wild and forest biodiversity are restricted to schools, colleges and institutions in the urban areas only.
- Human -Wildlife conflict resolution.
- Need for identification and maintenance of biodiversity ‘hotspots’ and heritage sites in the state.
- Lack of adequate facilities for *ex-situ* propagation and reintroduction of fast disappearing wild flora and fauna in the state.
- No information available about the impact of developmental projects on wild floral and faunal diversity and also their tolerance to various pollutants.

ii) Strategies Required:

- Establishment of biodiversity sample plots and areas for long term monitoring and data collection.
- Develop databases and make them available in the public domain.
- Ensure that data, concerns and action regarding biodiversity conservation are available to all agencies and key actors / sectors.
- Develop capacity within scientists and researchers in the state to take up taxonomic study and research related to wild biodiversity.
- Extend focus to lower wild animals and plants as well as to micro flora and fauna.
- Acknowledge biodiversity conservation as a priority sector and earmark a specific percentage of the budget for such schemes.
- Inform, train and encourage local communities to voice their concerns and actively participate in planning and strategy formulation.
- Extend such programmes to all communities, particularly in rural areas.
- Include chapters on wildlife and biodiversity in all school curricula.
- Extend education and awareness amongst villagers regarding the importance of wildlife conservation and how to avoid conflict.

- Wetlands, grasslands, special habitats to be identified and declared nature heritage sites.
- Create and strengthen facilities for *ex-situ* conservation and reintroduction of endangered flora and fauna.
- Wildlife and forestry studies to form an essential component of impact assessment prior to approval for establishing industries in the state.

iii) Action Required:

- All concerned departments to compile available information and make it available on-line.
- Develop a nodal agency for the collection, compilation and dissemination of all biodiversity related data and information.
- Strengthen taxonomy departments in universities and research institutions.
- Sponsor taxonomic research on wild biodiversity.
- Support scholars taking up wild animal and plant taxonomy in universities and institutes.
- Initiate studies on the status and vulnerability of lower animals and plants and draw up plans for their conservation.
- Departments engaged in land based activities to include schemes for wild biodiversity conservation in their plans, and seek for funding state and central sponsored schemes.
- State to earmark adequate budget for wild biodiversity conservation.
- Identification of stakeholders for wild biodiversity conservation.
- Hold awareness and training workshops at various levels.
- Adopt a Participatory Forest Management process in all planning and policy formulation activities.
- Revise curricula to include chapters on the importance of biodiversity.
- Hold workshops, seminars and meetings on a regular basis at Panchayat and Block levels.
- Train stakeholders to adopt measures for conservation of local biodiversity.
- Formulate clearcut policy and guidelines relating to the extension of human activities in forest/wildlife habitats.
- Initiate studies on modified wild animal behaviour.
- Review existing policies relating to the management of wildlife populations in the state.
- Identify 'hotspots' of wildlife and forestry.
- Carry out status surveys of wild biodiversity.
- Amend existing legislation, if necessary, to protect such areas for posterity.

- Create nurseries and captive breeding facilities in various agro-climatic and ecozones in the state.
- Take up scientific studies on these aspects.

(b) Farming and Biodiversity:

i) Major Issues of Concern:

- Lack of understanding of traditional farming practices leading to erosion of agro-biodiversity in all agro-climatic zones.
- Intangible values do not figure in the planning process.
- Lack of adequate information on the vulnerability of communities to biodiversity change.
- Lack of incentives for the conservation of on farm biodiversity.
- Lack of policy for compensation for loss of agro-biodiversity due to development activities such as roads, dams and industries.
- Lack of policies on discouraging the damagers and polluters of biodiversity directly or indirectly.
- Lack of an effective market mechanism for diverse agriculture produce.
- Inadequate exploitation of available water resources for irrigation.
- Lack of grazing policy.
- Exotic weeds, namely *Lantana camara*, *Ageratum* spp, *Eupatorium* spp and *Parthenium* spp, are spreading rapidly in agriculture lands.
- Agro-biodiversity-based cottage/ small industries not receiving state recognition.
- Inclination of farmers towards monoculture.

ii) Strategies Required:

- To sensitize farmers, planners, administrators and extension workers.
- Stakeholders should participate in the planning process.
- Economic values of biodiversity, tangible and intangible, should form an integral part of all planning processes.
- To assess the impact of biodiversity change.
- Develop an index of community sensitivity to biodiversity change.
- Make policy and legal provisions to encourage conservation of biodiversity on farms.
- Develop policy and guidelines for users to compensate for the loss of diversity on government as well as private lands.

- Develop local markets for traditional produce (local crops).
- To improve irrigation facilities.
- Grazing policy should be enunciated with the involvement of stakeholders.
- Create awareness amongst the stakeholders.
- Develop and demonstrate technology for the control of weeds.
- Explore use of weeds for income generation.
- Recognition of agro-based cottage industries by the government.
- Frame policy for agro-based cottage industries and generate more jobs.
- Inventory of agro-based cottage small industries in the state.
- Inventory and evaluation (nutritional and medicinal) of useful wild edible foods and fruits.
- Optimization of traditional and modern agriculture.
- Diversification of agri-horticultural crops base in order to achieve sustainability.
- Documentation and bio-mapping of wild species of crop plants.
- Conservation of wild species.
- Using wild species in research programmes.

iii) Actions Required:

- Documentation of traditional farming practices and indigenous knowledge related to agro-biodiversity.
- Creation of awareness through workshops, group meetings and training.
- Encourage on farms conservation of traditional crops.
- Maintain gene banks of traditional agro-biodiversity on government farms.
- Economic evaluation of agro-biodiversity.
- Integration into the project/programme process for the conservation of farming and biodiversity.
- To identify communities that are most vulnerable to biodiversity loss and change.
- Classify them according to the community sensitivity index.
- Evaluation of existing legal framework and the laying down of policy and legal guidelines.
- Provide incentives and disincentives.
- Impact assessment and valuation of diversity loss.
- Create standard norms for fixing compensation.
- Strengthen co-operative mechanism for production and marketing.
- Create facilities for the procurement of traditional farm produce.
- State level PDS should procure and distribute the produce.

- Develop technologies and evolve schemes for rainwater harvesting and provide rainwater harvesting trainings to farmers.
- Study existing grazing practices and pressures and also the problems.
- Initiate the consultation process with stakeholders.
- Organise group meetings and workshops for the stakeholders.
- Prepare education and publicity material for use by common stakeholders.
- Initiate formulation of policy for recognition and making environment friendly agro-based cottage and small industries popular.
- Prepare an inventory for the establishment of agro-based cottage and small industries.
- Awareness generation on food and agriculture values.
- Collection of ethno-botanical information and generation of literature on ethno-botanical awareness (particularly in local language).
- Organic farming and use of bio-fertilizer be popularized and encouraged.
- Optimum use of chemicals in agriculture and horticulture.
- Orientation of farmers through extension agencies.
- Revival of traditional crops.
- Make lesser known economic plants commercially viable.

(c) Animal Husbandry and Biodiversity:

i) Major Gaps in Animal Husbandry:

- Animal biodiversity in the state is a result of centuries of careful observation and innovative experiments by the livestock rearers, and no information register has been prepared provenance (source), characteristics and uses of domesticated biodiversity.
- Ethno-veterinary practices among tribal and migratory shepherds and gaddis-documentation is lacking.
- Link of livestock rearing farmers with suitable markets for new animal-based products through diversification are lacking.
- Re- synthesis of technological package not carried out.
- Deletion of those items of technology from the general package which are not relevant or suitable for a particular animal system.
- Addition of new technological practices which are specific to that particular area/location.
- Addition of all those indigenous technological options which are evolved from other sources of innovation in the state by progressive farmers.
- Motivation of livestock farmers/ rearers through exposures is lacking.

- A loss of local animal genetic resources has been experienced in the state.
- The cause for replacement of local livestock breeds is because of their low productivity.
- Vulnerability of wild fauna to communicable diseases from domesticated animals.
- Low use of animal biodiversity for commercial purposes.

ii) Strategies Required:

- Develop computerized knowledge and information system relating to the provenance (source), characteristics and uses of biodiversity through priority funding programmes.
- To develop a state information register which would prevent bio-piracy and encourage continued use and up-gradation through continuous R & D.
- Document prevailing ethno-veterinary practices among tribal and migratory shepherds.
- Facilitate links of livestock rearing farmers with suitable animal based products through diversification.
- Motivation of livestock farmers to conservation and economic valuation of livestock biodiversity.
- Improvement of existing animal husbandry practices.
- Effective health management of livestock.
- Promotion of animal produce based industry, such as dairy, poultry, wool, meat, apiary, fishery, piggery and sericulture.

iii) Action Required:

- Register prepared for documentation of animal biodiversity for livestock rearing in the state for recording provenance, characteristics and use.
- Documentation to be done by undertaking research on ethno-veterinary practices prevalent in the state.
- Link to be established with suitable markets for animal based products.
- Re synthesis of technological packages need to be carried out.
- Organizing awareness cum training camps for the livestock rearers on these technological gaps.
- Livestock farmers need to visit to farms where these breeds are successfully maintained.
- Economic valuation of all local animal genetic resources.
- On-farm conservation.
- Documentation of reasons for low productivity.
- Research and extension of improved livestock practices.

- Disease surveillance.
- Veterinary dispensaries at Panchayat level.
- Application of ethno-veterinary knowledge at ground level.
- Mandatory vaccination of all livestock entering forests.
- Encourage cooperative management of financial support for the conservation of livestock biodiversity.
- Imparting technical knowledge on modern management practices.
- Linking production with marketing.

(d) Health and Biodiversity:

i) Major Issues of Concern:

- Inadequate information regarding relationship between health and biodiversity and its status.
- Inadequate co-ordination and adoption of appropriate technologies for propagation and conservation of health related bio-resources.
- Lack of adequate genuine planting material and R&D activities and extension in the field.
- Inadequate markets for cultivated biological resources.
- Certification issue is to be answered if long term marketing and sustainability of produce is to be ensured.
- Patenting of certified origin of knowledge or local technology must be pursued.

ii) Strategies Required:

- Survey, assessment and publicize biodiversity resources related to health in each agro-climate zone.
- Popularize cultivation of healthcare species.
- Standard package of practices for farming.
- Identification of nodal agencies for coordination.
- Encourage mass production of germplasm.
- Strengthen R&D on biodiversity relating to health.
- Provide financial and marketing support to growers.
- Standardize and assure quality control of medicines and food products based on biological resources.
- To assess the actual and future demand for bio-resources (domestic as well as global).
- To establish and strengthen buy-back arrangements.

iii) Action Required:

- Develop IEC education activities and programmes.
- Train personnel on IEC.
- Develop publicity and education material.
- Create bio-resource database.
- Establish herbal gardens, demonstration plots, farms and nurseries.
- Declare medicinal plant board as nodal agency.
- Train farmers in nursery practices, maintenance and mass production of medicinal plants.
- Involve R&D sectors of different institutions to develop a package of practices.
- Making arrangement for easy financing.
- Provide subsidized input to farmers.
- Develop standards for extraction, manufacturing procedure and practices for value addition.
- Assure genuine biological raw material.
- Strengthen R&D Institutions and Ayurvedic Pharmacies at Jogindernagar and Majra.
- Implement GMP and GLP.
- Identify demand pattern of drug industries (domestic as well as global).
- Develop extraction, semi-processing, value addition, manufacturing processes of medicines and food supplements based on biological resources.

(e) Aquatic Biodiversity :**i) Major Issues of Concern:**

- Inadequate data on aquatic life (macro and micro-organisms) and rare and unique species in temperate lakes and streams of HP.
- Danger to aquatic resources due to “developmental activities”.
- Ineffective implementation of laws relating to aquatic pollution.
- Illegal and / or unscientific fishing practices.
- Danger to existing indigenous fauna and aquatic ecosystem due to the introduction of numerous exotic species.

ii) Strategies Required:

- Initiate studies to document and catalogue rare and unique species in temperate lakes and streams of H.P.
- Policy on development should be consistent with the conservation of aquatic life.

- Strengthening establishments of effective mechanism for enforcement of legal provisions.
- Create awareness amongst the stakeholders.
- Enforce existing laws strictly.
- Develop policy and guidelines on introduction of exotics in aquatic systems in the state.

iii) Actions Required:

- Formulate research projects.
- Carry out studies to identify varied existing aquatic farms in the state.
- Identify sensitive areas for taking up remedial measures.
- Creation of multi-disciplinary task force.
- Strict enforcement of laws.
- Regular monitoring.
- Production of literature for creating awareness.
- Review, strengthen and streamline legal framework and implementation mechanism.
- Creation of awareness among stakeholders.
- Conduct impact evaluation studies on introduced species compared with indigenous fauna and issue guidelines on them.

(f) Microbial Biodiversity:

i) Major Issues of Concern:

- Inadequate information on microbial diversity.
- Limited knowledge of beneficial microbes.

ii) Strategies Required:

- Documentation of microbial diversity in different ecosystems.
- Listing and evaluation of beneficial microbial diversity.

iii) Action Required:

- Survey and identification.
- Documentation on fungi, bacteria, algae and viruses.
- Screening and documentation.
- Development of suitable technologies for propagation and use.

(g) Livelihood, Lifestyle and Biodiversity:**i) Major Issues of Concern:**

- Limited emphasis on biodiversity-based livelihood issues of nomadic graziers.
- Excessive exploitation of biodiversity for increased commercial benefits.
- Limited recognition of biodiversity-based cottage and small-scale industries.
- Limited documentation of biodiversity based livelihood activities.
- Villagers unaware of the need for conservation of biodiversity for sustained livelihood.

ii) Strategies Required:

- Forest policies to consider livelihood issues of nomadic graziers.
- Policy intervention for rational harvesting and conservation.
- Policies for sustainable harvesting of biodiversity.
- Policies needed to promote biodiversity and biodiversity-based cottage/small industries.
- Documentation of biodiversity-based livelihood issues necessary for creating awareness amongst people for the conservation of biotic resources.

iii) Action Required:

- Documentation of biodiversity-based livelihood issues necessary for creating awareness amongst people for the conservation of biotic resources.
- Reformulation of policies for rationalizing commercial benefits from biological resources.
- Creation of public awareness regarding the need for conservation of sustained resource availability.
- Establishment of small-scale biodiversity based-industries.
- Inventory of livelihood issues at local level.

(h) Culture and Biodiversity:**i) Major Issues of Concern:**

- Limited information on link between culture and biodiversity.
- Biodiversity and culture studied separately.
- Existing educational curricula lack information on cultural and biodiversity link.
- Lack of experts and resource people in the field of culture and biodiversity.
- Inadequate information, awareness and education about the agro-based culture in the state.
- Traditional knowledge of communities is not used.
- Inadequate documentation and recognition of sacred groves and limited effort in setting up of new sacred groves.

- Inadequate knowledge about existing systems, folklore and religious beliefs promoting biodiversity conservation.

ii) Strategies Required:

- Integration of biodiversity conservation with underlying cultural entities.
- Cultural and biodiversity links to be incorporated in curricula of schools, colleges and universities.
- Increased participation of ethnic communities in studies and research on the subject.
- Sacred groves to be maintained as sites for conservation of culture-related biodiversity recognize importance of sacred groves in the culture of the people and clearly frame a policy for their upkeep.
- Create awareness and understanding among people of the importance of traditional agro-based cultures.
- Document, disseminate and promote traditional knowledge.
- Investigate, document and publicise existing systems, folklore and religious beliefs promoting biodiversity conservation.

iii) Action Required:

- Documentation of information on links between culture and biodiversity.
- Identification and codification of animal and plant species related to culture.
- Formulation of policies and provisions to incorporate biodiversity activities in the education system.
- Addition of culture and biodiversity topics in existing curricula through policy and administrative provisions.
- Identification of ethnic communities with hereditary knowledge of culture and biodiversity links.
- Spread awareness regarding cultural heritage and biodiversity conservation links.
- Development of sacred groves through policy interventions.
- Documentation of the practices related to agro-based culture.
- Prepare biodiversity registers and maintain them at community and Panchayat level.
- Identify communities practicing traditional techniques and document their knowledge.
- Publicise and propagate the knowledge and skills amongst other stakeholders.
- Prepare inventory of existing sacred groves.
- Encourage the establishment of new sacred groves around places of worship in the villages.
- Recognize and reward the communities maintaining sacred groves.
- Publicise through newsletters and journals.

(i) Economics and Valuation of Biodiversity:**i) Major Issues of Concern:**

- There is no proper understanding of traditional farming systems.
- No information base of traditional ecosystems in marginalized tribal and remote areas.
- People are totally ignorant of the value of the genetic resources available to them.
- Limited documentation on traditional wisdom.
- No weight given to regional assessment and time horizons as important considerations for biodiversity valuation.
- Lack of people's participation in understanding the valuation process.
- Lack of valuation of impact of development projects on biodiversity.
- Social expectations and needs from the forest ecosystems are not clearly identified.
- Traditional forestry and biodiversity conservation focuses only on economic objectives.
- Limited information on community sensitivity and vulnerability to changing biodiversity.
- Absence of effective legal and regulatory framework along with provision of incentives for biodiversity valuation.

ii) Strategies Required:

- Understand and assess the temporal and spatial movement of genes and varieties into and out of the cropping system.
- Create understanding of biological resources and the human use of agro-biodiversity.
- Create awareness among farmers, and potential industrial users of the genetic resources, about the economic importance of biodiversity and genetic resources conservation.
- Recognize and document traditional ethos and wisdom.
- Provide for comprehensive, adequate and representative system of biodiversity valuation through regional assessments.
- Recognition of ethnically diverse mountain societies through assessment.
- Involve small farmers, nomadic graziers, pastoralists and progressive farmers, having different interests in effective valuation of mountain biodiversity.
- Include value of biodiversity threatened due development activities in the project cost and assess the loss in terms of their impact.
- Consider wider range of values and needs like commodity, amenity, environment quality, ecological, public use, spiritual and health heritage.
- Seek to develop an index of community sensitivity to change based on social indicator analysis.
- Integrate social, economical and environmental factors for the effective implementation of the legal and regulatory framework.

iii) Actions Required:

- Initiate studies on traditional farming systems of high altitude regions and remote areas.
- Study and document traditional practices in marginalized, remote and tribal areas for integrating social, cultural and economic aspects including their food habits the climate and available crop plant species.
- Launch an extensive awareness programme at block level regarding the economic importance of genetic resources and their conservation.
- Field surveys for documentation and publication of indigenous knowledge.
- Conduct regional assessments.
- Conduct ethnically diverse community based assessments.
- Document views of specific communities, groups, individuals and custodians of other biodiversity.
- Studies to be conducted on threatened plant and animal diversity, unique sites and habitats which are driven to extinction by public intervention and develop norms for valuing such losses.
- List social expectations from forests.
- Set priorities based on recognized ecological realities and expectations of all stakeholders.
- Identify communities that are more vulnerable to change in biodiversity due to their close links and develop an index of community sensitivity to change based on a social indicator analysis.
- Develop effective and implementable legal and regulatory framework.

(j) Policies, Laws and Institutions:**i) Major Issues of Concern:**

- Existing laws and policies in the state are merely *ad hoc* responses to emerging biodiversity problems.
- Lack of an effective central administrative mechanism at state level to deal with various aspects of bio-resource management and conservation.
- Inadequate documentation of indigenous knowledge and local traditions relating to conservation and uses of biodiversity.
- Inadequacy of facilities available for collaborative research on biodiversity matters in the state.
- Stakeholders are not involved while formulating policies and legislations relevant to biological diversity.

- Existing laws relating to biodiversity damage not stringent enough.
- Trade in some plant species is regulated but other less known or unknown species also need attention.

ii) Strategies Required:

- Establish a group of experts to evolve and implement a strategy for biodiversity valuation, management and conservation.
- Take up documentation of local customs, traditions and knowledge related to conservation and use of biodiversity.
- Develop facilities and encourage biodiversity related research in existing universities and R&D institutions.
- Policy that takes into account avoidance of human-animal conflict to be formulated.
- Inform, train and encourage local communities to voice their concerns and actively participate in planning and strategy formulation.
- Provide more stringent penalties for causing damage to or loss of biodiversity.
- Formulate rules under existing acts to regulate exploitation and trade in all plant and animal species.

iii) Actions Required:

- Formulate a comprehensive policy aimed at resource conservation, development, sustainable use and benefit sharing.
- Constitute a State Biodiversity Board and Local Biodiversity Committees to ensure conservation of biological resources.
- Conduct surveys and compile information on traditional customs and knowledge.
- Provide legislation to protect indigenous knowledge and recompense traditional practitioners for its sharing.
- Actively encourage collaborative research projects.
- Review existing policies relating to the management of wildlife populations in the state.
- Hold awareness and training workshops at various levels.

(k) Education, Awareness, Training and Research:

i) Major Issues of Concern:

- Teachers at primary and secondary level lack the requisite skills to relate the existing relevant content of the textbooks to biodiversity issues.
- Inadequate integration of biodiversity with existing botanical information in high school text books.

- Lack of biodiversity theme in extra-curricular activities like debates, quiz, essay writing, painting and competitions.
- School and college magazines have little information on biodiversity.
- Non-formal education lacks the contents of biodiversity conservation.
- Limited environmental awareness campaign with emphasis on biodiversity.
- Lack of co-ordination among various organizations undertaking research and extension on biodiversity.
- Limited interaction of children with nature.

ii) Strategies Required:

- Incorporate a module on biodiversity importance and conservation in teacher training programmes.
- Incorporate biodiversity concerns.
- Integrate biodiversity concerns with the extra-curricular activities conducted in schools and colleges.
- Encourage students to contribute articles in school and college magazines.
- Encourage maximum community participation in the discussions regarding local flora and fauna.
- Promote community action to protect and enrich biodiversity as part of the continuing education programme.
- Development of structured publicity programmes.
- Coordinate efforts to achieve the common objective of biodiversity conservation and use.
- Facilitate interaction of children with different forms of life.

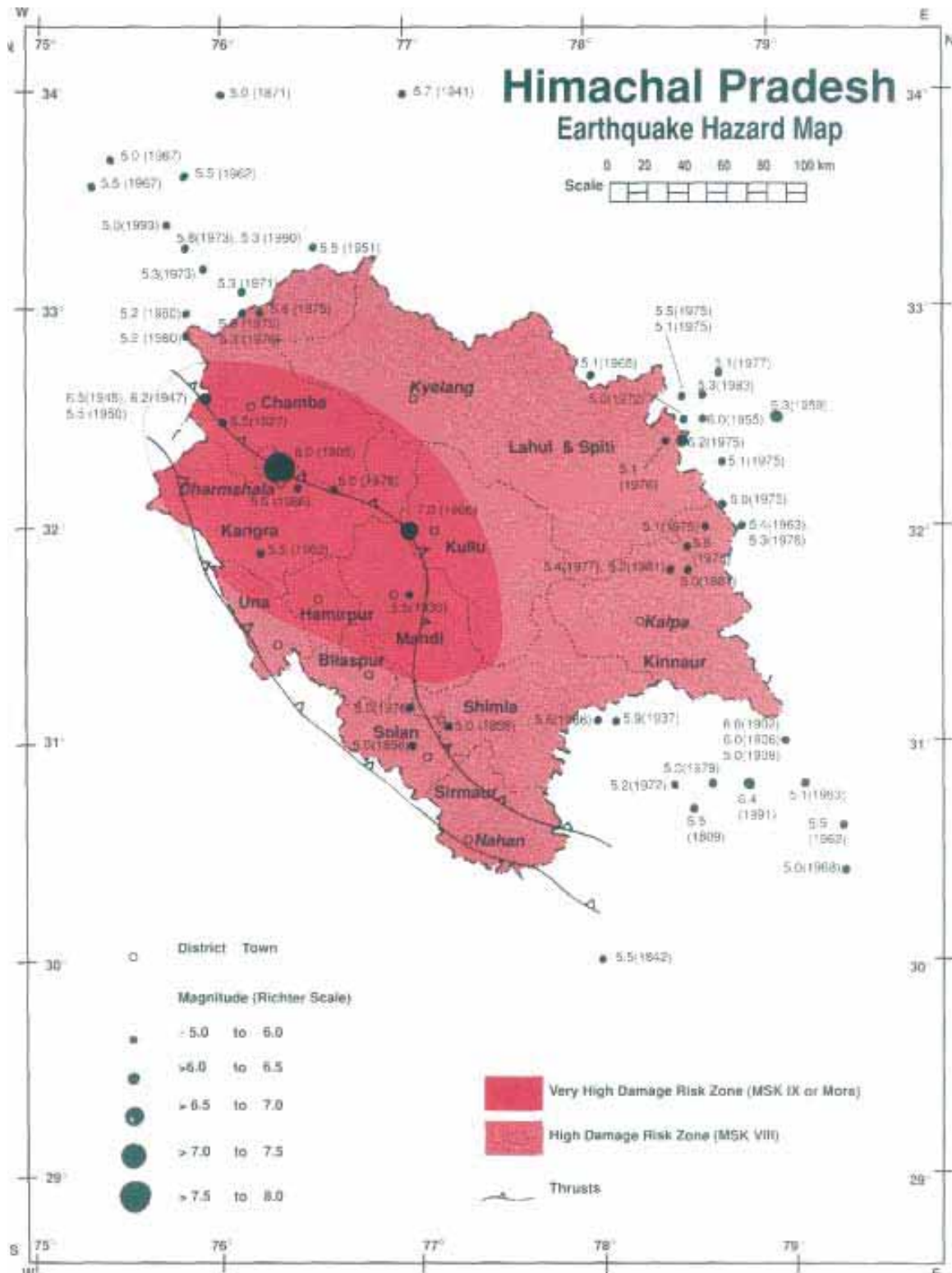
iii) Actions Required:

- Organize in-service programmes for teachers in teaching method with emphasis on biodiversity.
- Integrate a biodiversity component in existing high school course curricula.
- Motivate students by giving incentives to include themes related to biodiversity in their extra-curricular activities.
- Conduct awareness campaigns among students.
- Award prizes for best articles.
- Develop skills of literacy instructors in initiating community discussions on biodiversity concerns and integrating them with continuing education.
- Public awareness campaigns through audio-visual and print media.

- Organise seminars and workshops at different organizational levels to share recent research activities on biodiversity.
- Field trips to natural surroundings.
- Preparation of field guides.

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NATURAL DISASTERS AND CLIMATE CHANGE



Map 1.10 Earthquake Hazard Map of H.P.

Natural Disasters and Climate Change

Introduction:

The whole of the Indian subcontinent is susceptible to natural disasters of various kinds. It is said to be world's most disaster-prone area with 55% of the land vulnerable to earthquakes, 8% to cyclones and 5% to floods. In fact, the records over the years indicate that disasters have been on the increase both in terms of frequency and severity. Consequently there is a worldwide escalation in the damages and losses attributable to natural hazards. Though the nature and type of disasters are more or less same throughout the world yet the magnitude and intensity of the impact on society is not the same everywhere. It is the interaction of human activity and natural processes that determine the impact on each other. The poor section of the society living in developing countries is particularly vulnerable to natural disasters. The high vulnerability of such area is due to the lack of resources to avoid and deal with hazards.

Geology-related disasters, such as earthquakes, tsunamis and volcanic eruptions, are generally among the most destructive in terms of human lives lost and property damaged. In a global survey covering the period 1970-1997 prepared by the Swiss Reassurance Company, published in 1998: of the forty worst catastrophes in terms of fatalities listed, having caused over a million deaths, 48 per cent were inflicted by earthquakes. The fact that thirty of the forty above-mentioned catastrophes occurred in the ESCAP region (Economic and Social Commission for Asia and the Pacific) and 87 per cent of the casualties highlights the importance of this issue for the countries of this region. The table given below eloquently explains the relative vulnerability of developing countries with respect to geologically related hazards.

Table 4.39: Relative Intensity of Geology-related Hazards faced by some Developing Countries in Asia

Country	Earthquakes	Tsunamis	Volcanoes
Bangladesh	L	L	-
China	S	L	-
India	M	L	-
Indonesia	S	L	M
Islamic Republic of Iran	S	-	-
Nepal	M	-	-
Pakistan	S	-	-
Philippines	S	L	M
Thailand	L	-	-
Vietnam	L	-	-

S = severe M = moderate L = Low

Source: Asian Disaster Preparedness Centre

Mountain areas are especially vulnerable to natural disasters where development over the years has further accentuated the problem by upsetting the natural balance of various physical processes operating in mountain eco-systems. The increased pressure on the mountain environment has contributed in some measure to environmental problems such as landslides, land subsidence, removal of vegetation and soil erosion. According to one estimate, about 58.36 % of the land is subjected to intense soil erosion, majority of which is located in the Himalayas. An estimation of the sedimentation rate of the major river systems of the area depicts the seriousness of the erosion. According to one estimate, the Satluj watershed produces an average silt of 6 million tons, which has an average increase rate of about 40% every five years, and the Beas catchment has an average annual silt production rate of 19.35 million tons, with an increase rate of 46% in five years. However, on average about 28t/ha/yr of soil is removed in Himachal Pradesh.

4.1 Disasters in Context of Himachal Pradesh:

Himalayas, which were formed about 45 million years ago when the Indian Plate collided with Eurasian Plate at the rate of 15cm per year. The stress was great between the plates that caused earthquakes of high magnitude. The Indian Plate is still moving northwards today into the Eurasian Plate at the rate of about 2cm per year. Because of this the Himalayas are rising at the rate of about 5mm per year. This means that the Himalayas are still geologically active. When two plates move sideways against each other (at transform plate boundary), there is tremendous friction, which makes the movement jerky. The plates slip, then stick, as the friction and pressure build up to incredible levels. When the pressure is released suddenly, and the plates jerk apart, the result occurrence of an earthquake. For this reason, earthquakes are frequent in the entire Himalayan region.

The state of Himachal Pradesh, which forms part of the Northwestern Himalayas, is environmentally fragile and ecologically vulnerable. Geologically the Himalayas are considered to be the youngest mountain chain in the world and are still in the building phase. Natural hazards are a matter of immediate concern to the state of Himachal Pradesh as every year the state experiences the fury of nature in various forms-like earthquakes, cloudburst, flash floods, landslides, snow avalanches droughts etc. The fragile ecology of the mountain state coupled with large variations in physio-climatic conditions has rendered it vulnerable to the vagaries of nature. The incidence of cloudbursts in the last few years has baffled both the meteorologist and the common man equally. Notwithstanding, the continuous efforts made by the government to cope with natural hazards through relief and rehabilitation measures, landslides and snow avalanches continue to inflict widespread harm and damage to human life as well as property. The roads that are the state's lifeline are repeatedly damaged, blocked or washed away by one or other acts of nature. In the circumstances the government have to divert the already scarce resources of the state for relief and rehabilitation measures as opposed to long-term development.

The state as a whole is vulnerable to different kinds of disasters, natural as well as man-made in nature. The major natural disasters or hazards which the state has experienced over the years are as follows:

Earthquakes**Flash floods****Avalanches****Landslides****Cloud bursts****Hailstorms/Droughts**

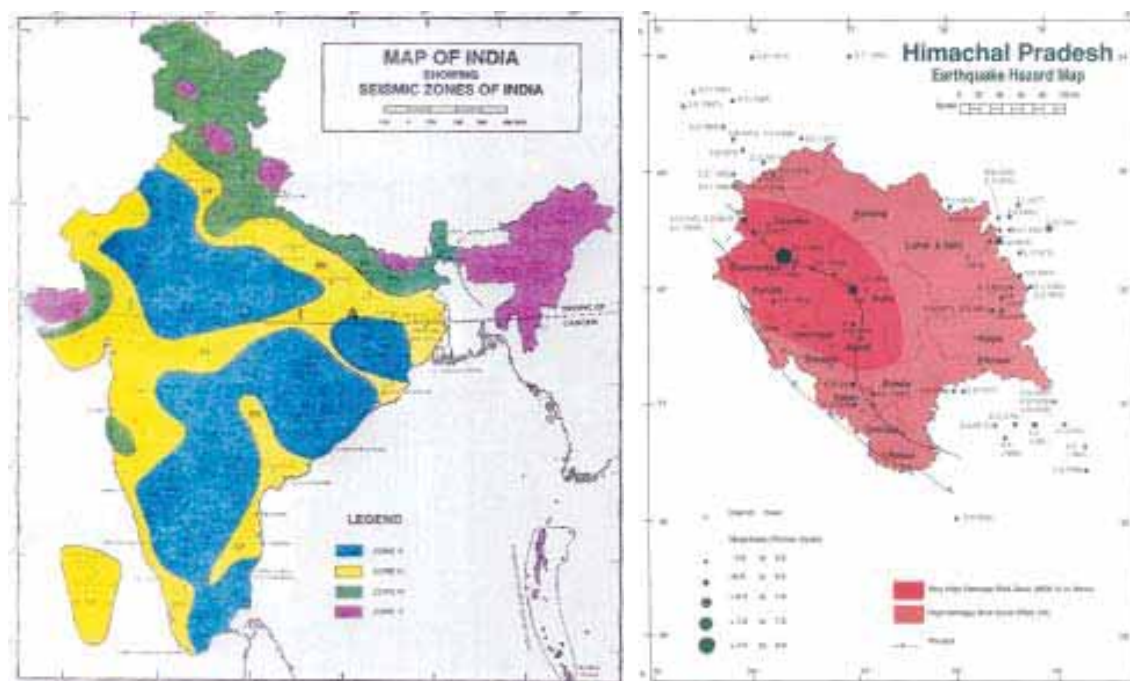
Besides these major natural disasters there are certain man made disasters which pose a great threat to the state as a whole:

Air accidents**Boat capsizing****Electric fires****Serial bomb blasts****Rail or road accidents****Building collapse****Forest fires**

4.2 Major Natural Disasters in Himachal Pradesh:

a) Earthquakes:

From a seismic point of view Himachal Pradesh is considered to be very sensitive as it falls in zone V and IV as per the Seismic Zoning Map of India contained in IS: 1893-1984 Fourth Revision. Earlier there were five seismic zones which have been further narrowed to four zones now. According to the Foreword to the seismic code IS: 1893-1984, the general basis of zoning is as follows:



Map 1.11 Seismic Zoning Map of India : Seismic Zoning Map, Himachal Pradesh

Zone V: Covers the areas liable to seismic intensity IX and above on Modified Mercalli

Intensity Scale. This is the most severe seismic zone and is referred to as the Very High Damage Risk Zone.

Zone IV: Gives the area liable to MM VIII. This zone is second in severity to zone V. This is referred to as the High Damage Risk Zone.

Zone III: The associated intensity is MM VII. This is termed the Moderate Damage Risk Zone.

Zone II: The probable intensity is MM VI. This zone is referred to as the Low Damage Risk Zone.

From the perusal of seismic zoning map of Himachal Pradesh it is seen that 32 % of the total geographical area is prone to the severest seismic risks as it falls into the Very High Damage Risk Zone V. It was subjected in 1905 to one of the most giant earthquakes of the recorded seismic history of India having a magnitude of 8.0 on the openended Richter Scale in which 20,000 people lost their lives, the towns of Kangra and Dharamshala were razed to the ground and no government functionary was left alive to report the happening to the higher authorities. It shook an area of more than 416000 km² in and around the present Himachal Pradesh. A maximum Intensity X on Rossiforel Scale was observed in the epicentral area which, when interpreted on the new current Modified Mercalli Scale, would be between X and XI. There have been 250 earthquakes of magnitude 4.0 and more including more than sixty earthquakes with magnitude 5.0 or more, which rocked the state of H.P. and adjoining areas of J&K and Uttranchal Pradesh in the last 90 years. The Kinnaur earthquake of January 19, 1975 (M=6.7) and the Dharamshala earthquake of April 26, 1986 (M=5.7) are well recorded in respect of damages caused and losses incurred. A list of earthquakes of M=4.0 or more is given in Table 4.40 which had their epicentres either within or close to the state boundary.



(Source: Memoir Geological Survey of India)

Palampur Town and Kangra Temple after Kangra Earthquake (1905)

Table 4.40 : Earthquakes having magnitude 4 or more on the Richter Scale in Himachal Pradesh during the last 200 years

S.No.	Year	Month	Day	Magnitude	Coordinates	Tentative location
1.	1809	-		5.5	30°42'00" 78° 30'00"	Near Labrang (Distt.Kinnaur)
2.	1827	9		5.5	32°30'00" 76°00'00"	Near Dalhousie (Distt. Chamba)
3	1856	4	7	5.0	31°00'00" 77°00'00"	Near Ranhog (Distt. Solan)
4	1858	8	11	5.0	31°7'12" 77°10'12"	Shimla (Distt.Shimla)
5	1865	4	11	—		Shimla region
6	1905	4	4	8.0	32°18'00" 76°15'00"	Karari Dal (Distt. Kangra)
7	1906	2	28	7.0	32°00'00" 77°00'00"	Near Karshing (Distt.Kullu)
8	1930	5	11	5.5	31°42'00" 77°00'00"	Shila Kiepr (Distt. Mandi)
9	1940	4	07	—	31 05 77 00	Near Kali Hatti Distt. Shimla
10	1945	6	22	6.5	32°36'00" 75°54'00"	Minu (Distt. Chamba)
11	1947	7	10	6.2	32°36'00" 75°54'00"	Minu (Distt. Chamba)
12	1950	8	12	5.5	32°36'00" 75°54'00"	Minu (Distt. Chamba)
13	1951	9	22	6.4	32 36 76 30	East of Dhan Kanda (Distt. Chamba)
14	1962	9	15	5.5	31°54'00" 76°12'00"	Near Dehra Gopipur (Distt. Kangra)
15	1965	2	21	4.5	32 14 76 54	Near Bara Banghal (Distt. Kangra)
16	1967	9	20	—	32 36 76 06	Near Rajpura (Distt. Chamba)
17	1968	5	11	4.9	32 22 76 22	Near Atrori, (Distt. Chamba)
18	1969	1	23	4.0	32 14 76 03	Near Trilokpur (Distt. Kangra)
19	1970	3	05	4.9	32 24 76 29	Near Sani (Distt. Chamba)
20	1972	1	29	4.7	32 51 75 54	
21	1973	12	16	4.9	32 17 76 01	Near Mordhu (Distt. Chamba)

S.No.	Year	Month	Day	Magnitude	Coordinates	Tentative location
22	1974	11	16	4.8	32 50 76 08	Tissa (Distt. Chamba)
23	1975	10	30	5.2	32 54 76 00	Near Bhujara (Distt. Chamba)
24	1975	12	11	5.1	32 50 76 58	Near Jankar (Sumdo, Lahaul & Spiti)
25	1975	12	10	5.0	32 49 76 11	Near Chhajaut (Distt. Chamba)
26	1975	1	19	6.7	31°56'24" 78°31'48"	Distt. Kinnaur
27	1975	2	2	5.1	32°33'36" 78°53'00"	Indo China Border
28	1975	7	19	5.1	31°57'00" 78°35'24"	Near Chnago (Distt. Kinnaur)
29	1975	7	29	5.5	32°34'12" 78°29'24"	Near Kanum (Distt. Kinnaur)
30	1975	2	10	5.3	32°57'00" 76°06' 00"	Near Janu Pass (Distt. Chamba)
31	1975	2	11	5.0	33°00'00" 76°10'12"	Near Sathrundi (Distt. Chamba)
32	1976	1	7	5.3	32°58'12" 76°7'12"	Dunchili Gad (Distt. Chamba)
33	1976	1	09	4.7	32 59 76 01	Along J&K Border
34	1976	2	05	5.0	31°14'24" 77°01'48"	Near Chebri (Distt. Shimla)
35	1976	4	10	4.5	32 43 76 30	Near Balthal Got (Distt. Chamba)
36	1976	4	16	4.0	32 52 76 00	Near makkan, (Distt. Chamba)
37	1976	7	6	5.1	32°26'24" 78°21'00"	Near Raksham (Distt. Kinnaur)
38	1976	9	8	5.3	32°14'08" 78°45'36"	Near Baspa origin (Distt. Kinnaur)
39	1977	2	19	5.4	31°48'00" 78°25'48"	Near Rangbar Thachang (Distt. Kinnaur)
40	1977	3	27	5.1	32°40'12" 78°39'36"	Lenchichi (Distt. Kinnaur)
41	1978	6	14	5.0	32°14'24" 76°36'36"	Near Singhau Pass along Kangra Border (Distt. Chamba)
42	1979	1	19	4.1	32 22 76 28	Near Chandota Pass (Distt. Chamba)
43	1980	5	29	4.2	31 33 76 33	

S.No.	Year	Month	Day	Magnitude	Coordinates	Tentative location
44	1980	9	4	4.0	32 00 76 54	Near Pajaund (Distt. Mandi)
45	1980	11	26	4.0	32 29 76 24	Near Khaddar (Distt. Chamba)
46	1981	2	14	4.0	32 35 76 37	Near Bara Kanda (Distt. Chamba)
47	1981	6	19	4.5	32 43 76 00	Near Lohari (Distt. Chamba)
48	1981	6	13	5.0	31 ⁰ 49'12" 78 ⁰ 27'36"	Nalpaya Thach (Distt. Kinnaur)
49	1981	5	28	5.2	31 ⁰ 49'48" 78 ⁰ 25'48"	Barling (Distt. Kinnaur)
50	1982	5	18	4.0	32 25 76 24	Near Chagrauta (Distt. Chamba)
51	1983	2	27	5.3	32 ⁰ 36'00" 78 ⁰ 34'12"	Khadi Thach (Distt. Kinnaur)
52	1983	4	13	4.0	32 46 76 14	Near Tikkri Khas (Distt. Chamba)
53	1985	3	11	4.8	31 15 77 00	Near Malaun (Distt. Shimla)
54	1985	12	29	4.9	32 37 76 06	Near Theru (Distt. Chamba)
55	1986	4	26	5.5	32 ⁰ 19'00" 76 ⁰ 24'00"	Near Nag Dal (Boundary of Chamba and Distt. Kangra)
56	1987	06	10	4.7	31 55 76 26	Near Daton (Distt. Chamba)
57	1987	12	26	4.3	32 07 76 41	Near Dewal Khas (Distt. Kangra)
58	1991	6	23	4.6	32 18 76 42	Near Gataunda (Distt. Shimla)
59	1992	1	26	4.5	32 16 76 24	Near Bhagsu Nath (Distt. Kangra)
60	1992	2	13	4.5	32 37 76 30	East of Dhan Kanda (Distt. Chamba)
61	1992	9	6	4.6	32 25 76 20	Near Darkund (Distt. Chamba)
62	1996	5	9	4.0	32 50 76 19	Near Kuntka Matha (Distt. Chamba)
63	1996	5	23	4.2	32 42 76 29	Near East of Kagal Dhar (Distt. Chamba)
64	1996	7	14	4.1	32 37 76 31	Near East of Dhan Kanda (Distt. Chamba)
65	1996	9	14	4.6	32 49 76 22	Near Kala Ka Bhandar (Distt. Chamba)

S. No.	Year	Month	Day	Magnitude	Coordinates	Tentative location
66	1997	7	29	4.7	31 33 76 48	Near Baldwara (Distt. Mandi)
67	1997	8	13	4.2	31 12 76 41	Near Jajjar (Distt. Solan)
68	1998	10	17	4.5	32 12 76 32	Near Kandha (Distt. Kangra)
69	1999	5	30	4.9	31 48 36 78 54 36	Near Miyang Lung (Distt. Kinnaur)
70	1999	1	8	4.2	31 26 24 77 18 00	Near Mehog (Distt. Mandi)
71	1999	5	30	4.9	31 48 36 78 54 36	Near Miyang Lung (Distt. Kinnaur)
72	1999	1	8	4.1	31 22 48 77 17 24	Near Karsog (Distt. Mandi)
72	2000	4	28	4.1	31 30 36 78 15 00	Near Mehbar (Distt. Kinnaur)
73	2000	8	28	4.5	32 01 48 78 18 00	
74	2000	9	26	4.0	30 55 12 75 39 00	
75	2000	6	17	4.3	31 48 00 78 27 00	Near Nalpaya, (Distt. Kinnaur)
76	2001	6	17	4.2	32 42 36 78 26 24	
77	2001	1	22	4.0	31 04 12 77 55 48	Along Uttranchal Border
78	2001	2	23	4.0	30 55 48 78 00 00	Along Uttranchal Border
79	2001	9	18	5.1	33 13 12 75 36 36	
80	2001		14	4.7	32 31 12 76 06 00	Near Pundla (Distt. Chamba)
81	2001		23	4.6	33 07 12 75 40 12	
82	2002	1	27	5.1	33 06 36 75 49 48	
83	2002	3	17	4.1	32 46 48 75 55 48	
84	2002	2	17	4.1	33 06 00 75 40 48	

(Source: IMD: India Meteorological Department, DLDH- Oldam (1883), ISS: International Seismological Summary, PDE: Preliminary Determination of Earthquakes).

It is also seen that according to the seismic zoning map of the state, five districts, namely Chamba, (53.2%) Hamirpur (90.9%), Kangra (98.6%), Kullu (53.1%) and Mandi (97.4%) have 53 to 98.6 percent of their area liable to the severest designed Intensity of MSK IX or more, the remaining area of these districts being liable to the next severe Intensity VIII. Two districts, Bilaspur (25.3%) and Una (37.0%) also have a substantial area in MSK IX and the rest in MSK VIII. The remaining districts Shimla, Lahaul & Spiti, Sirmour, Kinnaur and Solan are liable to Intensity VIII. As a whole nearly 31.94 % of the total geographical area of the state falls in the high seismic risk zone.

Unfortunately, in spite of the probable maximum seismic intensities being high, the house types mostly fall under Category A, consisting of walls of clay mud, unburnt brick or random rubble masonry without any earthquake resistant features. The percentage of various building types in each district can be seen in the Table below. It is observed that the category A houses account for a very high percentage in almost all districts. Now all such houses are liable to total collapse if an intensity IX or more earthquake actually occurs in future and will suffer severe damage called “destruction” with very large cracks and partial collapse even in Intensity VIII areas. Also the burnt brick houses classified as Category B as built in Himachal Pradesh, do not have the earthquake resisting features, namely, good cement mortar, seismic bands and roof-typing etc. Therefore, they are also liable to severe damage under Intensity IX, as well as in VIII, whenever such an earthquake occurs. This became quite evident even in the M 5.7 Dharamshala earthquake of 1986.

Table 4.41: Districts with Earthquake Intensities and Building Types

Sr. No.	Name of District (Total No. of Housing Units)	MSK IX or More %area	MSK VIII % area	A Cat (clay)	A-Cat (stone)	B-Cat (brick)	C-Cat Reinforced buildings, well built wooden structures	X-Cat Other types not covered in A,B,C These are generally light
1.	Kangra (397728)	98.6	1.4	75.60	5.77	16.19	0.72	1.72
2.	Mandi (313362)	97.4	2.6	19.12	73.90	3.47	3.14	0.37
3.	Hamirpur (144408)	90.9	9.1	77.25	8.47	13.40	0.33	0.56
4.	Chamba (145344)	63.2	36.8	7.95	84.30	3.25	3.03	1.46
5.	Kullu (123455)	53.1	46.9	1.22	88.69	3.00	6.80	0.30
6.	Una (129538)	37.0	63.0	47.96	4.72	44.86	0.59	1.87
7.	Bilaspur (111107)	25.3	74.7	48.35	40.23	9.33	1.24	0.86
8.	Solan (139261)	2.4	97.6	29.97	39.09	28.24	1.25	1.45
9.	Lahaul & Spiti (14521)	1.1	98.9	31.83	64.24	0.14	1.02	2.77
10.	Kinnaur (39351)	—	100.0	0.36	73.41	1.31	22.64	2.28
11.	Shimla (266871)	—	100.0	8.68	69.96	12.96	6.88	1.52
12.	Sirmour (150990)	—	100.0	8.29	74.45	13.46	1.02	2.77

(Source : Vulnerability Atlas of India of Himachal Pradesh, 1997)

In one of the case studies carried out by Professor Arya, the damage potential of an earthquake of magnitude 8.0 on the Richter scale to the housing in Kangra district has been worked out by referring to what happened during the 1905 earthquake. The potential damage to various types of houses has been reckoned for a hypothetical earthquake with a magnitude of 8.0 on the Richter scale based on the 1991 census. The following scene has emerged:

(a) Completely collapsed houses	1,36,000
(b) Those partly destroyed and partly with large and deep cracks which require reconstruction	2,63,000
(c) Those without total or partial collapse but with large cracks. Some of these may have to be reconstructed but most require 15 to 20% of the cost of reconstruction.	9,16,000
(d) Those with small cracks, repairable with evacuation	3,58,000
(e) Those with only fine cracks or no damage	1,43,000
(f) Number of potential deaths	65,000

Economic losses may amount to Rs. 5000 Crores besides the amount spent on relief and temporary shelter (Price index of 1997).

If, on the other hand, all such houses were initially built with earthquake resistant feature in kutchha as well as pukka houses, the damage scene will change as follows:

Total collapsed houses	8,300
Destroyed with partial collapse	95,000
Deep large cracks	3,12,400
Small cracks	6,48,000
Estimated loss of human lives	12,000

Economic loss estimated is reduced to Rs.1960 Crores. Besides the cost of relief and temporary shelter will also be reduced to one third of the above.

The same benefit of seismic resisting features can be derived in the case of existing housing pattern in all the districts, if the existing unsafe houses are refitted to upgrade their seismic safety. Post construction refitting will, however, cost 2.5 to 3 times more than seismic resisting features in new constructions of similar types.

Thus, large losses of totally damaged houses can be minimized and loss of life reduced to less than one fifth, only if refitting of existing houses and buildings is adopted as a government strategy for earthquake disaster prevention.

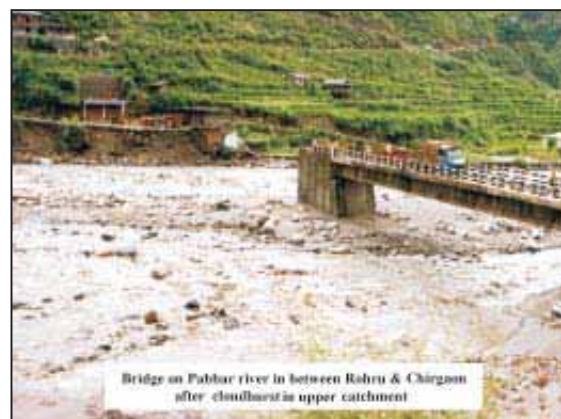
The relationship between the seismic intensity and maximum damage to the buildings has been assessed as below:

Table 4.42: Seismic Intensity and Maximum Damage to Buildings

Building Type	Intensity VII	Intensity VIII	Intensity IX
Mud and Adobe houses, random stone construction	Most have large deep cracks. Few suffer partial collapse	Most suffer partial collapse	Most suffer complete collapse.
Ordinary brick buildings, buildings of large blocks and prefab type, poor half timbered houses	Many have small cracks in walls.	Most have large and deep cracks	Many have partial collapse. Few complete collapse.
Reinforced buildings, well built wooden buildings	Many have fine plaster cracks.	Most may have small cracks in walls, Few may have large deep cracks	Many may have large and deep cracks, Few may have partial collapse

Most=about 75%**Many** =about 50%**Few**=about 5%**(b) Floods:**

Floods are another form of natural disaster which the state experiences every year. Due to the diverse topography of the area, the flood problem in the state is largely isolated in nature. High monsoon rains in the area of the Shiwalik and lower and mid Himalayan ranges cause extensive floods during rainy seasons. In the upper reaches of the Beas and Satluj valley the main problems are flash floods and bank erosion because of the steep slopes of rivers and high river flows due to heavy rains. Often the flash caused due to cloudbursts, glacial lake outbursts and temporary blockade of the river channels have been also observed. As a result of breaches in embankments and damage to various utilities such as irrigation /flood control schemes and houses are also observed.



The rivers of importance from flood damage angle are-

- **The River Satluj and its tributaries like Spiti, Baspa river, Surkhad, Gambhar khad, Sir khad, and Swan river.**

- **The River Beas and its tributaries Uhl, and Suketi khad, Parbati and Neogal khad.**
- **The River Ravi and tributary Siul.**
- **The River Yamuna and its tributaries Pabbar, Giri and Bata khads.**

As a consequence of flood damage to public property and public utilities is a common phenomenon. As per available records during the floods of 1990, 89, 88, 85, 78 and 1971 considerable damage was caused to housing and infrastructure. The details of past damage caused from floods in the state can be seen in Table 4.43.

Table 4.43: Some of the devastating Floods, which caused heavy damage to Private as well as Public Property in Himachal Pradesh

Sr.No.	Prominent Flash Floods	History of Damage Occurred
	8 July 1973	Lake formed by the blockage of Satluj river due to Nathpa rock fall damaged Sanjay power house, loss of about Rs.45 million estimated.
	In Satluj basin two blockages were observed in Spiti valley. One on Parechu River between Sumdo and Kaurik due to landslide created by 19 Jan. 1975 earthquake, which occurred along the Sumdo-Kaurik fault. Blockage was 60m in height and 150m in length created temporary lake. In March this lake burst causing flash floods in Spiti valley.	
	On 29th Sept. 1988 (2.30 a.m.) a flash flood occurred due to cloud burst in Soldang khad causing huge damage to property.	Caused heavy loss of life and property in the Soldang village • Washed away the Bhabanagar water works Washed away 2 km of NH-22 across Soldan khad • Created landslides along the eastern slopes of Soldan khad and damaged road to Ponda • Lake was formed on the Satluj river near confluence • Block stopped the flow of Satluj river for about 30 minutes and created a temporary lake having dimensions roughly about 6000 m long, 200-250 m wide and 25-30 m deep extending up to Wangtoo bridge • Lake water entered Sanjay Vidyut Pariyojna and damaged the Power House

Sr.No	Prominent Flash Floods	History of Damage Occurred
	31 July and 2 August 1991 24 Feb 1993 Satluj river blocked twice due to major landslide and rock fall near Jhakri and Nathpa, damaging NH-22 Another flash flood occurred in two phases along Duling khad on 4th and 5th September causing extensive damage in Tapri, district Kinnaur - First flash flood occurred on 4th September 1995 at 2 p.m. After cloudbursts in the upper catchment of Duling and damaged the PWD rest house. - Another flood came at 6 a.m. and 9 a.m. on 5th Sept. 1995 bursting the lake formed during the previous cloudbursts	Cloudburst and flash flood along Soldan khad in Satluj valley killed 32 people, 15 houses, 35 bigha agriculture land, 600 apple trees, 2km of road of NH 22 and 20 m bridge on Soldan khad washed away 31 July & Flash flood and landslide on 2 August 1991 along Maling nala in lower Spiti valley damaged 1500m road section of NH-22 and washed away agriculture land along Leo village situated downstream Flood washed away 15 houses, 35 bigha of agriculture land and about 600 apple trees in Soldang village. * 32 people and 35 cattle lost their lives - Huge debris formed a fan along Satluj and formed a lake partially blocking the Satluj - Flash flood caused heavy damage due to change in course of Satluj from left to right bank increased the tow and lateral erosion at Tapri. - Washed away 19 houses, HRTC workshop along with 3 buses - Change in course is still causing tow erosion to NH-22
	High magnitude floods have also recorded in Beas valley in 1902,45,93,95. Continuous anthropogenic pressure on existing Geo-Eco system has increased the severity and damaging impact of these flash floods.	
	4th and 5th Sept. 1995 flash flood in Kullu valley	Flash flood in Kullu valley occurred which cause damage to the tune of Rs.759.8 million
	February 1993	500 m road section of NH-22 washed away by Jakhri slide. Rs.10 million loss to road and forest land, a village upper slope was in danger
	4-5 and 12 Sept. 1995	Flood and landslide along Beas river in Kullu valley killed 65 people, NH damaged at numerous places, loss to government and private property, road and bridges estimated US \$ 182 million.

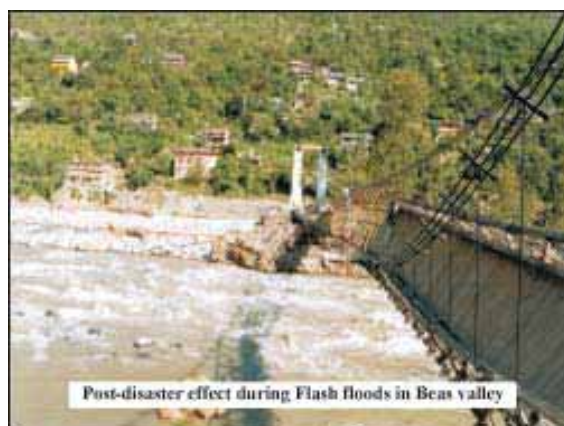
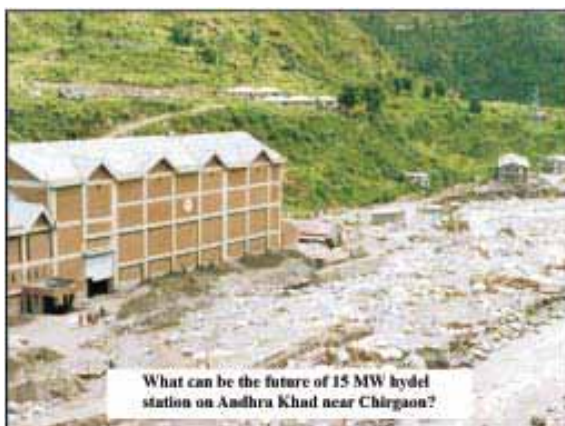
Sr.No.	Prominent Flash Floods	History of Damage Occurred
	4-5 Sept. 1995	Flash flood along Panwi khad in Satluj valley washed away 19 houses, 3 buses, HRTC workshop and damaged HPPWD rest house at Tapri
	11 August 1997	Flash flood and landslide along Andhra khad in Pabbar valley killed 124 people, 456 cattle, washed away government and private buildings, 200 m road section and damaged Andhra power house at Chirgaon. Loss was estimated Rs. 10.63 million
	August 1997	Cloudburst and flash flood along Satluj river killed 19 people, 464 cattle, 105 houses damaged, 10 cattle sheds and 39-hectare agriculture land. Total loss was estimated Rs. 672.9 million.
	Flash floods in the night of 31 st July and 1 st August 2000 in Satluj valley	Flash floods in the Satluj valley resulting in the increase in water level of Satluj an up to 60 feet above the normal level. The flash flood was termed as the one that occurs once in 61,000 years. Widespread damage in the valley right from its confluence with Spiti river near Khab to downstream areas. Extensive damage to 200 km of NH-22, washed away 20 bridges, 22 Jhulas and badly damaged 12 bridges. About 1000 irrigation, sewerage, flood protection and water supply schemes were badly damaged. Extensive damage to hydel projects including NJPC. 135 people and 1673 cattle lost their lives. The total estimated loss was to the tune of Rs. 1466.26 crore.
	Flash floods on the night of 22 nd July 2001 in Sainj valley in District Kullu	Cloudbursts in the upper reaches of Sainj valley caused flash floods in two nallahs namely, Sainj and Jeeba, affecting about 40 families. 2 bridges on Sainj and Jeeba nallahs and plenty of fertile land were washed away. Connecting road to Siund and Sainj was also washed away at a number of places. Two persons were washed away and 5 cattle perished. Some other areas in Kullu district were also affected due to excessive rains in July and the population of 6355 was adversely affected.
	17 th and 19 th July 2001 floods in Mandi district	Excessive rains caused damage to 160 houses in Mandi district and destroyed 11 cattle and one human life.

Sr.No.	Prominent Flash Floods	History of Damage Occurred
	Flash floods in the night of 29 th and 30 th July 2001 in Chhota Bhangal and Baijnath Sub Division of Kangra District	Caused widespread damage in the area. 12 deaths occurred due to flash floods and loss of 150 cattle was reported from the area. Bridge connecting Deol and Baijnath was also washed away. Total estimated loss was to the tune of Rs.18.27 crores.
	Flash floods in the night of 9 th August and 10 th August 2001 on Moral-Danda peak in the Rohru sub Division in Shimla District	Flash floods occurred along two streams, one along the Devidhar area and an other along Darkali in Rampur Sub Division. Damage to infrastructure like roads, bridges, water supply schemes, forest wealth, agriculture land, horticulture land, footbridges, village paths, residential houses and water mills and loss of 3 lives and 39 cattle and destruction of private property. Total loss in both the Sub Divisions was 145.15 Lacs. In Rohru Sub Division 7 bridges, 8 village paths, 8 water supply schemes, and 1 power house were damaged besides 16 houses, whereas in Rampur Sub Division, 10 bridges, 8 village paths, 1 water supply scheme, 1 soil conservation plant, 7 residential houses and 16 water mills were damaged.
	Flash floods in the night of 21 st and 22 nd August 2001, cloudburst in Ani Sub Division of Kullu district occurred	Due to flash flood in village Badhali 2 houses in which a couple were buried alive and their two children injured. In village Sarli 7 people lost their lives, 15 houses were washed away besides the loss of 12 cows, 18 oxen and 40 sheep and about 115 bighas of agriculture and horticulture land was washed away.
	Flash floods in Sihunta area and Tissa areas of Chamba district in the night of 12 th and 13 th August 2001	Washed away 9 hectare of fertile land, 2 small bridges causing a total loss to property of some Rs. 2 Crore.
	Flash floods due to cloudbursts in Gharsa valley on 16 th July 2003 in Kullu district	Due to these flash floods 21 people lost their lives, 21 people suffered major injuries and 9 are still missing.
	Flash floods in Kangni nalla near Solang in Kullu district on 7 th August 2003	30 people lost their lives and 19 people were injured and 9 people are missing. 2 people lost their lives due to landslide in Bhang nalla
	Flash flood in Satluj river due to breach in the Parachoo lake in Tibetan catchment on 26 th June 2005	Extensive damage as a result of risen water level of Satluj river due to breach in Parachoo lake formed in Tibet catchment. Washed away the NH-22 at a number of places. 10 bridges, 11 ropeways washed away, 15 Motorable bridges and 8 Jeepable

Sr.No.	Prominent Flash Floods	History of Damage Occurred
		And footbridges damaged/affected. 10 km stretch of NH-22 between Wangtoo and Samdo was washed away, and various link roads were damaged. Total loss estimated to the government as well as public property was some Rs. 610 crore.
	Flash floods during July 2005	Flash floods in Pabbar river in Rohru Sub Division resulted in heavy losses to roads, bridges, public buildings, residential houses, cowsheds, private land. Chirgaon block was totally cut off. On July 7 th , 2005, flash flood in Baspa river took place causing the loss of 6 bridges and 600 mt link road to Sangla. More than 3000 cattle perished in different parts of the state leading a total loss of some Rs. 55980.76 lacs.

(Source: Bhandari, 1988; Sah et al, 1996; Sah and Mazari 1998; Sah and Bist, 1998; Paul et al, 2000, Revenue Department, Govt. of Himachal Pradesh).

4.3 Landslide Hazards in Himachal Pradesh:



Landslides are known to play havoc causing death and destruction. In India, Western and Eastern Ghats, Jammu and Kashmir, Himachal Pradesh, Uttranchal and North Eastern parts are well known for landslides. Delineation of landslide-prone areas requires a large data set. Various forms of landslides are slumps, debris or rock slides, debris falls or rock falls. Various factors influence the landslides : steepness of slopes, saturation by heavy rains or melting snow and ice, rocks vibrations, excess load from embankments, fills and waste dumps,



changes in water content, frost effect, weathering of rocks, effect of ground water, change in vegetal cover.

The hills and mountains of Himachal Pradesh are liable to suffer landslides during monsoons and also in high intensity earthquakes. The vulnerability of the geologically young and unstable steep slopes in various Himalayan ranges, has been swiftly increasing in recent decades due to inappropriate activity, such as deforestation, road cutting, terracing and changes in agriculture pattern requiring more intense watering.

As in other Himalayas the landslide activity in Himachal Himalayas can also be visualized and distinct three zones based on their characteristics depending upon altitude, geology and topography as described in Table 4.44.



Table 4.44: Landslide Distribution in Major Himalayan Zones

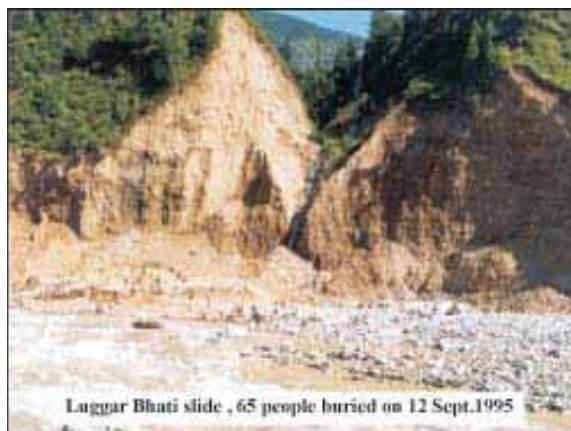
From north to south, Himalayas has been divided into three major zones based on relief processes and geological conditions.

Himalayan Zone	Characteristics	Prone to
Higher Himalayas	High relief zone of glaciation characterized by typical alpine mountain steep slopes generally devoid of vegetation and valleys are covered by glacial and periglacial deposits	Least inhabited part of Himalayas so mass movement phenomena are not of common concern.
Lesser Himalayas	Medium relief zone consists mainly of sedimentary rocks. This zone is covered by natural vegetation. High rate of fluvial erosion and weathering processes	Most inhabited, facing the problem of ecological and environment imbalances due to anthropogenic factors.
Outer Himalayas	Low lying hill ranges of Siwalik sediments of soft Tertiary rocks such as sandstone, siltstone, shale and clays. These ranges are main barrier to low monsoon winds so receive maximum rainfall	Most inhabited part prone to large-scale mass movement, cloudbursts and landslides.

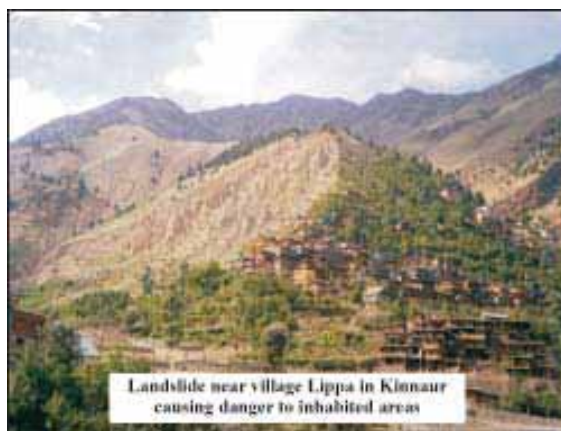
The important slides in Himachal Pradesh which caused huge damage are:

Sr.No.	Landslide Area	History of Damage
1.	Maling (1968)	This slide damaged 1 km NH-22 and is still active
2.	Kinnaur (Dec.1982)	This occurred at Sholding nala collapsing 3 bridges and 1.5 of road vanished.
3-	Jhakri (March 1989)	At Nathpa about 500 m of road was damaged due to this slide and is still active.
4.	Luggarbhati on 12 Sept. 1995 Prominent slides in Beas valley are at Marhi, Bhang, Chhyal, and Mandu in upper catchment of the Beas river.	65 people (39 as per official record) were buried alive during the slide.

The devastating landslides in H.P. need more intensive scientific studies and engineering measures focused on the problem of landslides. As the first step, it will be necessary to prepare zoning maps of landslides and rock-fall-prone areas through geological and geo technical studies. The landslide prone areas should be avoided while locating new settlement or buildings and those which are already occupied should either be resettled or protective measures undertaken based on expert advice.



Luggar Bhati slide , 65 people buried on 12 Sept.1995



Landslide near village Lipra in Kinnaur causing danger to inhabited areas

a) Land Slide Hazard Zonation Mapping of the State :

Mapping of the state along major National Highways and State Highways was completed using High Resolution Satellite Data on 1:12,500 scale. The information has been generated along the corridor in Bilaspur- Samdo sector, Bilaspur- Manali, Dalhousie sector and Chamba-Bharmour sectors. Based on the information on slope, slope aspect, morphology, geology, structures, soil, landuse/landcover, mapping of the area was completed, delineating vulnerability of the area towards landslide hazards and suggesting various mitigation measures.

4.4 Avalanche Hazard in Himachal Pradesh:

The sagas of mountaineering contain many accounts of sudden deaths from snow avalanches. For instance, the treacherous Nanga Parvat (9000 m) in the Himalayas claimed sixteen lives in 1937 when a German mountaineering team was trapped by an avalanche. Climbers of the Himalayas, Andes, Alaskan Ranges and even the Alps must always be on the lookout for dangerous snow slope conditions. Himachal Pradesh too has a great threat from avalanches particularly the higher regions in the Kinnaur and Lahaul & Spiti districts of the Great Himalayan Ranges.

“An avalanche may be defined as the sudden downward motion of the snow mass, which may contain rocks, soil, ice and trees. In a number of ways, avalanches of snow resemble certain kinds of landslides, but important differences are involved. As a material, snow has some mechanical properties in common with soil, such as cohesion, angle of internal friction, and density, all related to one another in a complex way. When snow falls on a sloping hillside and accumulates, the conditions which govern whether or not an avalanche occurs are similar to those in the case of shallow soil landslides on a long slope. That is to say, the snow will remain in place if the shearing strengths at all depths exceed the shearing stress developed by the weight of snow and the angle of slope. If the shearing strength is exceeded by the downslope component of weight, an avalanche will develop. The depth of snow accumulation before a slide takes place depends on the properties of density, cohesion, and friction in the snow and the slope angle in the same way as these conditions apply to soil on an infinite slope. The snow depth at which the stresses are exceeded is usually referred to as the critical depth”.

The Higher hills comprising the districts of Kinnaur, Lahaul & Spiti, Chamba, and Kullu are particularly vulnerable to the hazards of avalanches, and the destruction caused as a result of avalanches in the past in Himachal Pradesh though not widespread is confined to the higher reaches of the state only. Details of prominent avalanches which have a history of damage in the state is as per Tables 4.45 & 4.46.

Table 4.45: Events of Avalanche Damage in Himachal Himalayas

Location	Date/Year	Damage Occurred
L& Spiti	Jan 1975	Earthquake shocks triggered an avalanche of great dimensions damaging road network
L & Spiti	Mar 1978	About 30 people killed, road and property damaged.
	Mar 1979	About 237 people killed. Communications disrupted
Tinku	Mar 1991	Tinku avalanche occurs every year 4-5 times from Jan to March. Road was blocked for 40 days in 1991
	Sept.1995	Due to avalanche, huge chunks of debris came down which later changed into floods

(Source: SASE, DRDO Chandigarh)

Table 4.46: Districtwise Breakup of the Avalanche Accidents in Himachal Pradesh

Sr.No.	District	No. of Accidents	Persons involved	Persons killed	Persons injured
1.	Chamba	12	59	53	0
2.	Kinnaur	32	144	129	9
3.	Kullu	6	13	9	4
4.	Lahaul & Spiti	21	397	298	53
5.	Shimla	2	6	1	5

(Source: SASE , DRDO Chandigarh)

a) Hailstorms/Droughts:

Besides the major natural disasters the state as it is characterized by diverse topography, experiences inclement weather conditions; sometimes excess rains or drought or hailstorms. During the past losses occurred due to these natural disasters in this hill state as under:

- On 31st March 1994 extensive damage occurred to agriculture in Solan district due to hailstorms.
- On 1 and 2 April 1994 heavy loss took place in Phati, Nither of Thesil Nirmand, district Kullu.
- On 5th April 1994 in Jawalamukhi and adjoining areas of Dehra in district Kangra.
- On 4th May 1994 heavy loss occurred to agriculture in Mandi district from hailstorms.

Besides these hazards, the state also suffers a great loss of public as well as private property every year either due to excessive rains, hailstorms or drought etc (Annexure enclosed). The damage occurred due to these hazards in different sectors and the loss estimated from 1995-2000 in the state is as under:

4.5 Damage Due to Extensive Rains, Landslides etc**a) During the Year 1995:****i) Physical :**

Human lives lost	114
Heads of cattle perished	5,625
Houses, cowsheds damaged	25,183
Agriculture cropped area affected	2.838 Lac Hac.
Horticulture cropped area affected	0.513 Lac Hac.
Land washed away/damaged	0.262 Lac Hac

ii) Estimated Monetary Loss	(Rs. in Lacs)
Loss to private proper such as houses, cowsheds etc	7,552.00
Loss to agriculture crops	13,251.00
Loss to Horticulture crops	10,108.29
Total	30,881.29

b) Damage due to Extensive Rains, Flash Floods in 1996:

i) Physical:	
Human lives lost	51
Head of cattle perished	2250
Houses, cowsheds damaged	5774
Agriculture crop area affected	2,579 Lac Hac.
Horticulture crop area affected	0.409 Lac Hac.
Land washed away/damaged	0.220 Lac Hac
ii) Estimated Monetary Loss:	(Rs. in Lacs)
Loss to private property such as houses, cowsheds	6,928.00
Loss to public property	16,152.60
Loss to agriculture crops	16,511.00
Loss to Horticulture crops	8,085.60
Total	47,677.20

c) Damage due to Extensive Rains, Cloud Bursts and Flash Floods During the Year 1997:

1. Physical:	
Human lives lost	223
Head of cattle perished	4,809
Houses damaged (fully)	3,763
Houses damaged (partially)	7,304
Cowsheds damaged	8,146
Agriculture crop area affected	2.287 Lac Hac.
Horticulture crop area affected	0.249 Lac Hac.
Land washed away/damaged	0.170 Lac Hac

ii) Estimated Monetary Loss:	(Rs. in Lacs)
Loss to private property such as houses, cowsheds	8,146.00
Loss to agriculture crops	12,260.00
Loss to Horticulture crops	5,064.90
Loss in terms of land that has been washed away	17,000.00
Total	42,470.90

iii) Loss in Respect of Public Property:	
Works being maintained by Deputy Commissioners	23,580.00
Works being maintained by PWD	4,297.76
Works being maintained by IPH	2,097.52
Works being maintained by Forest	899.01
National Highways being maintained by GOI	3,000.00
Total	33,874.29
Grand Total	76,345.19

d) Damage due to Extensive Rains and Flash Floods During the Year 1998:

i) Physical:	
Human lives lost	71
Head of cattle perished	221
Houses damaged (fully)	3,431
Houses damaged (partially)	1,619
Agriculture crop area affected	2.210 Lac Hac.
Horticulture crop area affected	0.139 Lac Hac.
Land washed away/damaged	0.165 Lac Hac

ii) Estimated Monetary Loss:	(Rs. in Lacs)
Loss to private property such as houses, cowsheds	84.02
Loss to agriculture crops	9,084.50
Loss to Horticulture crops	1,492.00
Loss in terms of land that has been washed away	11,550.00
Total	22,210.52

iii) Loss in Respect of Public Property:	(Rs. in Lacs)
Works being maintained by Deputy Commissioners	4,985.00
Works being maintained by PWD	4,067.00
Works being maintained by IPH	1,964.27
Total	11,016.27
Grand Total	33,226.79

e) Damage due to Extensive Rains, Flash Floods and Drought During the Year 1999:

i) Drought:

Agriculture crop area affected	2.423 Lac Ha
Horticulture crop area affected	0.447 Lac Ha

Loss in Terms of Money:	(Rs. in Lacs)
Agriculture loss	10928.00
Horticulture Loss	12559.00
Total	23487.00

ii) Excessive Rains:

a) Physical :

Human lives lost	30
Heads of cattle perished	129
Houses damaged (fully)	649
Houses damaged (partially)	904
Cowsheds damaged	671

b) Estimated Monetary Loss:	(Rs. in Lacs)
Loss to private property such as houses, cowsheds etc	2,730.00

c) Loss in Respect of Public Property:

Works being maintained by Deputy Commissioners	8,450.00
Works being maintained by PWD	7,283.00
Works being maintained by IPH	688.67
Total	16,421.67
Grand Total	19151.67

4.6 Damage Due to Drought Conditions in Himachal Pradesh

a) During the Year 2000-2001 (Rabi Season):

Main Affected Crops	Qty. in (000,MT)	Estimated Value (Rs. in Crore)
Damage to Agriculture Crops	411.00	238.79
Damage to Horticulture Crops	226.34	122.06
Total Loss	637.34	360.85

b) During the Year 2002-03 (Kharif Season):

Main Affected Crops	Qty. in (000,MT)	Estimated Value (Rs. in Crore)
Damage to Agriculture Crops	612393	366.00
Damage to Horticulture Crops	225382	341.21
Total Loss	837775	707.21

c) During the Year 2005-06 (Rabi Season):

Main Affected Crops	Qty. in (000,MT)	Estimated Value (Rs. in Crore)
Damage to Agriculture Crops	356.02	235.00
Damage to Horticulture Crops	2.25	90.00
IPH Department		20.00
Animal Husbandry		21.00
Total Loss		366.00

4.7 Impact of Climate Change on the Himalayan Region:

Mountain ecosystems harbour a wide range of significant natural resources and play a critical role in the ecological and economic processes of the earth. Deforestation, landslides, land degradation, desertification and Glacier Lake Outbursts Flooding (GLOF) are some of the common environmental issues in mountain regions. The major challenge currently faced by the mountain environment is the escalation of these issues through atmospheric as well as man-induced changes. Mountain systems are particularly sensitive to climate changes. Since industrialization, human activities have resulted in steadily increasing concentrations of greenhouse gases - particularly carbon dioxide (CO₂), methane (CH₄), chlorofluorocarbons (CFCs) and nitrous oxide (NO_x) - in the atmosphere. As these gases absorb some of the radiation emitted by the earth rather than allowing it to pass through the atmosphere to space, there is general consensus that the Earth's atmosphere is warming. The third assessment report of the Inter - Government Panel on Climate Change (IPCC, 2001) concludes that the global average surface temperatures have increased by $0.6 \pm 0.2^{\circ}\text{C}$ during the twentieth century and that, for the range of scenes developed, the global average surface air temperature is projected to warm 1.4 to 5.8°C by 2100 relative to 1990. Analysis of the temperature trend in the Himalayas and its vicinity shows that temperature increases are greater in the uplands than lowlands. Regional changes in climate have already affected diverse physical and biological systems in many parts of the mountain regions. Shrinkage of glaciers, thawing of permafrost, late freezing and earlier break up of ice on rivers and lakes, polewards and altitudinal shifts of plant and animal species, declines of some plant and animal populations, and earlier emergence of insects have been observed (IPCC, 2001).

Climate influences weathering processes, erosion, sediment transport, and hydrological conditions. It also affects the type, quantity, quality, and stability of vegetation cover and, therefore, biodiversity. Mountain systems are particularly sensitive to climate changes. Small changes in climate can produce significant regional or larger-scale effects. In particular, marginal environments are under high stress. Small changes in water availability, floods, droughts, landslides and late frosts can have drastic effects on agriculture economics.

a) A Historical Overview:

There have been at least seventeen major glacial advances (glaciations) in the last 1.6 million years alone (Goudie 1983). The most recent, the Last Glacial, reached its peak some 20,000 to 18,000 years ago and came to an end about 10,000 years ago (Goudie 1983). Glaciations are followed by “interglacial” periods, during which the glacier ice retreats as a result of global warming. The interglacial typically continues for about 10,000 years before the cooling or the next glacial begins. This cyclical activity is generally accepted to be caused by gradual changes in the earth’s rotation, tilt and orbit around the sun, which affects the solar radiation the earth receives.

Glacial cycles are punctuated by relatively short periods of localized cooling and warming, during which glaciers advance and retreat. The most recent cooling episode of the present interglacial commonly referred to as the “Little Ice Age” (LIA), affected parts of North America (Curry 1969), Asia (Chu ko-Chan 1973) and Europe from about 1300 AD through to the latter half of the nineteenth century. During the LIA (1550-1850 AD) glaciers were much longer than today (Yamada *et al.* 1998). It may have been the result of volcanic eruptions and the presence of volcanic ash in the atmosphere that caused cooling by reducing the amount of solar radiations reaching the earth’s surface (Lamb 1970). Changes to ocean currents have also been suggested, as has tectonic activity, concentration of carbon dioxide in the atmosphere, and sunspot activity (Goudie 1983).

b) The Present Scenario:

The twentieth century has been a watershed vis-à-vis glacial fluctuations on a global scale. This has been a period of dramatic glacier retreat in almost all alpine regions of the globe, with accelerated melting of glacier and ice fields in the last two decades. The first phase of this glacier retreat was associated with the emergence from the Little Ice Age that ended in 19th century. It corresponds with a warming of 0.3°C in the first half of the 20th century in the northern hemisphere. In the last 25 years, a second 0.3°C warming pulse has caused northern hemisphere temperature to rise to unprecedented levels compared with the last 1000 years. The 1990s were the warmest decade of the millennium and 1998 the hottest year of the millennium. In all, there was a temperature rise of close to 1°C across the continents.

Research shows that the glacier cover of mountain regions worldwide has decreased significantly in recent years as a result of warming trends. A recent comparison of historical glacier data with images from ASTER (Advance Spaceborne Thermal Emission and Reflection Radiometer) instrument on NASA’s TERRA satellite by the US Geological Survey revealed a significant shrinkage of mountain glaciers in the Andes, the Alps and the Himalayas over the past decades (Wessels

et al. 2001). These observations are consistent with published results from many other glacier studies around the world that also recorded rapid glacier retreat in recent years.

According to Haeberli and Hoelzle (2001) of the World Glacier Monitoring Service (WGMS), the measurements taken over the last century “clearly reveal a general shrinkage of mountain glaciers on a global scale”. They observed that the trend was most pronounced during the first half of the 20th century and that glaciers had started to grow again after about 1950. However, they claim that mountain glacier retreat has been accelerating again since 1980s at a “rate beyond the range of pre-industrial variability”. Based upon a number of scientific investigations (e.g. Kuhn 1993a, Oerlemans 1994) and the IPCC (1966b) the forecast is that up to a quarter of the global mountain glacier mass could disappear by 2050.

Himalayan glaciers have also been found to be in a state of general retreat since 1850 (Mayewski & Jeschke 1979). The Khumbu glacier, a popular climbing route to the summit of Mount Everest, has retreated over 5 km from where Sir Edmund Hillary and Tenzing Norgay set out to conquer the world’s highest mountain in 1953. Since the mid 1970s the average air temperature measured at 49 stations of the Himalayan region rose by 1°C with high elevation sites warming the most (Hasnain 2000). This is twice as fast as the 0.6°C average warming for the mid - latitudinal northern hemisphere over the same time period (IPCC 2001b), and illustrates the high sensitivity of mountain regions to climate change (Oerlemans *et al.*, 2000). The Dokriani Bamak glacier in Uttarakhand Himalayas retreated 20m in 1998, and the Gangotri glacier is reducing at the rate of 30m/year.

At present the rivers have shown 3-4% surplus water due to a 10% increase in the melting of the glaciers of the western Himalayas, and a 30% increase in the eastern Himalayan glaciers. But, after 40 years, most of these glaciers will be wiped out and then South Asia will have water problems. In March 2002, UK’s Department of International Development funded a project called Sagarmatha (Snow and Glacier Aspects of Water Resources Management in the Himalayas) to assess the impact of deglaciation on the seasonal and long term water resources in snow-fed Himalayan rivers. This study was vital for policy-makers and specially those working on interlinking of rivers, as the flows available in rivers are likely to change dramatically over the decades depending on the region. The study, which reveals some major facts about the melting mountain majesties and warming glaciers, is an eye-opener.

In Upper Indus, the study sites show initial increases of 14% and 90% in mean flows over the next few decades which will be followed by decreasing flows by 30% and 90% of baseline in the subsequent decades in a 100-year scenario. For the Ganges, the response of the river near the glacier in Uttarkashi is different from downstream Allahabad. At Uttarkashi, flows peak at between 20% and 33% baseline within the first few decades and then recede to 50% of baseline after fifty years.

Near the source of the Brahmaputra there is a general decrease in decadal mean flows for all temperatures as glaciers are few in the area and flows recede as the permanent snow cover reduces with increasing temperatures. The catchments in the eastern Himalayas which benefit from high precipitation of the summer monsoon, are more vulnerable to the impact of deglaciation than those in the west where the monsoon is weaker.

In short, the deglaciation in the Himalayas is influenced by various factors, climatic and regional. However, the main underlying factor is the ever-increasing-warming on the mountains, chiefly because of excess emission of greenhouse gases and Asian brown cloud. The ongoing ice melting is only the tip of the iceberg that will hit us in the near future.

4.8 Retreat of Glaciers over Himalayas:

In the Indian Himalayas there are more than 15,000 glaciers and most of them are shrinking fast and, as they shrink, this part of the world is slowly losing one of the many attractions which reflect the grandeur of the mountains around them.

Glaciers in the Himalayas are fast retreating like other ice mountains the world over. A recent study showed that the last three decades of the twentieth century have been the hottest period in 1,000 years. The melting of the Gangotri glacier is accelerating at an average retreat rate of thirty metres annually. The rate between 1935 and 1990 was eighteen metres per year and seven metres annually between 1842 and 1935. The overall deglaciation from 1962 to 2001 in the Baspas basin of Himachal Pradesh has been estimated at 19%. The Chhota Shigri glacier of Chandra valley has also retreated by about 12% in the last one and half decades. The deglaciation processes are also noticeable in large glaciers in the Ganga headwater the Gangotri which has shown about 10% decrease during the last eighteen years. The maximum retreat of 34.5 metres per year has been observed at Meola glacier in Dhauliganga river basin. The retreat of the Parbati glacier is reported to be unusual and even more alarming.

“Glaciers in the Himalayas are receding faster than in any other part of the world, and if, the present rate continues, the likelihood of their disappearing by the year 2035 is very high,” says the International Commission for Snow and Ice (ICSI) in its recent study on Asian glaciers. **“But if the Earth keeps getting warmer at the current rate, it might happen much sooner”** says Syed Iqbal Hasnain former Professor in the School of Environment Sciences, JNU, New Delhi.

a) Causes and Impacts:

The main reason for deglaciation the world over is global warming. The atmospheric levels of the greenhouse gas, carbon dioxide, have increased since pre-industrial times from 280 part per million (ppm) to 360 ppm, a 31% increase. Carbon dioxide is a by-product of the burning of fossil fuels, such as gasoline in an automobile or coal in a power plant generating electricity. Levels of atmospheric methane, another powerful greenhouse gas, have risen 145% in the last 100 years. Methane is derived from sources such as rice paddies, bacteria in bogs and fossil fuel production. Greenhouse gases such as nitrous oxide and carbon dioxide in the Earth's atmosphere decrease the escape of terrestrial thermal infrared radiation. Increasing carbon dioxide, therefore, effectively increases the input radioactive energy to the Earth.

Anthropogenic greenhouse gas emissions levels depend on the human population size, the level of economic activity, and the technologies in use. Increases in population and the level of economic activity tend to be closely tied to increased use of energy. Insofar as fossil fuels are used as the

source of this energy, increased use of energy will lead to increased carbon dioxide emissions unless sequestration, energy efficiency improvements, or other technologies can balance it.

In addition to this, aerosols are a long-recognised major environmental hazard, also now known to have strong impacts on South and East Asian climates. It has been estimated that aerosols may reduce by up to 10% the seasonal mean solar radiation reaching the earth surface, producing a global cooling effect that opposes global warming.

This means that the potential perils that humans have ascribed to global warming may be far greater than we can detect at present.

As a key component of the Earth's climate system, the water cycle is profoundly affected by the presence of aerosols in the atmosphere. Through the so-called "direct effect" aerosol scatters and/or absorbs solar radiation, thus cooling the earth surface and changing the horizontal and vertical heating contrast in the atmosphere. The heating contrast drives anomalous atmospheric circulation, resulting in changes in convection, clouds and rainfall.

Another way aerosol can affect the water cycle is through the so-called "indirect effects" whereby aerosol increases the number of cloud condensation nuclei, prolongs lifetime of clouds, and inhibits the growth of cloud-drops in to raindrops. This leads to more clouds, and increased reflection of solar radiation, and further cooling of the Earth's surface.

In monsoon regions, the response of the water cycle to aerosol forcing is especially complex, not only because of the presence of a diverse mix of aerosol species with vastly different radiative properties, but also because the monsoon is strongly influenced by ocean and land surface processes, land use, land change as well as regional and global greenhouse warming effects.

Thus, sorting out the impacts of aerosol forcing and interaction with the monsoon water cycle is a very challenging problem. The direct impact of greenhouse gas emission and resultant global warming on the glacier environment is melting. There are different reasons for ice melting. Its repercussions are also different, depending on regional and climatic variables. Flood, sea level rise, fresh water scarcity, threat to fauna and flora are major security implications of deglaciation. With an estimated contribution of 0.2-0.4 mm per year from melting glaciers, the average global sea level rose by 1 to 2 mm per year during the 1900s.

It is expected that the melting ice from ice caps and glaciers will raise sea levels between 10 and 90 cms in the twenty first century. It is observed that, about 20,000 years ago, the sea level was 25 metres lower than it is today. Sea-level rise will affect coastal regions throughout the world, causing flooding, erosion, and saltwater intrusion into aquifers and freshwater habitats. Even the modest sea-level rise seen during the twentieth century led to erosion and the loss of 100 km² of wetlands per year in the US Mississippi river delta. In Trinidad and Tobago, as in many low-lying islands, beaches are retreating several metres per year and salinity levels have begun to rise in coastal aquifers. Small Pacific islands such as Tonga, the Marshall Islands and the federated states of Micronesia are particularly vulnerable, and could lose large portions of their land areas to rising

seas and storm surges. A global sea level rise of 1 metre would inundate 80% of the Maldives; displace 24 million people in Bangladesh, India. As 16% of the world's ocean water is contributed by the glaciers of the Himalayas, any environmental threat leading to excess deglaciation should be viewed with more concern. It is also observed that any ecologically bad effect in the Himalayas will have a wider impact on the lives of millions of people living in South Asia. If the Himalayan glaciers, that feed seven of the great rivers of Asia (the Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang Hu) and ensure a year-round water supply to two billion people, vanish, it will be catastrophic for the entire Asia. It will create a fresh water shortage, wipe out glacier feeding rivers and for a time of it will create floods in the region.

4.9 Status of Glaciers and Snowfields Over Himachal Himalayas:

Five major perennial rivers of northern India pass through Himachal Himalayas, which have their origin in the glaciated terrains either in the state or outside. These are the Ravi, Chenab, Beas, Satluj and Yamuna rivers. Rivers such as Chenab, Ravi and Beas, originate from Himachal Pradesh where as the other two have their origin outside the state. In order to understand the dynamics of the glaciers, which can be considered as the direct indicators of climate change, it is important to have the systematic inventory or study of the Himalayan glaciers.

As the glaciers are located in the higher regions it is not possible to map them by any conventional method. So space technology has been proved useful for mapping the Himalayan glaciers and estimating the potential for water as well as hydel development. According to investigations carried out in the Himachal Himalayas, there are a total of 334 glaciers in the entire Satluj basin which includes the information about the Beas, Sainj, Spiti, Baspa basins and 457 glaciers in the Chenab basin in Himachal Himalayas. The total area covered by these glaciers in Satluj and Chenab basins is 2175 km². Besides the glaciers there are about 1826 permanent snowfields in these basins with a total area of 1101.737 km². Out of 334 glaciers in the entire Satluj basin, 202 glaciers are located in Himachal Pradesh (Kulkarni *et al.*).

Table 4.47: Basinwise Distribution of Glaciers and Snowfields in Himachal Himalayas

Basin Name	Number of Glaciers	Aerial Extent (km ²)	No. of Permanent Snowfields	Aerial Extent (km ²)
Beas	06	15.843	47	72.442
Parvati	36	450.627	131	188.188
Sainj	09	37.255	59	51.934
Spiti	71	258.237	597	368.366
Baspa	25	203.300	66	64.964
Satluj	55	154.762	194	110.843
Chenab	457	1055.27	732	245.000
Total	659	2175.294	1826	1101.737



Fig. 1.9

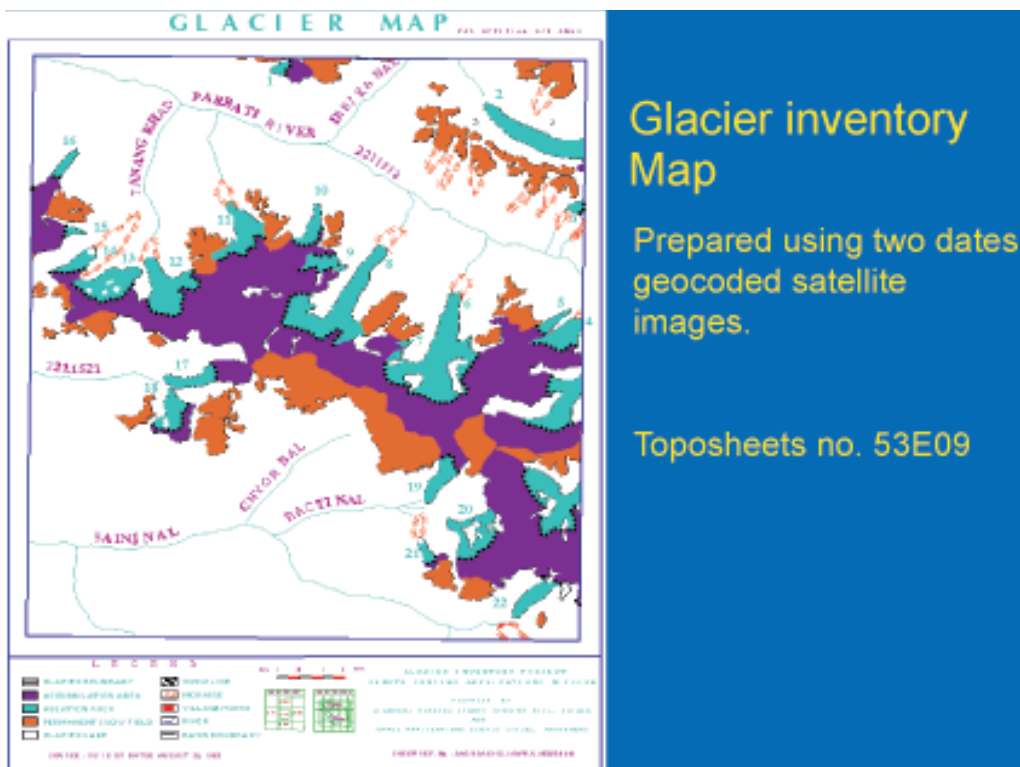


Fig. 1.10

a) Global Warming and Run off:

In the case of Himalayan rivers the major contribution is from the snow and glacier melt which affects the discharge of the streams considerably. To understand the effect of global warming on the hydrological balance, snow ablation studies in the Himalayas were carried out. Initially, the investigations were carried out in the Beas and Baspa basins in Himachal Pradesh. To understand these changes snow cover monitoring was carried out in the Beas and Baspa basins using IRS WIFS satellite data from October to June for the period from 1997 to 2001.

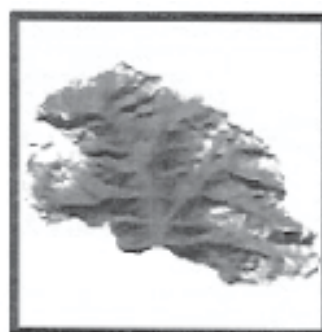
4.10 Changes in the Snow Cover in the Beas Basin:

On the basis of the study carried out by the Space Application Centre in the Beas basin pertaining to the period from October to June 1997-98 and 2001-2002. It was observed that snow accumulation in early winter, that is from November to January for 1998-99 and 1999-2000 was substantially lower than in 1997-1998 and 2000-2001. This may be due to low snowfall in the early winter and abnormally high temperatures as the average maximum temperature in the months of November and December was higher in the years 1998 and 1999 as compared to 1997. On the other hand snow accumulation pattern in the year 2000-2001 was entirely different. Overall snow cover was very high in the months of November-December, but right from the beginning of December snow cover started retreating and this trend continued up to the middle of February. The data suggest that the snow accumulation was above normal for 1997-1998 and very low for 1998-1999 affecting the snow ablation pattern. In May 1998 snow cover was almost 70% compared to 30% in 1999. Altitude-wise monitoring of snow was also done in the Beas basin between 1800m to 5400m at intervals of 600m. It was found that there was a substantial retreat of snow in the month of December up to 5400 m altitude in this basin. In January retreating snow was observed up to 4200 m in the Beas Basin. The melting of snow cover in high altitude regions in the month of December and January is an unusual observation (Kulkarni *et al.*).

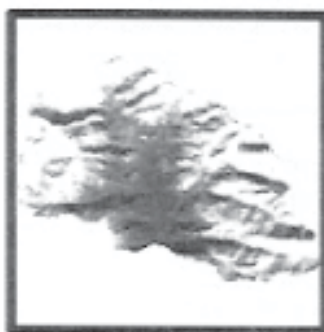
Showing distribution of snow cover in month of January the data suggests low snow covers in January 2000 (Kulkarni *et al.*).



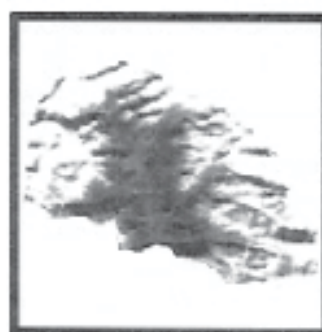
IRS-1D of Jan 1, 1998



IRS-1D of Jan 5, 2000



IRS-1D of Jan 14, 1999



IRS-1D of Jan 4, 2001

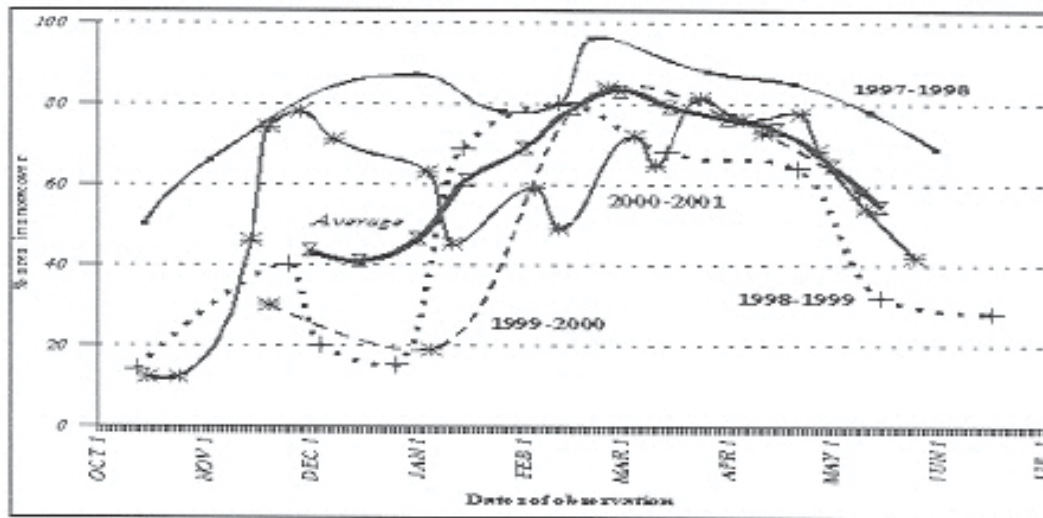


Fig. 1.11 Snow Accumulation and Ablation Pattern in the Beas Basin

Snow accumulation and ablation pattern in the Beas basin upto Manali. Thick line shows average snow cover. Average is taken from 1997-98 to 2000-2001 (Kulkarni *et al.*).

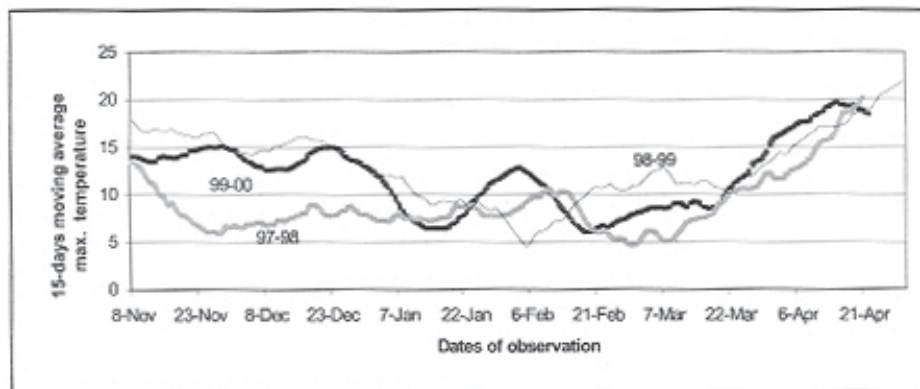


Fig. 1.12 Fifteen days Average Maximum Temperature at Manali

Fifteen days average maximum temperature at Manali in a period between November and April (Kulkarni *et al.*).

4.11 Changes in the Snow Cover in Baspa Basin:

In the Baspa basin weekly altitude-wise monitoring was carried out using 2000-2001 data between and 3000-4800 m at intervals of 600m. It was observed that there was snow retreat from November to February in all the altitude zones. These changes are similar to the Beas basin, and maximum retreat was observed in the month of December. However, to link snow cover retreat with global warming, long-term satellite data are needed. However, if additional areas start melting due to global warming in winter, then winter run off will increase. For summer season less snow will be available which can cause reduction of stream run off. However, in the initial phase this may not

happen, as the reduction in snow melt will be compensated by glacier melt. Therefore, change in stream run off during the winter will be a good indicator for assessing the influence of global warming. If long-term stream run off during winter is increasing then it will suggest that snow melting in higher altitudes is due to global warming. Since December is the beginning of winter and the maximum variation is observed in this month the average stream run off of December was used to confirm the impact of global warming. Average stream run off from December 1966 to 1992 when plotted, suggests that there is an overall increase in the stream run off from 1966 onwards (Fig. 1.14). The stream run off in the last 29 years has gone up by almost 75%, which is a substantial change (Kulkarni *et al.*).

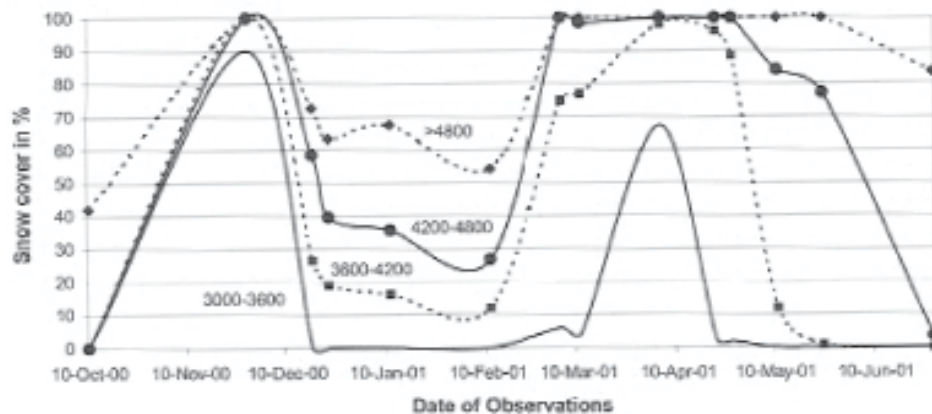


Fig. 1.13 Changes in Snow Cover in Baspa Basin

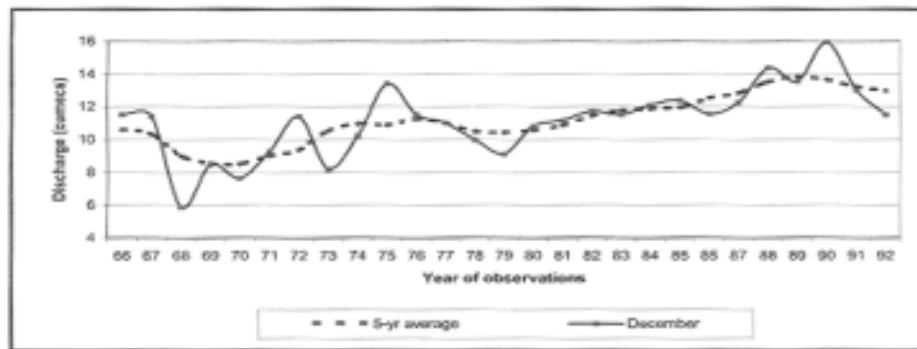


Fig. 1.14 Graph showing average and five-year running average of stream run off

A graph showing average and five-year running average of stream run off for the month of December. This graph confirms an overall increasing trend of stream run off in the month of December (Kulkarni *et al.*).

4.12 Evidence of Glacier Retreat in Himachal Pradesh:

On the basis of the updated inventory of the glaciers in the Baspa basin, a total of thirty glaciers could be mapped (Fig. 1.15). Out of these nineteen glaciers were selected to estimate glacier retreat. Investigation reveals that almost all the glaciers are receding and overall 19% deglaciation is observed from 1962 to 2001. Glaciers located around 5000m have shown 24 % loss compared

to 14% for those located in altitudes higher than 5400 m and the mean altitude of the glacier terminus is shifted upward by 88m i.e. from 4482 to 4570. In the last 39 years almost 19% of the glaciated area is reduced in the Baspa basin (Table 4.48). In addition, in the months of December and January snow melting was observed in the altitude range as high as 4800 m, which will have a profound effect on the stream run off pattern of many glaciers and snow fed streams.

Table 4.48: Glacier Retreat in Baspa Basin, Himachal Pradesh

FROM 1962-2001 Glacier Number	Glacier Number in Data sheet	Glacier Area (km ²)		Loss in Area (%)	Snout Altitude (m)	
		1962	2001		1962	2001
1	53I07001	10.5	8.7	17	4480	4560
2	53I07002	4.6	4.3	6.5	4520	4720
3	53I07003	2.2	2.0	9	4600	4640
4	53I07004	4.6	4.1	11	4720	4720
5	53I07005	1.7	1.2	29	3920	4360
6	53I11013	3.2	3.2	0	4920	4920
7	53I11014	1.5	0.8	47	5000	5080
8	53I12001	5.9	5.6	5	4760	5000
9	53I12002	38.4	33.5	13	4320	4360
10	53I12003	2.7	2.2	19	4480	4480
11	53I11009	7.1	5.0	30	4600	4600
12	53I11010	6.9	5.8	16	4640	4640
13	53I11011	8.7	4.5	48	4760	4760
14	53I07006	35.2	30.4	14	4200	4240
15	53I07007	11.6	9.9	15	4240	4240
16	53I07008	5.5	4.1	26	4360	4360
17	53I07009	3.9	1.9	51	4200	4440
18	53I07010	8	7.0	13	4360	4400
19	53I07011	10.8	6.1	44	4080	4320
Total Area/ Average Altitude		173	140.3	18.9	4482	4570

On the basis of ground observations and satellite data interpretation from the years 1963 and 1997, 650 m glacier retreat has been observed for Janpa glacier and 1050 m for Shuane Garnag glacier in the valley. Thus an overall 1.9 m/year retreat in the case of Janapa and 3.8 m/year for Shaune Garang glacier is observed.

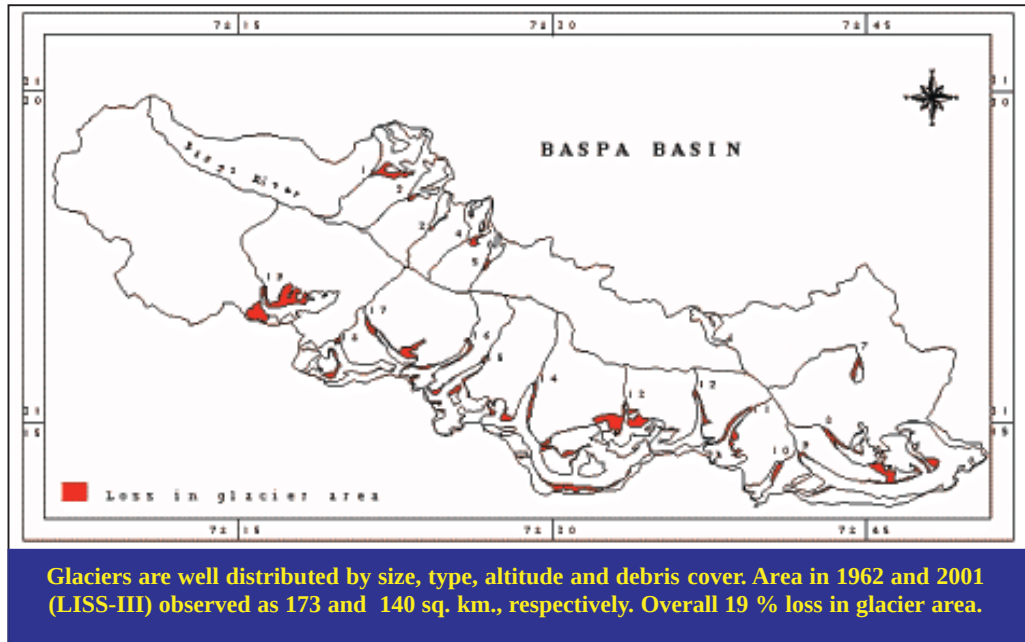


Fig. 1.15 Loss in Glacier Area 1962-2001

4.13 Glacier Retreat In Chandra Basin:

On the basis of the investigations carried out on Chotta Sigri glacier in the Chandra basin, the following observations were made.

Snout of Chotta Sigri glacier has receded by

8m/year from 1963 to 1984

23 m/year from 1984 to 1986

It has further receded by about 15 to 20 m from September 1986 to August 1987.

Average melting rate calculated was 6.5 cms/day, 4.1 cms/day and 3.0 cms/day in snout, ablation and accumulation zones.

The results have proved that the rate of melting was maximum in the snout zone and minimum in the accumulation zone.

Mass balance studies were also undertaken for the Chotta Sigri glacier. To assess the common value of AAR (Accumulation Area Ratio) representing zero mass balance for the western Himalayas field-based AAR and mass balance were compiled from different sources. The AAR representing zero mass balance is 0.42. It can be argued that glacier with AAR less than 0.42 will have negative mass balance will loss more ice than accumulation of snow, whereas the glaciers with AAR value more than 0.42 will have a positive mass balance. By applying the lapse rate as suggested by Upadhaya (1989) which is 1 deg C for 277 m, the mass balance studies were also compiled for the other glaciers in the valley, and the results obtained suggests that almost all the glaciers in the valley have negative mass balance indicating that the ablation in the glaciers is more than accumulation.

4.14 Associated Impacts of Glacier Retreat on Fresh Water Regime:

More than half of humanity rely on the freshwater that accumulates in the mountains (Mountain Agenda 1998). Glaciers 'mother' several rivers and streams with melt run off. A significant portion of the low flow contribution of Himalayan Rivers during the dry season is from snow and glacier melt in the Himalayan region. The runoff supplies communities with water for drinking, irrigation and industry, and is also used for maintaining river and riparian habitat. It is postulated that the accelerated melting of glaciers will cause an increase in river levels over the next few decades, initially leading to higher incidence of flooding and landslides (IPCC, 2001a). But, in the longer term, as the volume of ice available for melting diminishes, a reduction in glacial run off and river flows can be expected (IPCC 1966b, Wanchang *et al.* 2000). In the Ganga, the loss of glacier melt water would reduce July-Sept. flows by two thirds, causing water shortage for 500 million people and 37 percent of India's irrigated land (Jain 2001, Singh *et al.* 1994).

4.15 Glacier Lake Outburst Floods (GLOF):

Glacier lake outbursts floods (GLOFs) are catastrophic discharges of water resulting primarily from melting glaciers. The accelerated retreat of glaciers in recent times has led to an enlargement of several glacier lakes. As the glaciers retreat, they leave a large void behind. The ponds occupy the depression earlier occupied by glacier ice. These dams are structurally weak and unstable and undergo constant changes due to slope failures slumping and run the risk of causing GLOFs.

Principally, a moraine dam may break by the action of some external trigger or self-destruction. A huge displacement wave generated by rockslide or a snow/ice avalanche from the glacier terminus into the lake may cause the water to top the moraines and create a large breach that eventually causes dam failure (Ives 1986). Earthquakes may also be one of the factors triggering dam break depending upon magnitude, location and characteristics. Self – destruction is a result of the failure of the dam slope and seepage from the natural drainage network of the dam.

Characterized by the sudden release of huge amounts of lake water, which in turn would rush along the stream channel downstream in the form of dangerous flood waves, GLOF waves comprise water mixed with morainic material and cause devastation for downstream communities, hydro power stations and other infrastructures. In South Asia, particularly in the Himalayan region, it has been observed that the frequency of the occurrence of GLOF events has increased in the second half of the twentieth century. GLOF have cost lives, property and infrastructure in India, Nepal and China.

Glacial Lake Outburst Floods (GLOF) are the main natural hazards in the mountain areas of this region. A 1964 GLOF in China destroyed many kilometres of highway and washed away twelve timber trucks 71 km from the scene. An outburst at Zhangzangbo Lake in 1981 killed four people and damaged the China-Nepal Friendship Bridge in the northern border, seven other bridges, a hydropower plant, Arniko highway and 51 houses. The damage was estimated to be US \$3 million. A large avalanche triggered the 1985 GLOF at Dig Tsho. A hydroelectricity project,

fourteen bridges, thirty houses and farmlands worth US \$ 4 million were destroyed. In 1998, the outburst of Tam Pokhari in Nepal killed two people, destroyed more than six bridges and washed away arable land. Losses worth over 150 million rupees have been estimated. A high water level was observed even after nineteen hours in the Koshi barrage near the Indo-Nepal border. The river reverted to its original flow only after three days (Dwivedi 2000).

As per the investigation carried out in the Himachal Pradesh Himalayas, the retreat of glaciers has resulted in the formation of number of small as well big moraine dam lakes in the glacial terrains. There are about 38 lakes in the entire Satluj basin, out of which 14 lakes falls in the Himachal Himalayas whereas the remaining lakes fall in the Tibet an Himalayas. The aerial extent of these lakes is given in Table 4.49.

Table 4.49: Distribution of Moraine Dammed Lakes in Satluj Basin in Himachal Himalaya

Sr.No.	Basin No.	Toposheet No.	Area of Lake in km ²
1.	2211314	53E09013	0.200
2.	2211314	53E09014	0.100
3.	2211521	53E09018	0.075
4.	2211531	53E09021	0.050
5.	2220012	53I07013	0.025
6.	2220012	53I07014	0.050
7.	2220060	53I10024	0.050
8.	2220061	53I14001	0.100
9.	2220308	53I07017	0.025
10.	2220711	53I07010	0.150
11.	2221000	53I05001	0.075
12.	2221400	52L16003	0.200
13.	2221400	52L16005	0.025
14.	2221400	52L16006	0.050

Table 4.49(a): Inventory of Moraine Dam Lakes in Satluj Basin in Tibet Himalayas

Sr.No.	Basin Number	Toposheet No.	Area of Lake in km ²
1.	2222010	52P03004	0.025
2.	2222010	52P03005	0.025
3.	2222010	52P03007	0.050
4.	2222010	52P06001	0.050
5.	2222010	52P06002	0.025
6.	2222042	62B06010	0.050
7.	2222051	53M12001	0.050
8.	2222052	53M12008	0.050
9.	2222052	53M12005	0.050
10.	2222052	53M12006	0.100
11.	2222052	53M12008	0.025
12.	2222053	53M08004	0.050
13.	2222203	62E04007	0.025
14.	2222230	62E08001	0.050
15.	2222230	62E08002	0.050
16.	2222266	62F07001	0.050
17.	2222267	62F07002	0.100
18.	2222267	62F07003	0.075
19.	2222322	62B10001	0.025
20.	2222410	62B06001	0.050
21.	2222410	62B06002	0.050
22.	2222410	62B10007	0.025
23.	2222421	62B06005	0.050
24.	2220028	53M08003	0.050

An inventory of such lakes has also been prepared for the Chenab basin in Himachal Pradesh. These investigations have been carried out using high resolution IRS LISS III satellite data. During the investigation a total of fifty Moraine dam lakes could be delineated from the images on 1:50,000 scale (Table 4.50) Supra Glacier lakes.

One such lake formed in the Chenab basin has been studied for assessing the volume of water it contains using the empirical relation suggested by Clague and Mathew. The temporal changes in the aerial extent of the lake is in Table 4.51.

Table 4.50: Distribution of Lakes in Chenab Basin in Himachal Pradesh**Distribution of moraine dammed lakes in Chenab basin**

Sr. No.	Toposheet No.	Lake Area (km ²)	Sr. No.	Toposheet No.	Lake Area (km ²)	Sr. No.	Toposheet No.	Lake Area (km ²)
1	52C/12	.013	20	52 D/13	.006	39	52 H/06	.003
2	52C/12	.021	21	52 D/13	.019	40	52 H/06	.006
3	52C/12	.043	22	52 D/13	.007	41	52 H/06	.010
4	52C/12	.207	23	52 D/13	.023	42	52 H/06	.002
5	52C/12	.023	24	52 H/01	.012	43	52 H/06	.003
6	52C/12	.017	25	52 H/01	.003	44	52 H/06	.005
7	52C/12	.033	26	52 H/01	.009	45	52 H/06	.677
8	52C/16	.012	27	52 H/01	.036	46	52 H/06	.051
9	52C/16	.028	28	52 H/01	.033	47	52 H/06	.011
10	52C/16	.025 (SGL)	29	52 H/02	.003	48	52 H/08	.063
11	52C/16	.013 (SGL)	30	52 H/02	.538	49	52 H/08	.023
12	52C/16	.005 (SGL)	31	52 H/03	.062	50	52 H/10	.017
13	52C/16	.005 (SGL)	32	52 H/05	.076	51	52 H/10	.049
14	52C/16	.004 (SGL)	33	52 H/06	.105	52	52 H/11	1.053
15	52C/16	.015	34	52 H/06	.104	53	52 H/11	.004
16	52C/16	.015	35	52 H/06	.096	54	52 H/11	.003
17	52 D/13	.021	36	52 H/06	.054	55	52 H/11	.004
18	52 D/13	.011	37	52 H/06	.006	SGL: (Supra Glacier lake)		
19	52 D/13	.012	38	52 H/06	.041			

Table 4.51: Temporal Variation of the Aerial Extent of the Lake formed near the snout of Geepang Gath Glacier in the Chandra Basin, Himachal Pradesh

Year	Aerial Extent (km ²)
1976	0.27
1990	0.42
1998	0.50

Table 4.52: Estimated Volume of the Lake in Geepang Gath Glacier in Chandra Basin

Year	Aerial Extent (km ²)	Volume Estimated (million cu. m.)
1976	0.27	4.86
1990	0.42	7.56
1998	0.50	9.00

The formation of such lakes could be dangerous as they may contain large quantities of water. If any lake bursts, can cause flash floods in the downstream areas. To estimate the possible run off from these lakes, the lake formed at the snout of the Geepang Gath Glacier was studied in detail using the empirical relation (suggested by Clague and Mathews, 1973). This lake is located near the snout of the glacier and its aerial extent was measured as 0.27 km² using the 1976 Survey of India toposheet. The temporal variations in its extent were measured using the satellite data for the years 1990 and 1998. The lake area was seen to have increased to 0.42 km² in the year 1990 and 0.50 km² in the 1998 (Table 4.52) . Thus, there is an overall 0.22 km² increase in its area within a span of 22 years. Using the empirical relation the peak discharge of 326.89 m³/sec was estimated with volume as input. This discharge is extremely large in comparison to the summer discharge estimated for the Chotta Sigri glacier which is only 10 m³/sec. Therefore, this discharge can cause a significant increase in the river discharge at the confluence with the Chandra river and may cause flash floods downstream. Thus, in order to assess possible threats from such water bodies, careful systematic monitoring is required for these glacier lakes.

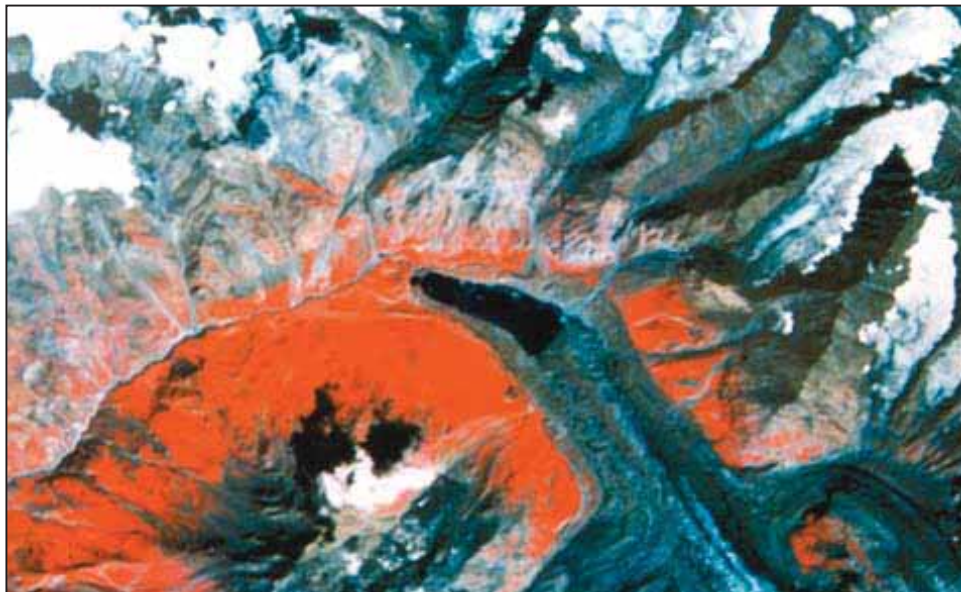


Fig. 1.16 Moraine Dam Lake near the Snout of Geepang Gath Glacier in the Chandra River Basin, Himachal Pradesh

4.16 Other Associated Hazards of Climate Change Over Himalayan Region:

a) Regional Haze:

In addition to greenhouse gases, the effects of regional haze is also becoming an emerging challenge for some mountain regions. For example, the recent Indian Ocean Experiment (INDOEX) revealed a brownish layer over the Indian Ocean more than 1000km off the coast. Haze affects climate and environment in many different ways. Observation results and climate model studies (UNEP and C4, 2002) suggest that the haze layer could have potentially significant impact on monsoon climate, water stress, agriculture productivity and human health. The most direct effects include: a significant

reduction in the amount of solar radiation reaching the surface; a 50-100% increase in solar heating of the lower atmosphere; suppression of rainfall; reduction in agriculture productivity; and adverse health effects.

Aerosols can directly alter the hydrological cycle by suppressing evaporation and rainfall. With respect to agriculture production, decrease in the amount of solar radiation received by vegetation can alter productivity directly; and indirectly through the induced changes in temperature and hydrological cycle.

b) Impact on the Agriculture and Horticulture Pattern Over the Himalayan Region:

Rising temperature now estimated to be 0.2°C per decade or 1°C by 2040 would diminish the yields of some crops, especially if night temperatures are increased. Higher temperature may increase dark respiration of plants, diminishing net biomass production. However, higher temperature could have a positive effect on the growth of plants of the CAM type.

Higher temperature in cold - season may lead to earlier ripening of annual crops, diminishing yield per crop, but would allow locally for the growth of more crops per year due to lengthening the growing season.

Winter kill of pests is likely to be reduced at high latitudes, resulting in greater crop losses and higher need for pest control. Higher temperatures will allow for more plant growth at high latitudes and altitudes.

Present (agro) ecological zones could shift in some cases over hundreds of kilometres horizontally, and hundreds of metres altitudinally, with the hazard that some plants, especially trees, and animal species cannot follow in time, and that farming systems cannot adjust themselves in time.

The climate change has brought forward and reduced the Rabi season due to delayed and less rainfall. The yield of wheat crop has been affected owing to high maximum and minimum temperatures. The area under rice crop has been diverted to maize crop.

Soil, as a medium for plant growth, would be affected in several other ways. Increased temperatures could lead to denitrification and more decomposition of soil organic matter.

Increased plant growth due to the CO₂ fertilization effect may cause other plant nutrients such as N and P to become in short supply which would stimulate mycorrhizal activity (making soil phosphorous more easily available) and also biological nitrogen fixation (whether or not symbiotic).

The changes in patterns and amounts of rainfall, thus long spells of drought particularly during summer. Loss of vigour in plants reduction of their fruit bearing ability and deficiency of macro and micronutrients essential for their growth.

Quantitative loss to the standing crop by way of reduction in size of the fruits and their dropping due to moisture stress.

Qualitative loss to the crop in terms of less juice content, low colour and shorter shelf-life, frequent pest outbreaks especially of mites and insects.

On the other hand, long spells of incessant rains cause loss of topmost and fertile layers of soil that rendering the land more or less unsuitable for cultivation.

Comparatively less snowfall during the winter and large scale fluctuation in the day and night temperatures results in non-fulfilment of chilling requirement especially for temperate fruits like apple, pear, cherry which is a pre-requisite for a good crop.

Overall rise in average temperature of the region over the years has also rendered large area, supposed to be marginally suitable for the cultivation of apple one-two decades ago, unfit for the and the farmers are shifting from apple cultivation to other crops like stone fruits, pomegranates, walnuts.

c) Implications:

Mountain issues cannot be separated from issues and activities in the lowlands, especially in the context of emerging atmospheric issues. These issues will pose major challenges for mountain areas and their natural resources in the formidable future.

4.17 Policy Development and Implication:

Mountain issues cannot be tackled by mountain communities or by individual countries alone. This is particularly true for atmospheric issues, which derive from regional to global processes. Consequently, partnership between institutions and programmes concerned with mountain and atmospheric issues are vital, so that the issues can be tackled jointly. Therefore, regional agreements should be adopted, recognizing the need for joint action. Such agreements should not limit their scope to practical dialogue above. Under the framework of such agreements, national policies should be developed to establish the scientific basis for understanding these issues.

The development and distribution of relevant educational material and information on climate change and its implications on mountain environments and socio economic consequences are also vital in order to move the policy cycle forwards. The existing conservative approach on data sharing should be changed and dissemination of scientific findings should be encouraged.

4.18 Practical Implication:

In order to cope with hazards such as GLOFs, an early warning system should be developed and implemented using a multi-stage approach, multi-temporal data sets, and multi-disciplinary professionals. The initial focus should be on known potentially dangerous hotspots. The development and implementation of monitoring, mitigation, and the early warning system involves several phases.

Early warning systems should be supported by continuous monitoring of key environment variables. This requires the establishment of, and long-term support for, observatories for air quality, meteorological, aerosol monitoring. Hotspots areas should be given priority when establishing the observatories. Together with satellite observations, data from these observatories should provide critical coverage to understand long-term trends.

A more complete picture of the roles and interactions of greenhouse gases, aerosols and ozone is urgently needed. The aerosols and high level ozone that result from rural and urban air pollution are implicated in global warming since they could influence climate change by altering the radiative balance at regional, and perhaps global scale. Their presence can also have ecosystem impact, notably on vegetation. Thus, there is a need to assess impact within a single framework, not only monitoring, but also coordinated scientific studies complementing observatories' results should be conducted.

4.19 People's Perceptions About Changing Climate Indicators:

Based on the consultation meeting with the farmers at village, it became evident that they have started perceiving the impact of the changing climate. Some of the observations of the farmers, cited in support of their apprehensions, are as follows:-

- Kikar (Acacia) and Tali (Dalbergia) trees are drying up.
- Population of water fowl is on the decline.
- Decline in paddy grown areas as they have been diverted to maize crops..
- Population of Kikar and Shisham and Ban trees is on the decline.
- Vultures are reducing in the area.
- Yield of wheat crop is reducing.
- Sources of water are drying.
- Incidence of diseases and pests increasing in Rabi crop.
- The inherent soil moisture decreasing.
- House sparrows, crow population on the decline.
- Incidence of forest fires is on the rise.
- Rabi season has been brought forward.
- Floods and drought on rise.
- Yield of crops declining.
- Morinue trees drying up.
- Devdar (Cedrus deodara) and Ban (Quercus) trees the decline.
- Honeybees and butterflies decreasing.
- Apple production declining, more area diverted to vegetables.
- Population of ducks, waterfowl has reduced.
- Chir-Pine forest is noticed at a higher elevation.

4.20 Recent Geo-Environmental Phenomena:

a) Landslide and Hot Gaseous Emanation:

Recently emissions of hot gaseous vapours started from an old landslide at village Ravana in district Sirmour in the month of October 2005. Ravana village is located along the left bank of the Giri River and is bounded between $30^{\circ} 48' 35''$ North latitude and $77^{\circ} 15' 45''$ East longitude. This emanation created panic amongst the common people as they feared it to be some volcanic activity in the area. The other reason for their fear was the Kashmir earthquake that occurred on 8th October 2005.



Hot Gaseous Vapours Temp. around 570 Celcius

A preliminary survey was carried out by the team to allay the fears of the local people of about any "Volcanic activity" in the area. At the site, the landslide associated with emanations of white vapour and hot gases was noticed. This survey revealed that an active landslide can be related to the active faulting in the area that is situated close to the Giri Fault. The Giri Fault is known to extend in a NW-SE direction for a distance of over a 100 km from about Kandaghat in the northwest to the southeastern part of Sirmour district. The Giri fault demarcates a predominantly carbonate sequence (Krol group) in the southwest from an older sequence comprising the Shimla Group. The Giri Fault that steeply dips in the northeast is located on the inverted limb of a macroscopic anticline. The fault is a reverse fault that has brought the older Shimla rocks up to occupy a higher tectonic level. The Giri Fault is shown to have been offset by a number of transverse faults that have a small aerial extent. This survey shows that the Ravana landslide is located at the junction of one such transverse fault on footwall block of the Giri Fault. The landslide zone covers a rectangular area of about $300 \times 200 \text{ m}^2$ on these steep slopes of the western bank of the Giri river. It represents a composite landslide that is made up of multiple rotational landslides of variable dimensions. The bedrock composed of black carbonaceous shale that shows stains of brown, yellow and white coloured sulphates and other salts. The toe of the landslide zone is truncated by a southeasterly flowing



Old landslide with the Activation of Gases

river valley. The crown of the landslide zone that is situated about 200 m above the river bed is marked by about 10m escarpments face that has an arc shape in the upper part of the slope.

The landslide zone is truncated both in the northwest and the southeast by a relatively straight line morpho-tectonic feature that is apparently marked by a newly appeared escarpment face that reaches up to about 30 m maximum in the middle part above the slide zone. The escarpment line trend is parallel to the slope and at right angles to the southeasterly flowing Giri River. The river also takes a sharp transverse bend downstream at a point close to the foot of the escarpment. The river valley regains its NW-SW trend after about 100 m long transverse valley trend further downstream. The sharp bend in the Giri river can also be linked to other geomorphic features defining a lineament on the satellite imagery of the area. The northwestern limit of the landslide zone is also marked by morphotectonic features that are transverse to the river valley. Graben like landforms can be seen on the northwestern boundary of the landslide zone. Fresh appearance of straight-line fissure that has an opening of up to 10cm on the ground can be traced in the NE-SW direction along the slope along about the middle of the graben like feature.

b) Groundwater Emergence at Village Domehar:

This is another geological on related phenomenon that took place in the state recently after the emanation of hot gaseous vapours at Ravana. In the month of April the sudden appearance of groundwater in a large quantity was observed by the local people in village Domehar in Arki Tehsil of Solan District. This village is located near Kunihar and is bounded between $31^{\circ} 6' 45''$ North latitude and $76^{\circ} 57' 15''$ East longitude. The emergence of springs was noticed along the contact zone (in close proximity to Krol thrust). Geologically the area is characterized by the presence of rocks of Shimla group and Dharamshala formations. The dominant litho units exposed in the area are shales with limestone of Shimla Group underlaid by sandstone and shales of Dharamshala formation. The contact between the two litho units is separated by the Krol thrust which has the regional extension separating the Tertiary from Pre-Cambrian rocks.

Recommendations: The following recommendations were made in respect of these two episodes after field visit by an expert team.

- These two incidences of the recent geo-environmental phenomena cannot be considered a precursor for a major seismic event. However, if such occurrences are reported in greater numbers, then those should be considered seriously and monitored together with other parameters of precursors.



Emergence of Ground Water At Domehar

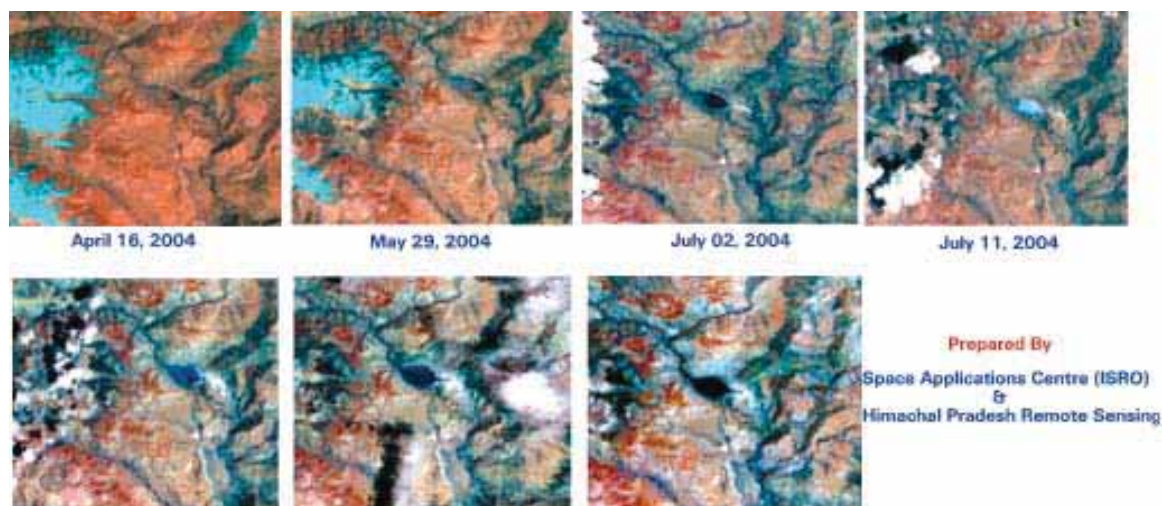
- A detail mapping of the landslide zone of Ravana village needs to be carried out showing the bedrock lithology and overburden material.
- The above mapping should include measurement of fractures and other geological features to analyse the stress affecting the area.
- The different groups emanating heat and gas may be trenched up to a depth of five metre or more, to study the geothermal energy in the area.
- Radon and Helium gas measurement should be taken up in the slide zone.
- A detail geo - hydrological study should be carried out for the entire basin.

c) Parechu Lake Threat:

Parechu is a small tributary of the Spiti river joining the main stream at Samdo at the boundary of the Kinnaur and Spiti Sub Division of Lahaul & Spiti Districts of Himachal Pradesh. Parechu river originates within Tibetan territory and flows in an almost N-S direction before it joins the Spiti river.

During the year 2004 while Satluj Jal Vidyut Nigam Ltd. was undertaking a study through the National Remote Sensing Agency Hyderabad, they observed the formation of a water body in the catchment area of the Satluj river. The matter was reported to the government for taking immediate precautionary measures as the water body feeds the areas in the Himachal territory. As a follow up of this investigation continuous monitoring was carried out of this water body.

The general topography of the area where this water body was created is a small depression at an altitude of 3880 m above m.s.l. The braiding in the river is a conspicuous feature of this depression and is very well observed from the satellite data as well as from the Survey of India toposheets. The river course was blocked due to a landslide which is common feature in this zone. The temporal variation in the aerial extent of the water body for the year 2004 when it was formed can be seen from the pictures.



Temporal Variations in Parechu Lake:

As the satellite data analysis the following observation were made:

- On 16th April 2004, the conditions were normal and data show no accumulation of water in the depression.
- Slight accumulation of water was observed on May 29, 2004.
- The water extent in the depression started increasing as a result of blockage along the river course on July 02, 2004.
- The accumulated water drained off on July 11, 2004.
- On July 16, 2004, the river course was blocked by a landslide along the river course and accumulation of water was observed again.
- On July 21, 2004 onwards the situation remains the same and water extent kept on increasing.
- July 26, 2004 the depression was full to capacity and backwater was observed in the upstream direction.
- In the year 2004 the lake was not breached.
- In the year 2005 on 26th June 2005, the lake was breached and caused wide spread damage in the downstream areas.
- After the experience of 2005, a close vigil of the lake is being undertaken by the government and the administration is taking all required precautionary measures.
- From the satellite data of August 2006, it is observed that the conditions are normal and there is not much accumulation of water in the depression and there is regular outflow of water.

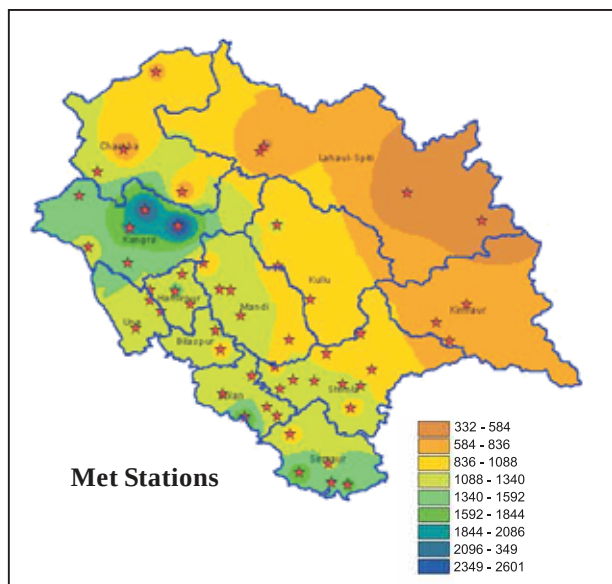


Parechu Lake

Some Trends in Climate Change:

An analysis of the rainfall trends in the four different elevation sites of Himachal Pradesh and their vicinity show that rainfall changes are lower in the mid hill than uplands and lowlands. On an average, rainfall amount in the Himachal Pradesh are 26.5 to 1365 mm lower than in the 1980s decreasing by 1.9 to 44.0 mm per year.

On an average, air temperatures in the Himachal Pradesh are one degree centigrade higher than in the 1970s rising by 0.06°C per year.



Map 1.12(a) Rainfall Pattern of Himachal Pradesh

Source: Centre for Geo-Informatics, CSKV, Palampur

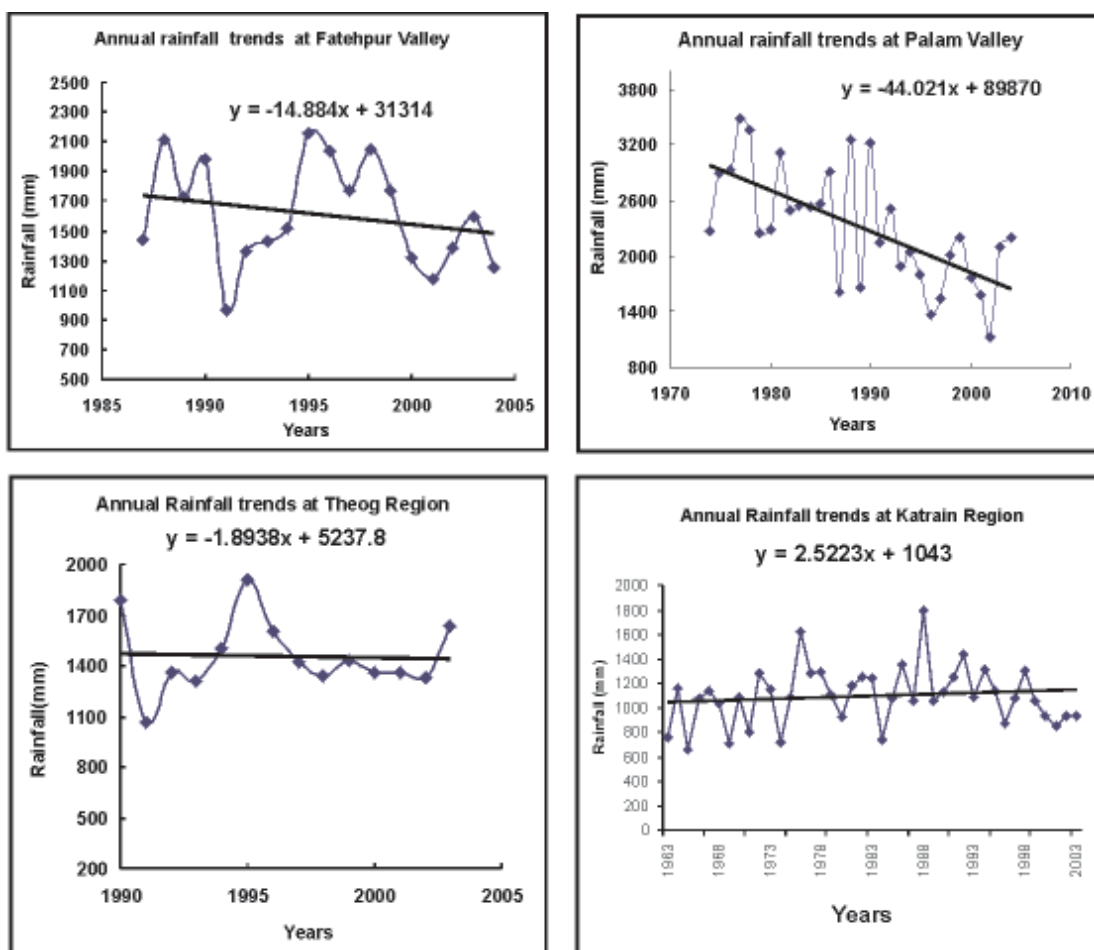
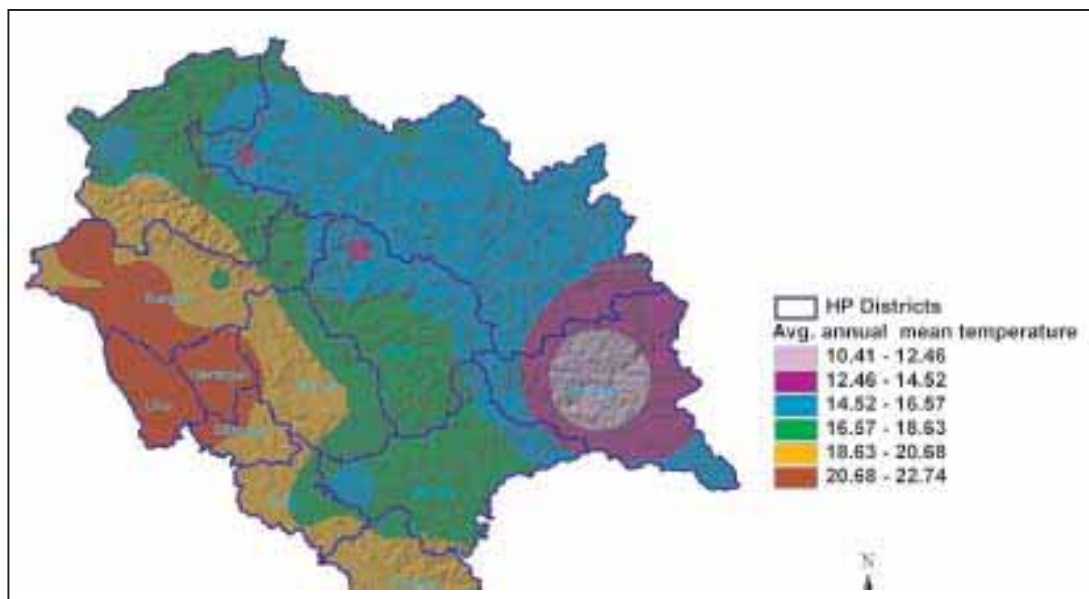


Fig. 1.17(a) Annual Rainfall Trends of Some Areas

Source: Centre for Geo-Informatics, CSKV, Palampur



Map 1.12(b) Average Annual Mean Temperature

Source: CSKV, Palampur

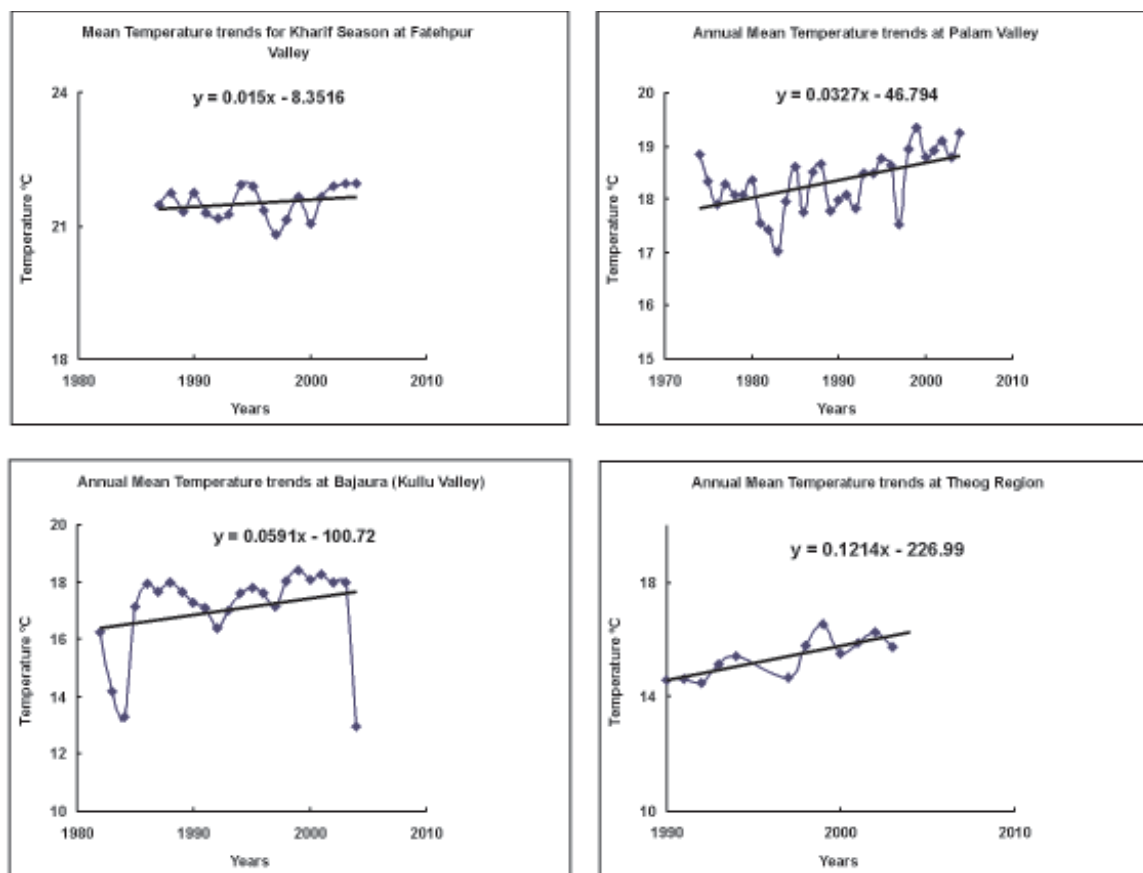
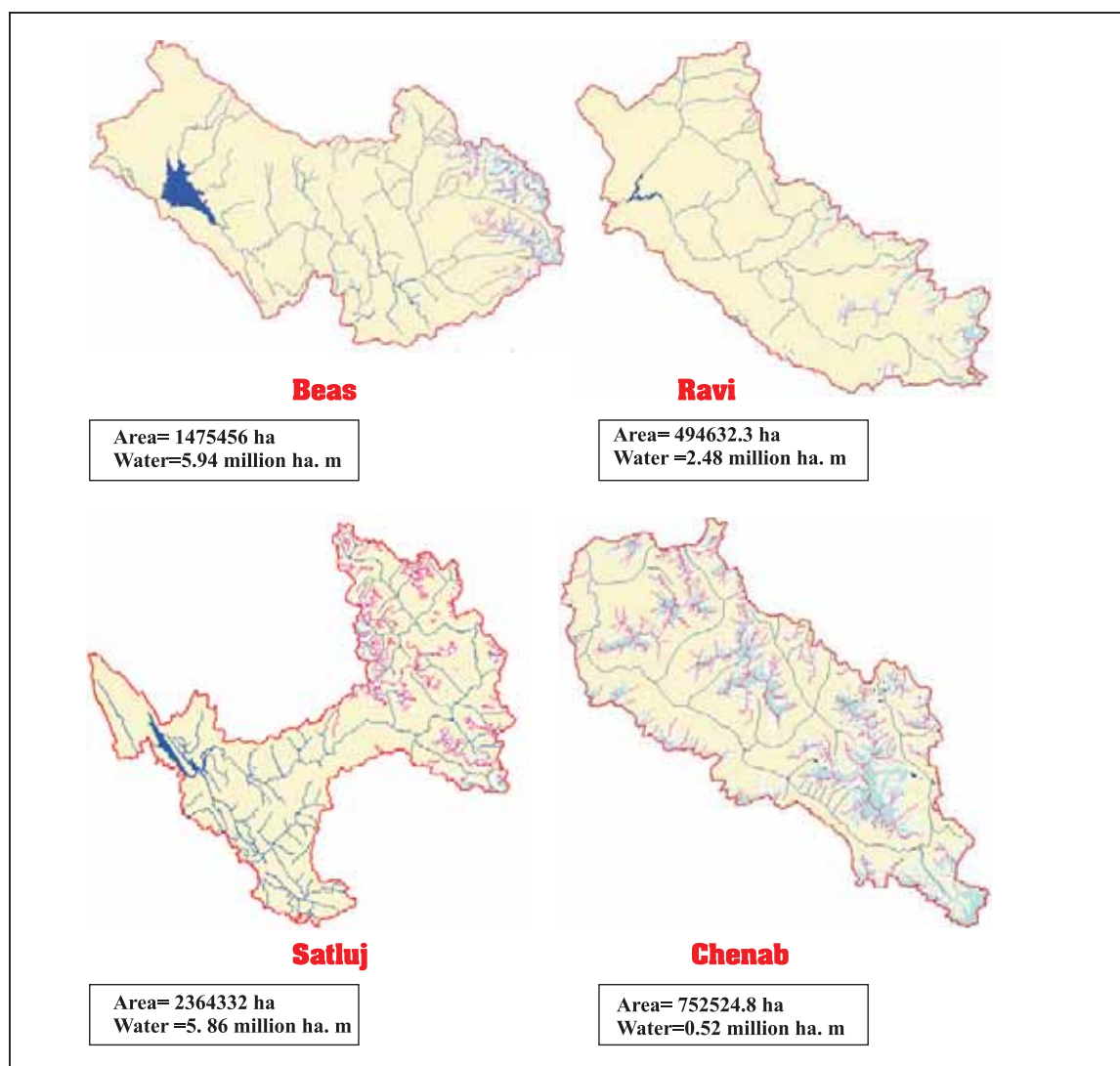


Fig. 1.17(b) Annual Temperature Trends of Some Areas

Source: CSKV, Palampur

Water Availability in Major River Basins of Himachal Pradesh 5-7 per cent Increase in all Basins.



Source: CSKV, Palampur

Impact of Climate Change:

Climate change is already impacting plants and altering the structure of plant communities. Species that are particularly vulnerable to climate change include those with limited ranges and dispersal abilities (Highly endemic species in our cold region or dry deserts are at great risk).

Historical plant migrations suggest that some species will likely migrate to areas with appropriate climates, but many plant species will not be able to migrate fast enough to keep pace with current rates of warming. Most of the highly valued plant species are the poorest competitors and have least adaptability.

Many plant species are also responding to climate change by advancing the onset of leaf burst, flowering, and fruiting, and delaying leaf drop. The growing season is lengthening.

It has major impacts on timing-sensitive relationships with pollinators, seed dispersers, and herbivores. Events that have long occurred in synchrony may become decoupled (Shift in cropping season, apple bud burst in and around Shimla, Adaptability of Citrus and peaches under Shimla).

- Frequency and intensity of snowfall has decreased. The average snowfall was 272.4 cm during 1976-80 which has declined to 77.20 cm during 2001-04 which resulted in large scale mortality in *Robinia pseudo acacia* in sub temperate and lower part of the wet temperate areas.
- Tips of *Cedrus deodara* trees growing in sub temperate forests are showing sign of drying from terminal portion because of non fulfillment of their chilling requirements.
- Gap between minimum and maximum temperature in dry temperate zone is increasing. It was 19.3°C during 1991-95 which has increased to 20.4°C during 2001-04 which led to rapid increase in regeneration of *Juniperus macropoda*. These conditions go against the regeneration and establishment of Neoza Pine (*Pinus gerardiana*), a highly economic tree species of the region.
- The species like *Taxus bacata* and *Corylus colurna*, which have narrow altitudinal range (7000-9000 feet) and have severe natural regeneration problems will face stiff competition for their survival.
- The occurrence of frequent cold wave conditions during spring season will not allow the natural regeneration of Sal (*Shorea robusta*) growing in foot hills of Himalayas. Because Sal seedlings are highly susceptible to frost damage.
- The winter seasons rains have shifted from Nov-Feb to Jan-March. This led to fluctuation in the productivity of Rabi crops like wheat.
- The distribution of species in Himalayan region is mainly governed by their stratification requirement. Because of non fulfillment of their stratification requirements in their original habitats there will be upward shift (for every one degree increase in temperature there will be a shift of about 270 m towards higher altitude). The apple belt has shown a considerable shift in altitude.



Lantana Invasion -Many species are eliminating in the competition (by the Rule of Survival of the Fittest)

- The cold waves result in decline in productivity/ cold injury to mango, litchi, papaya, banana, pomegranate and aonla.

4.21 Climate Change:

a) Understanding Climate Change:

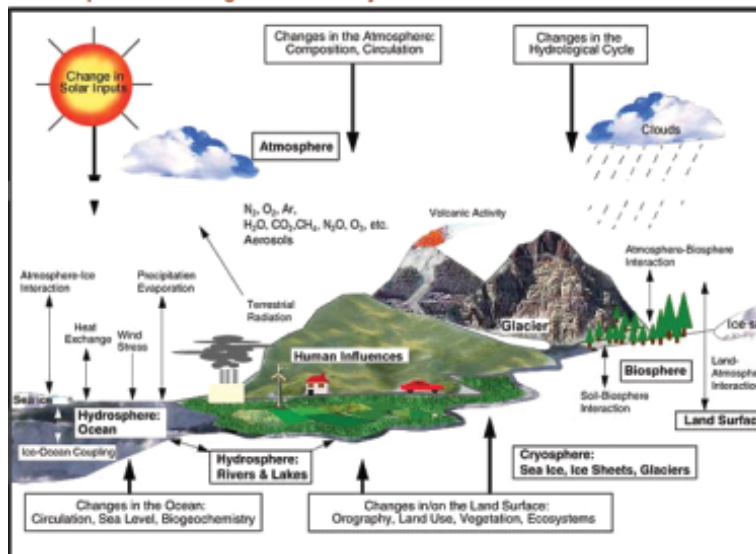
The atmosphere carries out the critical function of maintaining life-sustaining conditions on Earth, in the following way: each day, energy from the sun (largely in the visible part of the spectrum, but also some in the ultraviolet and infra red portions) is absorbed by the land, seas, mountains, etc. If all this energy were to be absorbed completely, the earth would gradually become hotter and hotter. But actually, the earth

both absorbs and simultaneously releases it in the form of infra red waves (which are invisible but can be felt as heat). All this rising heat is not lost to space, but is partly absorbed by some gases present in very small (or trace) quantities in the atmosphere, called Green House Gases (GHGs).

The earth is surrounded by a layer of these gases that keep its surface warm and able to sustain life. Since industrialization, this layer has grown thicker, as human beings produce more and more greenhouse gases, trapping in heat. While greenhouse gases occur naturally, they are also produced by burning fossil fuels and through other human activities. As a result, our planet is getting warmer faster than ever before.

The main greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs). Levels of all key greenhouse gases (with the possible exception of water vapour) are rising as a direct result of anthropogenic activities. Concentration of carbon dioxide (mainly from burning coal, oil & natural gas) methane & nitrous oxide (due to agriculture and changes in land use), and CFCs (produced by industries) are changing at an unprecedented speed. The result is known as “enhance greenhouse effect”. This could lead to greater warming, which in turn, could have an impact on world’s climate. **Climate Change refers to statistically significant variation in either the mean state of the climate or its variability which is attributed directly or indirectly to anthropogenic activities that alter the composition of global atmosphere and which are in addition to natural climate variability observed over comparable time periods leading to phenomenon known as "Climate Change".** Climate or in simple terms the Weather refers to the various surface variables such as Temperature, Precipitation and Wind velocity.

The components of the global climate system



Past records suggest that the earth has become warmer by 0.5°C during the last century. An analysis of the temperature trends in the Himalayas and their vicinity show that temperature changes are higher in the uplands than the lowlands. On average, air temperatures in the Himalayas are one degree centigrade higher than in the 1970s rising by 0.06°C per year.

b) Historical Perspective:

Climate change emerged on the international political agenda in the mid-1980s with increasing scientific evidence of human interference in the global climate system and with growing public concern about the environment. The United Nations Environment Programme (UNEP) and the World Meteorological Organizations (WMO) established the Intergovernmental Panel on Climate Change (IPCC) to provide policy makers with authoritative scientific information in 1998. In its first report in 1990, IPCC concluded that the growing accumulation of human made green house gases in the atmosphere would "enhance the green-house effect, resulting in an additional warming of the Earth's surface" by the next century, unless measures were adopted to limit emissions. The UN General Assembly responded to this by launching negotiations to formulate an international treaty on global climate protection which resulted in completion of the United Nations Framework Convention on Climate Change (UNFCCC) in May 1992.

The convention was opened for signature at the Earth Summit in Rio de Janeiro in June 1992, Over 180 countries at the "Earth Summit" in Rio de Janeiro adopted the United Nations Framework Convention on Climate Change (UNFCCC). India signed UNFCCC on 10th June 1992 and ratified that in 1993. The UNFCCC is a legal framework that enables Parties to the Convention to start the process of stabilizing greenhouse gases (GHGs) in the atmosphere. Parties to the UNFCCC have been meeting every year since 1994 to implement and define this framework. The convention established the Conference of Parties (COP) as its supreme body. During COP-3 in Kyoto, Japan, the Parties agreed to a legally binding set of obligations for 38 industrialized countries and 11 countries in Central and Eastern Europe, to return their emission of GHGs to an average of approximately 5.2% below their 1990 levels over the commitment period 2008-2012. This is called the "Kyoto Protocol" to the convention. The Kyoto Protocol entered into force, on February 16, 2005, when countries represent at least 55 percent of the Annex-I countries' 1990 emissions levels had ratified the treaty. IT sets legally binding GHG reductions for industrialized countries, or so-called Annex-I Parties. The carbon trade came about in response to the Kyoto Protocol signed in Kyoto, Japan, by some 180 countries in December 1997.

The Protocol entered into force on February 16, 2005 and targets six main greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydro fluorocarbons (HFCs), per fluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

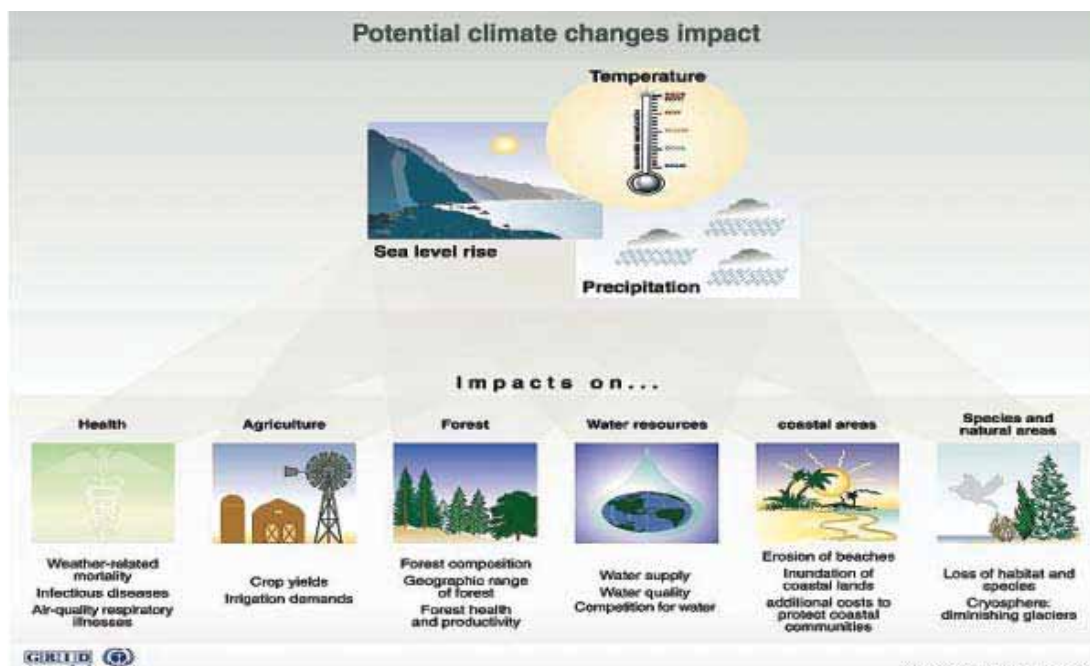
In time for the first compliance period (2008-2012), Annex-I Parties have to encourage or regulate private companies and individuals to reduce GHG emission. Most of these reductions will occur within the borders of each Annex-I country, but the Kyoto Protocol identified mechanisms by which credit can be received for GHG reduction projects in non-Annex-I countries. Recognizing that relying on domestic measures alone to meet the emission targets could be difficult, the Kyoto Protocol offers considerable flexibility. It is the Clean Development

Mechanism (CDM) through which industrialized countries can finance mitigation projects in developing countries contributing to their sustainable development.

c) Likely Impacts of Climate Change:

- Food Production and food security.
- Water stress and water scarcity.
- Glacier retreat.
- Floods & Droughts.
- Forest biodiversity, forest fires, forest regeneration and productivity.
- Infrastructure; hydro-projects.
- Health; vector borne diseases.

Likely Impacts of Climate Change



d) Mitigation and Adaptation Strategies:

In order to meet the challenges of "Climate Change" both Mitigation and Adaptation Strategies are required.

i) Mitigation:

Measures to reduce the Pace & Magnitude of the changes in global climate being caused by human activities.

ii) Adaptation:

Measures to reduce the adverse Impacts on human well-being resulting from the changes in climate that do occur.

4.22 Clean Development Mechanism (CDM):

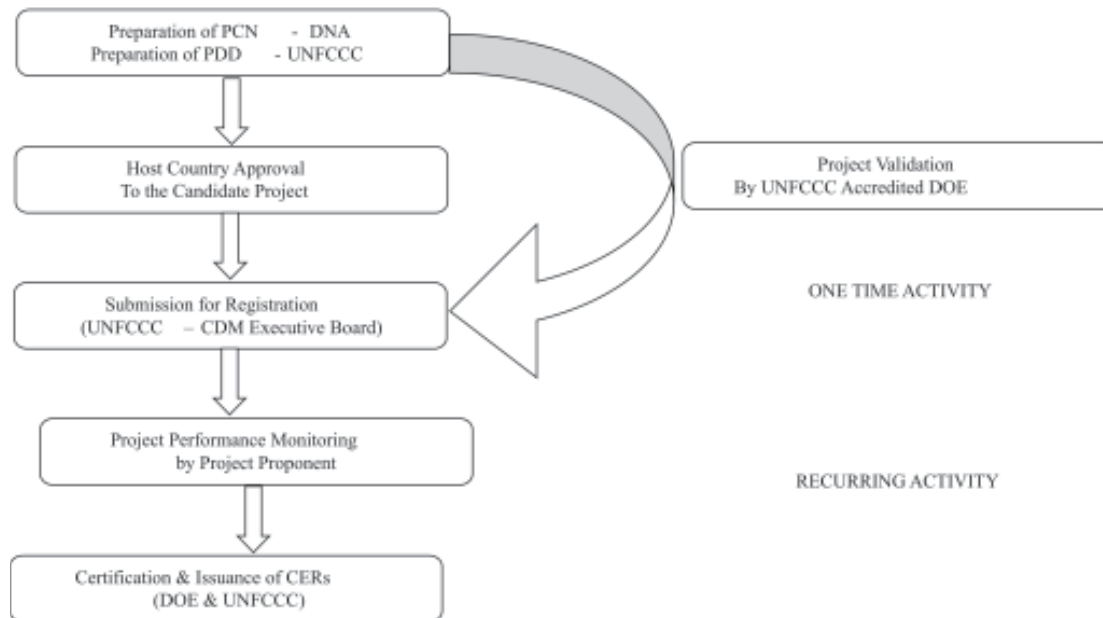
Greenhouse gases (GHGs) mix uniformly in the atmosphere, making it possible to reduce emissions at any point on the planet and have the same effect. This fact enables countries pursuing GHG reductions to do so where they can be reduced at lower costs. The purpose of the CDM is to benefit both the investor and host countries by contributing to sustainable development in the host developing countries and by allowing investor countries to meet their GHG reduction targets at the lowest possible cost by taking advantage of the lower marginal cost of reducing GHG emissions in developing countries. It is the sole prerogative of the host country to confirm whether the project contributes to its sustainable development. Developed countries that have ratified the Kyoto Protocol and are signatory to Kyoto Protocol (commonly referred as Annex-I countries) can engage in projects in developing countries to reduce any combination of six greenhouse gases. The *Certified Emission Reductions* (CER) are then received by the Developed Countries as investors to comply with its emission reduction targets.

The CDM is meant to work bottom up- to proceed from individual proposals to approval by donor and recipient governments to the allocation of "*Certified Emission Reduction*" (CER) credits. In other words a CDM project has to follow a definite CDM Project Cycle. The CDM is supervised by Executive Board which comprises 10 members, elected by the Conference of Parties (COP).

CDM Project Cycle:

Step	Definition	Responsible Entity
1. Project Design	A document with the information needed about the proposed CDM project that is submitted for validation.	Project Participants
2. Validation	Process of independent evaluation of a CDM project.	Operational Entity
3. Registration	Formal acceptance of a validated project by the UNFCCC.	Executive Board
4. Monitoring	The collection and archiving of all relevant data necessary for establishing GHG emissions by sources occurring within the project boundary during the crediting period.	Project Participants
5. Verification	Periodic independent review and determination that GHG reductions have occurred as a result of the registered CDM project activity during the crediting period.	Operational Entity
6. Certification	Written assurance that a project activity achieved the GHG reductions stated during the specified time period.	Operational entity

CDM Project Cycle - Basics



CDM Characteristics can be summed up as follows:

- CDM projects must be voluntary, and must have the host country's approval;
- They must meet the sustainable development goals defined by the host country;
- They must reduce GHG emissions above and beyond "business as usual";
- They must account for GHG emissions that occur outside the project boundary that are attributable to the project;
- They must include the participation of stakeholders;
- They must not contribute to environmental decline;
- They are limited to non-nuclear technology and there is a limited amount of forestry credits that are eligible.

a) Carbon Credit:

Carbon credits are a key component of national and international emissions trading schemes that have been implemented to mitigate global warming. They provide a way to reduce "Green House Gas" (GHG) emissions on an industrial scale by capping total annual emissions and letting the market assign a monetary value to any shortfall through trading. Credits can be exchanged between businesses or bought and sold in international markets at the prevailing market price. Credits can be used to finance carbon reduction schemes between trading partners and around the world.

For trading purposes, one allowance or Certified Emission Reductions CER is considered equivalent to one metric tonne of CO₂ emissions. These allowances can be sold privately or in the international market at the prevailing market price. This trade settles internationally and hence allows allowances to be transferred between countries. Each international transfer is validated by the UNFCCC.

b) CDM Potential in Himachal Pradesh:

The following areas offer both threats and opportunities in CDM scenario in Himachal Pradesh. The sector wise description is as under:

1. **Hydropower:** The government's policy objective is to exploit the huge hydro power potential in the State. At present, about 25% of the total installed capacity is accounted for by hydro in the country. For the State it is sun rise industry. There is a huge potential for tapping carbon credits in hydro power.
2. **Energy Efficiency and Conservation:** There is an urgent need that in Himachal Pradesh we too introduce practices such as use of Compact Florescent Lamp (CFL) by way of total shift from traditional incandescent bulbs to the Compact Florescent Lamps. Therefore, this has a huge potential for tapping carbon credits in energy efficiency and conservation.
3. **Renewable Energy:** Himachal can too usher in a very active programme to promote the use of renewable energy in solar, wind energy and biogas. There exists exciting potential with respect to solar sector in areas photovoltaic systems and its use in rural electrification, use solar heating in commercial entities, housing etc. with respect to wind energy it can be tapped for power generation, water lifting etc. Similarly, there exists potential.
4. **Transport:** The use of ropeway for transportation of both men and material another area which can be used for earning carbon credits. Similarly the use of railways for transportation of horticulture and agricultural produce vis-à-vis trucks and the environmental benefits accruing on account of saving of carbon fuels is another potential area for earning CERs. Promotion of biofuels is also a area which can help in mitigation of GHGs.
5. **Industry:** The major energy-consuming sectors are: steel, cement, caustic soda, brick, aluminum and electric power generation out of which cement, brick kilns, induction furnaces, paper, steel etc. are areas which can benefit from CDM regime.
6. **Afforestation & Land Restoration:** This area too offers opportunities in earning CERs benefits. The need is to tap funding from international donors for afforestation and reforestation programmes and prepare viable projects for securing CERs.
7. **Waste Management:** Setting up of common waste management facilities especially in lower areas for generation of energy from waste would facilitate earning of carbon credits.

Carbon Credits through Clean Development Mechanism (CDM) projects can be earned in several industries/projects

Industries	Applications of CDM
• Coal based power generation • Hydro power • Distillery & Brewery combo • Iron & Steel • Manufacturing • Paper and Pulp • Real Estate Developer • Refrigeration (HVAC) • Sugar industry • Tannery • Textiles	• Carbon capture and storage (CCS) • Contribution to a thermal based grid • Trigenation (CHCP) • Heat recovery • Energy efficiency • Cogeneration and power to grid • Green buildings • Use of environmental friendly refrigerants • Cogeneration and power to grid • Cogeneration and power to grid • Cogeneration and power to grid

h) Carbon Neutrality:

Carbon Neutrality relates to the maintenance of a balance between producing and using carbon, especially balancing carbon–dioxide emissions by activities such as growing plants in urban areas to offset vehicle emissions.

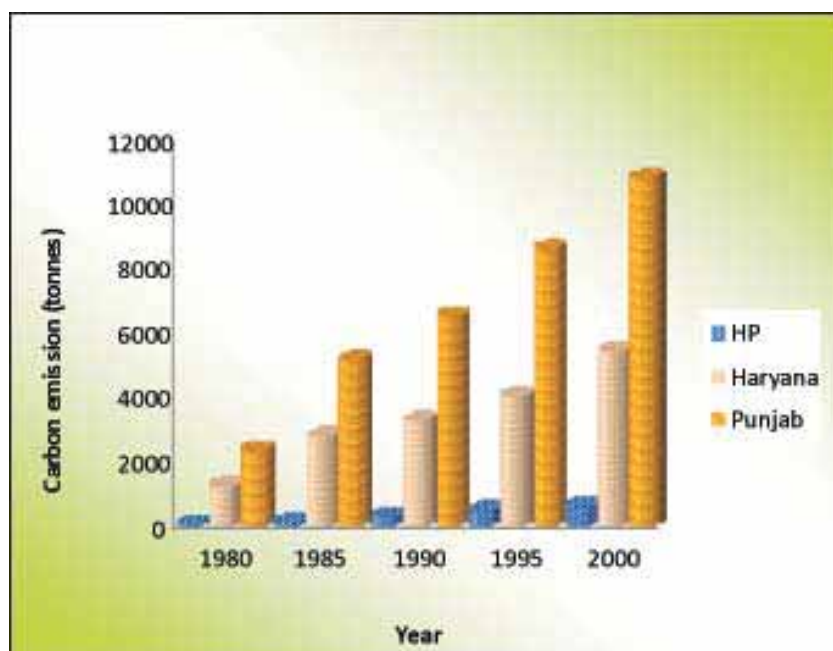


Fig. 1.18 Carbon Emissions Scenario from HP and other states (000' tonnes)
HP=660,000 t of C

Source: IIS Bangalore



Fig. 1.19 Per capita Carbon emissions
HP= 0.11 t C 0.4 t CO₂

Source: IIS Bangalore

i) Carbon Foot Print of Individuals /Households:

- The average footprint for people in India is 1.5 t CO₂ (0.40 t C).
- The average for the industrial nations is about 11 t.
- The average worldwide carbon footprint is about 4 t.
- To combat climate change the worldwide average needs to reduce to 2 t.
- Himachal Pradesh - average footprint is 0.4 t CO₂ (0.11 t C).

j) Energy Consumption in HP:

Energy Sources	Consumption in 2005/06	Renewable Energy Options
Diesel (HSD)	307,000 tonnes	Bio-diesel
Kerosene (Cooking and Lighting)	52,000 tonnes	Hydro-electricity/ SPV/Micro Hydro
LPG	78,000 tonnes	Bio-gas
Petrol (Motor Gasoline)	60,000 tonnes	Ethanol
Electricity	2,959 GWh § Industry (1492) § Domestic (830)	Micro hydro/SPV/Biomass power

4.23 National Action Plan on Climate Change:

In order to address the challenges of Climate Change the Government of India has launched National Action Plan on Climate Change. Under this Eight Missions has been initiated which are as follows

- National Solar Mission
- National Mission for Energy Efficiency
- National Mission Sustainable Habitat
- National Water Mission
- National Mission on Himalayan Ecosystem
- National Mission on Greening India
- National Mission on Sustainable Agriculture
- National Mission on Strategic Knowledge

Recognizing the ecological sensitivity and fragility of the State, the Government of Himachal Pradesh has constituted State Level Governing Council and State Level Steering Committee to dovetail State's initiatives with the Government of India. To achieve the objectives of the National Action Plan on Climate Change keeping in view the specific hill conditions the Government of Himachal Pradesh has distributed the specific tasks under the National Missions in following manner.

Mission	Department
National Solar Mission	MPP & Power, HIMURJA
National Mission for Energy Efficiency	MPP & Power, HIMURJA
National Mission Sustainable Habitat	Urban Development, TCP, Transport, PWD, Forests
National Water Mission	Urban Development, I&PH
National Mission on Himalayan Ecosystem	Environment, Science & Technology
National Mission on Greening India	Forests, Rural Development
National Mission on Sustainable Agriculture	Agriculture, Horticulture, Rural Development
National Mission on Strategic Knowledge	Environment, Science & Technology, Education

What we do today about climate change has consequences that will last a century or more. The part of that change is due to the green house gas emissions is not reversible in the foreseeable future. The heat trapping gases we send into the atmosphere in 2008 will stay there until 2108 and beyond. We are, therefore, making choices today will affect our own lives, but even more so the lives of our children and grand children. This makes climate change different than other policy challenges.

Emphasizing the need for moving ahead in a scientific and focused manner a number of initiatives have been taken by the State Government to reduce energy consumptions by:

- Promoting CFL – as energy saving instruments;
- Promoting hydel sector for meeting energy requirement of the State;
- Promoting run-off-river projects rather than dams/water impounding;

- Use of Solar Passive Technologies;
- Afforestation;
- Forest Fires Prevention Schemes;
- Ban on use of coal, fossil fuels and other traditional materials for the purpose of space heating;
- Rain Water Harvesting etc.

This document has been compiled on the basis of the information collected from the published work from the following references.

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FOREST AND ENVIRONMENT

**Recorded Forest Area**

Reserved Forest	1,896 km ²
Protected Forest	33,043 km ²
Unclassed Forest	2,094 km ²
Total	37,033 km²
<i>Of State's Geographic Area</i>	<i>66.52%</i>
<i>Of Country's Forest Area</i>	<i>4.78%</i>

Geographic Area	55,673 km ² (1.7% of country)
Population	6.07 million (0.57% of country)
Urban	0.59 million (9.8%)
Rural	5.48 million (90.2%)
Average Population Density	109 persons per km ²
Tribal Population	4.20%
Livestock Population	5.11 million (1.1% of country)
No. of Districts	12

Forest Cover

Very Dense Forest	1,093 km ²
Moderately Dense Forest	7,883 km ²
Open Forest	5,377 km ²
Total	14,353 km²

Tree Cover

Culturable Non-Forest Area (CNFA)	12,366 km ²
No. of trees per ha of CNFA	15.5
Tree Cover	491 km²
<i>Of State's Geographic Area</i>	<i>0.88%</i>
<i>Of CNFA</i>	<i>3.97%</i>

Forest & Tree Cover

Total Forest & Tree Cover	14,844 km ²
<i>Of State's Geographic Area</i>	<i>26.66%</i>
<i>Of Country's Forest & Tree Cover</i>	<i>1.91%</i>
Per capita Forest & Tree Cover	0.24 ha

Forest and Environment

Forest Resources

Introduction:

The forests and other natural ecosystems of Himachal Pradesh that constitute two-thirds of the geographical area of the state are crucial for its environmental, ecological and economic well-being and that the influence of the state's forests transcends well beyond its boundaries, significantly impacting on the ecology and economy of the Indo-Gangetic plains. The forests of the state are rich in biodiversity and play a vital role in preserving the fragile Himalayan ecosystem while also being a primary livelihood source for the rural population and the prime source of fresh water for both urban and rural populations. Forests, besides performing important ecological functions, provide essential services, such as food, fuel wood, fodder, timber, raw material for forest based industries and non-timber forest products. As per records nearly 66% of the geographical area of the state is forest lands; however, the extent of actual forest cover on all categories of land is only 26%. Himachal Pradesh has more than 12% of its area under two national parks and thirty two wildlife sanctuaries, which are home to some rare and endangered faunal and floral species such as the snow leopard, musk deer, pheasant and Himalayan Yew. The cold desert region of the state comprising Spiti sub-division of Lahul and Spiti District and Pooh sub-division of Kinnaur district is a distinct biome and manifests remarkable ecological and biological diversity unique characteristics of isolation and marginality. The forests of Himachal Pradesh, known for their grandeur and majesty, are like a green pearl in the Himalayan crown.

The Driving forces, Pressures, State of affairs, Impact and the consequent Responses (DPSIR) affecting the forests of the state are discussed in a nutshell as follows.

5.1 Driving Forces:

The life supporting systems in the mountainous state of Himachal Pradesh are now under great stress due to the impact of modern civilization, economic development and growth in human and cattle populations. According to the national Forest Policy, 1988, at least two-thirds of the geographical area should be under forests in mountainous states like Himachal Pradesh. The recorded forest area is 66.52 % of the state's geographic area, but only 26.66 % of the area is under forest and tree cover. However, 35.5 % of total available area can be brought under forest and tree cover as the remaining area is inaccessible, under permanent snow cover and above the tree limit.

5.2 Pressures:

Forest resources of Himachal Pradesh play an important role in the development of the economy and preserving the environment. Population growth has caused in increasing pressure on the limited land available for agriculture, and the forests remain the principal source of grazing, fuel wood

and fodder, especially among the poorest, as well as for rights and concessions such as Timber Distribution Rights. Non-wood forest products constitute an important source of livelihood for the poor and especially the landless. In the light of the increasing demand placed on the forest sector was its diminished capacity to meet the forest needs of the people, sustainability has become the major challenge which is being felt at national, state and local levels.

5.3 State of Affairs:

The forests are still contributing about two per cent to the National Domestic Product, while in Himachal Pradesh their share in the state GDP is about eight per cent. Forests were previously considered the main source in income of the state. Now the stress has shifted from exploitation to conservation. The State Forest Corporation has been conducting the felling of trees and sale of timber since 1974. The Forest Department concerns itself mostly with planting and the conservation of forests. The forest sector has to meet many diverse demands for forest products and services as the country has experienced three policy phases since independence, that is, industrial forestry, social forestry and protection/ regeneration. Degradation of forests, not deforestation, is currently the major problem in the forest sector, though deforestation was more important in the past.

5.4 Impacts:

Cumulatively, deforestation and forest degradation result in the adverse ecological and livelihood consequences listed below, leading to the reduced well-being of present and future generations.

- Reduction in biodiversity due to destruction of habitats of fauna and flora.
- Irregular water flow, drying up of natural springs and increased vulnerability to flash floods during rains.
- Loss of soil fertility associated with soil erosion, resulting in the reduction of agricultural productivity.
- Widening gap between demand and supply for wood products resulting in rapidly increasing prices and increasing imports of timber and other wood products.
- Scarcity of fodder and fuel-wood.
- Increase in carbon levels contributing to global warming.

5.5 Responses:

The Government has attempted to slow losses to its forests and increase tree cover through assistance from external donor agencies and a series of programmes and schemes, including social forestry, joint forest management and recently linking forest development with its rural development and poverty reduction strategies. The classification by vegetation and ecological types has been

done for the scientific management of forests, mainly for silvicultural purposes and legal categorization into Reserved Forests, Demarcated Protected Forests and Unclassed Forests is based on the degree of control. However, in the changed context for meeting environmental needs, forests are to be managed as an ecosystem for which functional classification of forests is important in the context of this Policy to promote appropriate land use for increased productivity, providing enhanced livelihood opportunities and improved conservation.

5.6 Legal and Administrative Status of Forests:

The forests have been classified into Reserved, Protected and Unclassed forest. The status of recorded forest as per legal classification the forest area and the growing stock of important tree species have been given at Tables 5.53 and 5.54.

i) Reserved Forests (RFs):

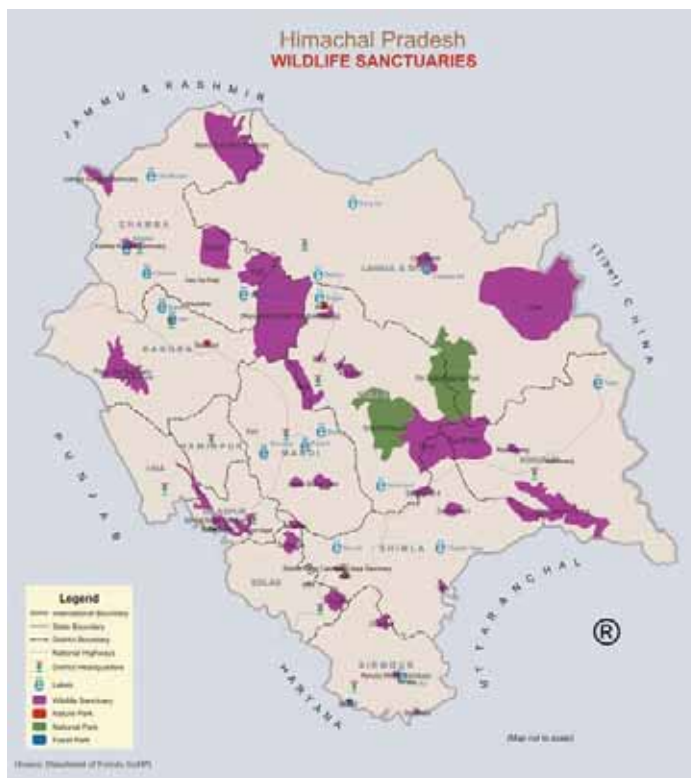
Reserve forests are the category most important to conservation or scientific management, and have been efficiently demarcated and notified under provisions of the Indian Forest Act (1927). These forests benefit from the highest degree of state control and the exercise of its proprietary rights. Generally, local villagers do not have any rights in reserve forests.

ii) Protected Forests (PFs):

Protected forests are similar to reserve forests but the state exercises a lower degree of control and proprietary rights. Local villagers can exercise some rights, unless specifically prohibited by notifications.

iii) Un-classed Forests (UFs):

All publicly-owned forests other than reserved forests and protected forests are categorized as un-classed forests. The state government exercises the least degree of control over such forests, and they are currently in a state of severe degradation. There is a gradual process of bringing un-classed forests into the category of reserved and protected forests.



Map 1.13 Wild Life Sanctuaries

Source: Department of Forests

Within the administrative/ legal classification of recorded forests framework, some areas are earmarked for specific preservation of wildlife, flora, and natural ecosystems. This has achieved by creating two national parks (under the Wildlife Preservation Act, 1972) and 32 wildlife sanctuaries in HP.

Table 5.53: Status of Recorded Forest Area in Himachal Pradesh

	Area (km ²)	Percentage
Reserved Forests	1896	5.12
Demarcated Protected Forests	11387	30.75
Un-demarcated Protected Forests	21656	58.48
Un-classed Forests	976	2.63
Others (managed by Forest Department)	370	1.00
Not managed by Forest Department	748	2.02
Total	37033	100.00

Table 5.54: Forests Area/ Growing Stock of Important Tree Species

Name of Species	Forests Area (km ²)	Growing Stock (000 m ³)
Deodar	811	16129
Kail	809	15074
Chil	1436	12648
Fir/spruce	1343	46357
Sal	183	2,563
Ban Oak	540	7988
Mohru Oak	35	893
Kharsu	246	5880
Maple	N.A	778
Horsechestnut	N.A	513
Walnut	N.A	331
Bird Cherry	N.A	256
Others	258	2315
Total	5661	111725

5.7 Forest Types of Himachal Pradesh:

Himachal has a diverse and rich flora as a result of the very varied physio-climate in its four agro-ecological zones. Differences in elevation lead to eco-zones with different vegetative cover, land use, and land capabilities. The vegetation of the state varies from tropical forests in the lower hills to alpine pastures in the high mountains. It has a rich and diversified flora because of the wide variety of soils, altitudes and climatic conditions. The altitudinal pattern of vegetation in Himachal Pradesh parallels latitudinal patterns of vegetation found globally. Hence the forest types seen in the higher altitudes of the state are more akin to those found in temperate latitudes. The forests of Himachal Pradesh are rich in vascular flora, which form the conspicuous vegetation cover. Out of a total of 45,000 species of plants found in the country as many as 3,295 species (7.32%) are reported in this state. More than 95% of the species are endemic to Himachal and characteristic of the Western Himalayan flora, while about 5% (150 species) are exotics introduced over the last 150 years. Among the rare plants is the living fossil tree *Ginkgo biloba*, a native of China, of which two plant species have been found in Manali and Kalpa.

The forests can be classified on an ecological basis broadly into coniferous forests and broad-leaved forests as laid down by Champion and Seth. The distribution of species follows altitudinal stratification, apart from area with microclimatic changes resulting from aspect, exposure, and local changes in rock and soil.

Table 5.55: Forest Types with Dominant Tree Species occurring in Himachal Pradesh

Forest Types	Area (km ²)	Important Tree Species
Tropical Dry Deciduous	2,140	<i>Shorea robusta</i> , <i>Acacia catechu</i> , <i>Anogeissus latifolia</i> , <i>Boswellia serrata</i> , <i>Lanea coromandelica</i> , <i>Aegle marmelos</i> , <i>Mallotus philipinensis</i> .
Tropical Thorn	43	<i>Prosopis spicigera</i> , <i>Salvadora spp.</i> , <i>Acacia spp.</i> , <i>Azadirachta indica</i> etc.
Sub-Tropical Pine	3,853	<i>Pinus roxburghii</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Quercus incana</i> , <i>Lyonia ovalifolia</i> , <i>Pyrus pashia</i> , <i>Crataegus crenulata</i> , <i>Rhododendron arboreum</i> .
Sub-Tropical Dry Evergreen	470	<i>Olea cuspidata</i> , <i>Pinus roxburghii</i> .
Himalayan Moist Temperate	4,064	<i>Quercus incana</i> , <i>Cedrus deodara</i> , <i>Pinus wallichiana</i> , <i>Pinus roxburghii</i> , <i>Rhododendron arboreum</i> , <i>Lyonia ovalifolia</i> , <i>Litsia umbrosa</i> , <i>Quercus dilatata</i> , <i>Q. semicarpifolia</i> , <i>Picea smithiana</i> , <i>Abies pindrow</i> .
Sub-Alpine and Alpine	2,512	<i>Abies spectabilis</i> , <i>Pinus wallichiana</i> , <i>Picea smithiana</i> , <i>Rhododendron companulatum</i> , <i>Taxus baccata</i> .

Agro-ecological Zones and Vegetation Types:

The state of Himachal Pradesh has been divided into four agro-ecological zones based on altitudes associated with different forest types with trees, shrubs and herbs species.

- i) Sub-tropical zone, comprising low hills up to 1000 m.
 - ii) Sub-tropical zone, covering mid- hills between 1000 m and 1500 m.
 - iii) Temperate wet zone representing high hills between 1500 m and 3000 m.
 - iv) Temperate dry zone representing high hills above 3000 m (Alpine pasture zone).
- i) **Sub-tropical, Low hills zone; up to 1000 m:** This zone is mainly dominated by tropical mixed deciduous forest and thorn scrub in the foothills and fallow lands. The main native tree species found are: *Acacia catechu*, *Embelica officinalis*, *Dalbergia sissoo*, *Terminalia chebula*, *Cassia fistula*, *Anogeissus latifolia*, *Zizyphus jujuba*. The most common shrubs found are *Euphorbia royleana*, *Adhatoda vasica*, *Vitex negundo* and *Woodfordia fruticosa*.
- ii) **Sub-tropical, Mid hills zone 1000-1500 m:** The sub tropical zone is characterized by the presence of Group 9 Sub-tropical pine forests also known as Upper Himalayan Pine forests. It bears an almost pure crop of *Pinus roxburghii*. The other species found in the mixture are *Quercus incana*, *Lannea sp.*, *Lyonia ovalifolia*, *Rhododendron arboreum*, *Indigofera sp.*, *Myrsine sp.*, *Rubus sp.*

Several sub-types of *Pinus roxburghii* dominated forests can also be recognized in this zone:

- a) *Pinus-Carissa*, *Terminalia chebula* and *Lannea*.
- b) *Pinus -Carissa -Indigofera* with abundant pine regeneration.
- c) *Pinus-Quercus* with *Myrsine* and *Berberis*.
- d) *Pinus-Acacia catechu* with *Mallolotus* and *Lannea*.
- e) *Pinus -Wendilandia* with *Dodonea* and *Carissa*.
- f) *Pinus -Carissa* with *Flacourtia*.

Himalayan scrub: These areas are characterized by dry and shallow soil with intensive influence of biotic factors. The species met with are *Diospyros melanoxylon*, *Embelica officinalis*, *Carrissa sp.*, *Dodonea viscosa*, *Acacia catechu*, *Anogeissus sp.*, *Lannea sp.*, *Cassia fistula*.

Euphorbia scrub: The vegetation is dominated by *Euphorbia royleana* with a mixture of palms controlled by edaphic factors and rocky ridges, steep slopes and very shallow soils.

Dry evergreen bush: The vegetation consists of *Olea cuspidata* with *Punica granatum*. Such vegetation is met with in plain alluvial beds in the valley.

- iii) **Temperate wet high hills zone between 1500-3000 m:** Group 12, Himalayan moist temperate forests constitute the major forest types in Himachal Pradesh and are dominant in the temperate wet zone.

The sub-types of group 12 forests are:

12/C1 Lower Western Himalayan temperate forests

12/c 1a Ban oak forest (*Quercus incana*)

12/c 1b Moru oak forest (*Q. dilata*) DS1 Oak scrub

12/c 1c Moist Deodar forest (*Cedrus deodara*)

12/c 1d Western mixed coniferous forest (*Picea smithiana*, *Pinus wallichiana* and *Abies pindrow*).

12/c 1e moist temperate deciduous forest

12/c 1f Low level blue pine forests (*Pinus wallichiana*)

DS1 Oak scrub

DS2 Himalayan temperate secondary scrub.

12/C2 Upper West Himalayan temperate forest

12/c 2a Kharsu oak forest (*Quercus semicarpifolia*)

12/c 2b West Himalayan upper oak/fir forest

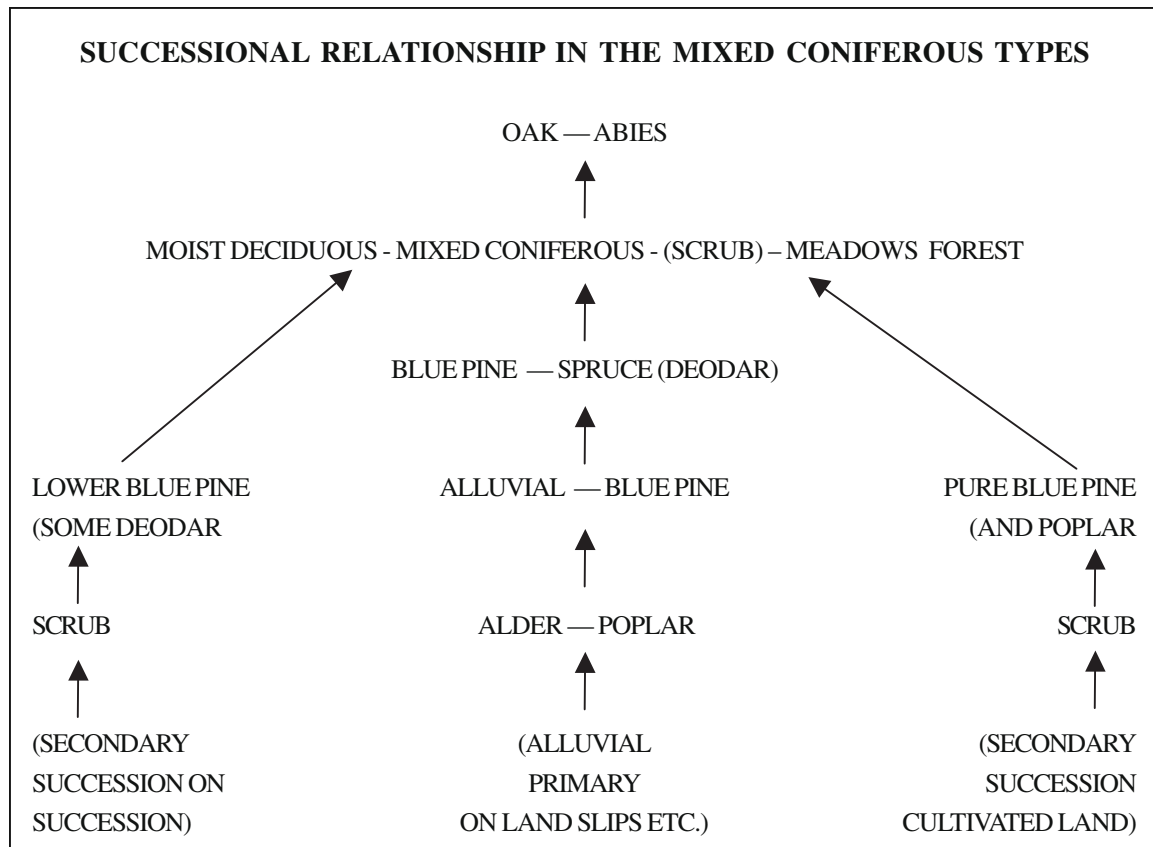
12/c 2c moist temperate secondary scrub.

The main conifers tree species met with are *Pinus wallichiana*, *Cedrus deodara*, *Picea smithiana*, *Abies pindrow* and main broad-leaved trees found are three Oaks species namely: *Quercus incana*, *Q. semecarpifolia*, *Q. dilata* along with *Aesculus indica*, *Acer caesium*, *Prunus padus*, *Populus cilata*, *Corylus colurna*, *Ulmus wallichiana*, *Juglans regia*, *Pyrus lanata*, *Betula alnoides*, *Fraxinus* sp., *Carpinus* sp. In this zone, typical of Western Himalayan forests, the three common oaks provide a simple and convenient basis for sub-division into altitude zones each with its typical coniferous counterpart as shown below.

Table 5.56: Western Himalayan Oaks

Altitude	Broad-leaved	Coniferous
3,000 m	Sub-alpine Birch- <i>Rhododendron</i>	<i>Abies spectabilis</i>
2,500 m	<i>Quercus semecarpifolia</i>	<i>Abies pindrow</i>
2,250 m	<i>Quercus dilatata</i>	<i>Abies pindrow</i> , <i>Picea smithiana</i>
2,000 m	<i>Quercus leucotricophora</i>	<i>Cedrus deodara</i> , <i>Pinus wallichiana</i>
1,500 m	(Sub-tropical tree species)	<i>Pinus roxburghii</i>

The succession phases of dominant species found in typical West Himalayan Temperate Forests is illustrated in the following diagram.



- iv) **Temperate dry high hills zone; above 3000 m:** The main grass species found in sub-alpine pastures are *Agropyron longeristatum*, *A. semicostatum*, *Bracypodium sylvaticum*, *Bromus asper*, *B. japonicus*, *Dactylus* sp., *Danthonia* sp., *Festuca* sp., *Milium effusum*, *Oryzopsis*, *Phleum*, *Poa* sp.). Alpine pastures (meadows) are composed mostly of mesophytic herbs with very little grass such as *Primula*, *Anemone*, *Fritillaria*, *Iris*, *Gentiana* spp. and at higher altitudes to stony desert with herbs such as *Sedum crassipes*, *Primula minutissima*, *Saxifraga imbricata*, *Potentilla fruticosa*, *Draba gracillima*, *Kobresia duhtei*. Dwarf shrub species of *Juniperus wallichiana*, *J. communis* and *Caragana* sp. predominate in the zone. Alpine scrub, which adjoins the dry temperate forests, may take its place under heavy pressure of grazing and has been described as *Alpine steppe*.

5.8 The Extent of Forest and Pasture Areas:

The perception of what constitutes a forest, and thus the size of the area classified as forest, has changed in recent years in the state. Until the mid eighties, forests were conceived in terms of tree production, and only the cultivatable area was measured (21,215 km², or 38.1 percent of the total geographical area). Since the introduction of the new forest policy, forests have been considered more as an ecosystem, and the definition of forest area extended to include areas of rocky precipices, alpine snow, and meadows which, although devoid of actual tree cover, are nonetheless an integral part of the larger forest eco-system. The legal forest area is now calculated to be 37,033 km², or 66.52 percent of the total geographical area of the state of which 14353

km² (25.78 % of state geographical area) is under forest cover and 12366 km² is cultivatable non-forest area. About 65 percent of the forest area is found at altitudes above 1,800 m.

Table 5.57: Protected Areas in Himachal Pradesh

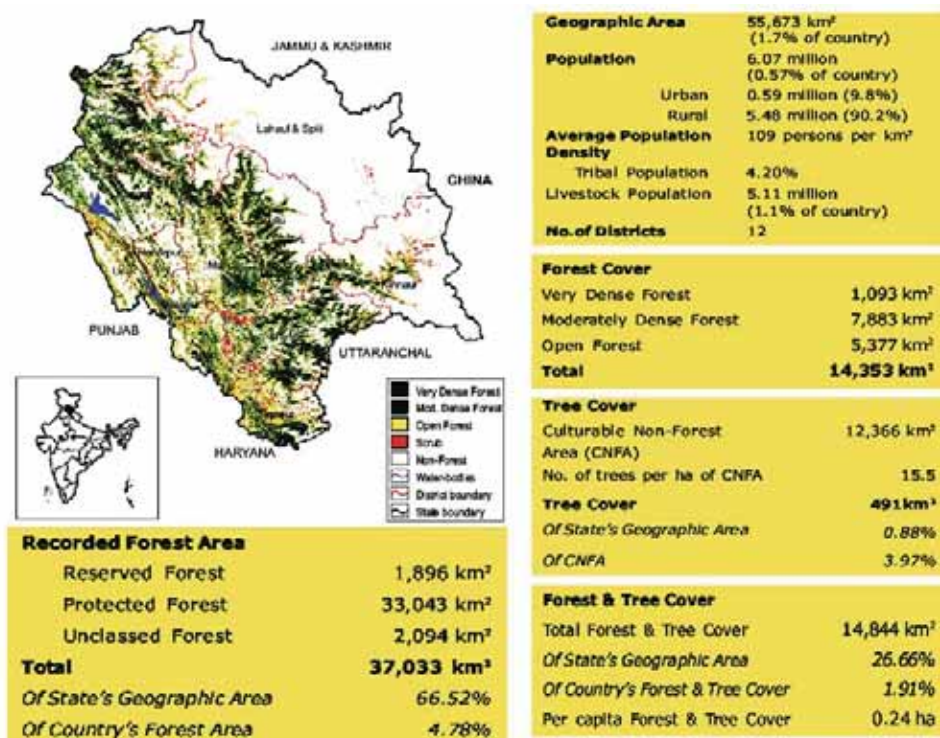
Sl. No.	Protected Areas	Area (km ²)	Biogeographic Zones
1	Great Himalayan NP	754.40	Himalaya
2	Pin Valley NP	675.00	Trans-Himalaya
3	Bandi WLS	41.32	Himalaya
4	Chail WLS	108.54	Himalaya
5	Churdhar WLS	56.15	Himalaya
6	Daranghati WLS	167.00	Himalaya
7	Darlaghat WLS	140.00	Himalaya
8	Dhauladhar WLS	943.98	Semi-arid
9	Gangul Saihbehi WLS	108.85	Himalaya
10	Govind Sagar WLS	100.34	Semi-arid
11	Kais WLS	14.19	Himalaya
12	Kalatop-Khajjiar WLS	61.00	Himalaya
13	Kanawar WLS	54.00	Himalaya
14	Khokhan WLS	14.05	Himalaya
15	Kibber WLS	1400.50	Trans-Himalaya
16	Kugti WLS	378.86	Himalaya
17	Lippa Asrang WLS	30.89	Himalaya
18	Majanthal WLS	40.00	Himalaya
19	Manali WLS	31.80	Himalaya
20	Naina Devi WLS	123.00	Semi-arid
21	Nargu WLS	278.37	Himalaya
22	Pong Lake WLS	307.29	Semi-arid
23	Renuka Lake WLS	4.02	Semi-arid
24	Rupi Bhaba WLS	269.00	Himalaya
25	Sainj WLS	90.00	Himalaya
26	Sangla (Raksham Chitkul) WLS	650.00	Himalaya
27	Sechu Tuan Nala WLS	102.95	Himalaya
28	Shikari Devi WLS	72.00	Himalaya
29	Shilli WLS	2.13	Himalaya
30	Shimla Water Catchment WLS	10.25	Himalaya
31	Simbalbara WLS	19.03	Semi-arid
32	Talra WLS	26.00	Himalaya
33	Tirthan WLS	61.12	Himalaya
34	Tundah WLS	64.22	Himalaya

Source: Indian Institute of Remote Sensing, Department of Space, Government of India, Dehradun, August, 2002

5.9 Forest Cover and Related Statistics of Himachal Pradesh:

“Forest cover refers to all lands with a tree canopy of more than ten per cent and may not be recorded as forest and should be distinguished from forest area which refers to all land recorded as forest and may not necessarily bear forest/ tree cover.”

Total forest cover in Himachal as per 2003 assessment is 14,353 km² (25.78%) of the total geographical area i.e. 55,673 km². Total dense forest cover is 8,976 km² (16.1%) and open forest cover is 5,377 km² (9.7%) of the geographical area 55.673 km². Thus, there is an overall increase in forest and tree cover by 0.16% during year 2003 as per FSI assessment.



Source: Forest Survey of India, State of Forest Report, 2003.

Area capable of sustaining Trees Resources:

- Total Geographical area = 55,673 km²
- Forest area (legal classification) = 37,033 km²
- State area (4000 m and above altitudes Unsuitable for tree crops) = 19,020 km²

It is estimated that entire 19,020 km² area is part of legally classified forest area, without private ownership, is uncultivable and cannot sustain tree crops.

There is also an area of about 1000 km² below 4,000 m altitude under streams, Nallahs, which cannot sustain tree crops.

- Thus total legally classified forest area that cannot sustain tree crops = 20,020 km²
- Legally classified forest area that can sustain tree crops (37,033 -20,020) = 17,013 km²

or 30.5%*

(Source HP Forest Department Statistics 2000 & HP Crop Report 2001-02)

- Area under Horticulture = 2,230 km² or 4.0%*

(Source Statistical outline HP 2002-2003)

- Land area under Misc. tree crops included in agriculture = 568 km² or 1.0%*
- Total area which is supporting or can support tree crops over Forest, Agriculture and Horticulture land = 35.5%*

Table 5.58: Forest Cover from 1972 to 2002 in Himachal Pradesh (Area in km²)

District	Geographical Area	Reserved Forests	Demarcated Protected Forests	Undemarcated Protected Forests	Un-classed Forests	Municipal Forests	Cantonment Forests	*Other Forests	Total Forest Area
Bilaspur	1,167	0.90	185.56	241.85	-	-	-	-	428
Chamba	6,522	372.53	3,960.33	685.06	-	5.31	6.42	1	5030
Hamirpur	1,118	-	99.06	57.36	27.13	-	-	35	219
Kangra	5,739	76.01	558.02	1,635.82	504.54	0.80	-	67	2842
Kinnaur	6,401	-	304.46	4,788.15	-	-	-	-	5093
Kullu	5,503	160.52	3,209.15	1,582.02	-	-	-	-	4952
Lahul & Spiti	13,841	70.54	396.61	9,665.76	-	-	-	-	10133
Mandi	3,950	-	1,575.57	37.72	246.73	-	-	-	1860
Shimla	5,131	53.46	1,148.89	2,161.49	-	18.69	-	35	3418
Sirmour	2,825	1,064.70	56.66	-	32.40	4.26	-	685	1843
Solan	1,936	53.55	287.92	214.13	165.77	-	6.98	-	728
Una	1,540	43.92	48.02	130.06	-	-	-	265	487
Total	55,673	1,896.13	11,830.25	21,199.42	976.57	29.06	13.40	1,088.00	37,033
Percentage of Total Forest Area	5.12	31.95	57.25	2.63	0.08	0.04	3.00	100.00	

a) Impacts:

Forests in Himachal Pradesh have a most productive ecological niche. As per latitude, the state falls in the tropical zone, but its geographical location and good forest cover have enriched it, both biologically and economically. During the immediate post-independence period, the forests of the state were identified mainly as a source of timber. This led to large scale felling and clearing of forest areas to meet the timber needs of industries set up in the plains and of the flourishing horticulture industry in the state.

Application of remote sensing technology in the assessment of forest cover of the country was made by the Forest Survey of India and National Remote Sensing Agency (NRSA) of the Department of Space in the early 1980s. The forest cover of the country is assessed biennially by FSI using satellite data. Beginning in 1987, nine such assessments have been made up to 2003 and brought out in the State Forest Reports (SFRs). The forest cover is classified into open forest (canopy density between 10 and 40 %), open forest (canopy density between 10-40 %, scrub (canopy density less than 10 %) and non-forest. Based on SFRs, forest cover based on various assessment years of dense and open forests for the state of Himachal Pradesh is presented.

Table 5.59: Changes in Forest Cover of Himachal Pradesh since 1972

Assessment Year & Data Period Forest Cover	1972 -75	1980 -82	1981 -83	1985 -87	1987 -89	1989 -91	1991 -93	1993 -95	1996 -98	2000	2002
Dense Forest	12,500	6,700	9,908	7,100	8,911	9,565	9,565	9,560	9,120	10,429	8,976
Open Forest	-	-	2,974	6,277	2,869	2,937	2,936	2,961	3,962	3,931	5,377
Total	-	-	12,882	13,377	11,780	12,502	12,501	12,521	13,082	14,360	14,353
Scrub	-	-	2,448	N.A.	1,918	1,845	1,845	1,825	566	566	389
Un-Interp- reted area	-	-	-	N.A.	18,967	-	-	-	-	-	-
Non-Forest	-	-	40,390	N.A.	23,008	41,326	41,327	41,327	42,025	40,747	40,931
G. Total	-	-	55,720	55,670	55,673	55,673	55,673	55,673	55,673	55,673	55,673

Table 5.60: Based on Forest Survey of India, SFRs District wise Forest Cover Change in Dense and Open

Assessment Year Forest Cover	SFR 1991	SFR 1993	Change	SFR 1995	Change	SFR 1997	Change	SFR 1999	Change	SFR 2001	Change	SFR 2003	Change	
1.	District Bilaspur (Geographical Area: 1,167 km ²)													
	Dense Forest	101	49	-52	49	0	59	+10	65	+6	135	+70	105	-30
	Open Forest	65	108	+43	108	0	99	-9	170	+71	166	-4	253	+87
	Total	166	157	-9	157	0	158	+1	235	+77	301	+66	358	+57
2.	District Chamba (Geographical Area: 6,522 km ²)													
	Dense Forest	1,625	1,801	+176	1,767	-34	1,768	+1	1,585	-183	1,652	+67	1,566	-86
	Open Forest	392	323	- 69	293	-30	293	0	716	+423	690	-26	847	+157
	Total	2,017	2,124	+107	2,060	-64	2,061	+1	2,301	+240	2,342	+41	2,413	+71
3.	District Hamirpur (Geographical Area: 1,118 km ²)													
	Dense Forest	156	151	-5	151	0	150	-1	93	-57	181	+88	109	-72
	Open Forest	60	62	+2	72	+10	73	+1	95	+22	93	-2	133	+40
	Total	216	213	-3	223	+10	223	0	188	-35	274	+86	242	-32
4.	District Kangra (Geographical Area: 5,739 km ²)													
	Dense Forest	808	1,071	+263	1,071	0	1,071	0	1,338	+267	1,719	+381	1,386	-333
	Open Forest	625	684	+59	673	-11	673	0	301	-372	311	+10	481	+170
	Total	1,433	1,755	+322	1,744	-11	1,744	0	1,639	-105	2,030	+391	1,867	-163
5.	District Kinnaur (Geographical Area: 6,401 km ²)													
	Dense Forest	565	547	-18	547	0	541	-6	436	-105	432	-4	365	-67
	Open Forest	68	82	+14	82	0	91	+9	213	+122	215	+2	248	+33
	Total	633	629	-4	629	0	632	+3	649	+17	647	-2	613	-34
6.	District Kullu (Geographical Area: 5,503 km ²)													
	Dense Forest	1817	1911	+94	1911	0	1907	-4	1631	-276	1749	+118	1412	-337
	Open Forest	131	133	+2	133	0	137	+4	343	+206	366	+23	521	+155
	Total	1948	2044	+96	2044	0	2044	0	1974	-70	2115	+141	1933	-182

7.	District Lahul & Spiti (Geographical Area: 13,841 km ²)														
	Dense Forest	0	15	+15	49	+34	49	0	34	-15	36	+2	35	-1	
	Open Forest	17	4	-13	34	+30	34	0	116	+82	118	+2	145	+27	
	Total	17	19	+2	83	+64	83	0	150	+67	154	+4	180	+26	
8.	District Mandi (Geographical Area: 3,950 km ²)														
	Dense Forest	839	848	+9	848	0	848	0	982	+134	1,112	+130	1,011	-101	
	Open Forest	462	461	-1	461	0	467	+6	557	+90	544	-13	637	+93	
	Total	1,301	1,309	+8	1,309	0	1,315	+6	1,539	+224	1,656	+117	1,648	-8	
9.	District Shimla (Geographical Area: 5,131 km ²)														
	Dense Forest	1,921	2,094	+173	2,094	0	2,084	-10	1,808	-276	1,878	+70	1,781	-97	
	Open Forest	299	331	+32	331	0	341	+10	582	+241	566	-16	602	+36	
	Total	2,220	2,425	+205	2,425	0	2,425	0	2,390	-35	2,444	+54	2,383	-61	
10.	District Sirmour (Geographical Area: 2,825 km ²)														
	Dense Forest	740	740	0	740	0	736	-4	742	+6	755	+13	687	-68	
	Open Forest	279	279	0	279	0	288	+9	366	+78	357	-9	692	+335	
	Total	1,019	1,019	0	1,019	0	1,024	+5	1,108	+84	1,112	+4	1,379	+267	
11.	District Solan (Geographical Area: 1,936 km ²)														
	Dense Forest	164	164	0	164	0	173	+9	274	+101	459	+185	353	-106	
	Open Forest	251	254	+3	254	0	249	-5	218	-31	224	+6	466	+242	
	Total	415	418	+3	418	0	422	+4	492	+70	683	+191	819	+136	
12.	District Una (Geographical Area: 1,540 km ²)														
	Dense Forest	175	174	-1	174	0	174	0	132	-42	321	+189	166	-155	
	Open Forest	220	216	-4	216	0	216	0	285	+69	281	-4	352	+71	
	Total	395	390	-5	390	0	390	0	417	+27	602	+185	518	-84	
	Himachal Pradesh (Geographical Area: 55,673 km ²)														
	Dense Forest	8,911	9,565	+654	9,565	0	9,560	-5	9,120	-440	10,429	+1,309	8,976	-1,453	
	Open Forest	2,869	2,937	+68	2,936	-1	2,961	+25	3,962	+1,001	3,931	-31	5,377	+1,446	
	Total	11,780	12,502	+722	12,501	-1	12,521	+20	13,082	+561	14,360	+1,278	14,353	-7	

Table 5.61: Changes in Growing Stock of Commercially Important Species

Year Species	1975	1980	1985	1990	1995	2000
Deodar	12,859	12,397	12,716	13,298	14,215	15,219
Kail	13,753	13,396	13,710	12,996	13,616	12,964
Fir/ Spruce	44,220	44,726	39,691	39,026	41,012	38,700
Chir	7,295	8,006	7,982	8,644	10,053	12,080
Sal	3,011	3,011	3,011	2,563	2,563	2,563
Others	18,723	17,949	18,733	20,312	21,052	13,736
Total	99,861	99,485	95,843	96,839	102,511	95,262

Based on changes in forest cover there has occurred a change in growing stock of commercially important species; this is represented in Table 5.61 based on statistics derived from Forest Working Plans of Forest Department.

b) Pressures:

Population Pressure on Forest Resources of Himachal Pradesh

The Table 5.62 provides the summary of population, forest area, forest cover and per capita forest area district-wise in the state.

Table 5.62: Forest Area and Population of Districts of Himachal Pradesh (Area in km²)

District	Geogra- phical Area	Forest Area 2002-03	Population as per 2001 Census	Forest Cover 2003	% age of Forest Cover to Geographical Area	% age of Forest Area to Geographical Area	% age of Total Forest Area in the District	Per Capita Forest Area in ha.
Bilaspur	1,167	428	340,885	358	30.68	36.68	1.16	0.11
Chamba	6,522	5,030	460,887	2,413	37.00	77.12	13.58	0.52
Hamirpur	1,118	219	412,700	242	21.65	19.59	0.59	0.06
Kangra	5,739	2,842	1,339,030	1,867	32.53	49.52	7.67	0.14
Kinnaur	6,401	5,093	78,334	613	9.58	79.57	13.75	0.78
Kullu	5,503	4,952	381,571	1,933	35.13	89.99	13.37	0.51
Lahul & Spiti	13,841	10,133	33,224	180	1.30	73.21	27.36	0.54
Mandi	3,950	1,860	901,344	1,648	41.72	47.09	5.02	0.18
Shimla	5,131	3,418	722,502	2,383	46.44	66.61	9.23	0.33
Sirmour	2,825	1,843	458,593	1,379	48.81	65.24	4.98	0.30
Solan	1,936	728	500,557	819	42.30	37.60	1.97	0.16
Una	1,540	487	448,273	518	33.64	31.62	1.32	0.12
Total	55,673	37,033	6,077,900	14,353	25.78	66.52	100.00	0.24

5.10 Forest Produce Extracted from HP Forests:

i) Timber :

Most of the villages in the state are situated on steep slopes and connected by tracks, village paths or by village roads. Moreover, the villages are either adjacent to or enclosed by forests, which are thus deeply integrated with the livelihood of the local people. They depend on the forests for timber, for the construction of houses, firewood, agricultural implements, fodder and a variety of other products and services, including certain medicinal herbs. Some of the users of forest products feel equally responsible for their conservation and ensure certain protection and regular regeneration of forests. The government of Himachal Pradesh constituted the Forest Corporation in 1974, the only agency responsible for the harvesting and exploitation of forests, including resin extraction. Previously, private contractors carried out all activities relating to forests. This resulted in unscientific harvesting and over-exploitation of forest resources.

Timber distribution (TD) allows local people to harvest timber legally in forests near their place of habitation, for constructing their own houses. It currently accounts for, on an average, an annual harvest of timber of over 1,00,000 cubic metres. In terms of value, it amounted to about Rs. 56 crore in 1998-99. The market value of this timber is more than one thousand times the nominal price paid by the villagers under TD. The state exchequer's share is negligible. The TD scheme dating back to the 1880s, has been widely exploited by a large number of influential people, at the cost of needy, for personal economic gains. The regulations need to be updated to plug the economic losses and then identify the genuine and needy users of timber. Timber distribution is more of a harvesting policy. In 1999-2000, the share of rights-holders in the total timber production of the state was 31 per cent, and if timber distribution to the free grantees is added it comes to about 33 per cent. Thus, one-third of the total timber produced in the state is consumed under timber distribution. The major effect of timber distribution from forests is the selective harvesting of certain species. Deodar and Kail are best suited for the construction of houses because of their durability. But the main focus of the government in the past has been on harvesting Fir/Spruce to meet the fruit growers' demands for boxes. In 1999-2000, more than 45 per cent of the total wood extracted by the rights-holders was Deodar and about 25 per cent Kail. The Himachal Pradesh State Forest Corporation concentrated on the extraction of Chil (39%) and Fir/Spruce (30%).

The most valued forest product is timber, followed by medicinal plants and herbs and resin along with bamboo, charcoal, fuelwood, bhabhar grass and khair. The outturn of forest produce and contribution to forest revenue in recent years is given in Table 5.63.

Until 1970, timber removal from the forests was more than the annual prescribed yield, which was unsustainable. To overcome this shortcoming, the government of Himachal Pradesh established the Himachal Pradesh State Forest Corporation, which was entrusted with all harvesting operations in the forests. As a result, since 1975, the annual removal from the forests has always remained below the prescribed yield. Timber measuring 470000 m³ was extracted annually from the forests of the state during the last five decades of the previous century (1950-2000). The average timber removal was the highest in the decade 1980-90 which is also reflected in forest cover estimation

in Table 5.64. Forest Produce, that is timber, firewood and charcoal, extracted by Government, Forest Corporation, Rights Holders, Free Grants, and other agencies from 1991-2004 has been given in Table 5.64.

Forest Revenue:

Table 5.63: Outturn of Forest Produce and its Contribution to Forest Revenue

S. No.	Name of Produce	Quantity Estimated Value					
		2001-2002	2002-2003	2003-2004	2001-2002	2002-2003	2003-2004
1	Timber (m ³)	371,599	367,330	334,085	14,698.07	14,615.12	13,967.5
2	Firewood (tonnes)	6,891	4,953	6,631	209.71	147.59	211.36
3	Charcoal (tonnes)	103	433	362	5.82	24.46	20.45
4	Resin (tonnes)	7,354	5,495	8,254	495.59	556.59	476.82
5	Bamboo	-	-	253	4.38	8.46	11.29
6	Bhabbar grass (tonnes)	351	428	925	0.78	0.5	1.16
7	Grazing /Fodder (tonnnes)	-	-	-	6.51	4.12	8.77
8	Medical herbs (tonnes)	2,491	1,795	1,366	718.07	1,057.06	448.62
9	Other Minor Products (tonnes)	-	-	-	65.13	1.81	34.03
10	Khair (tonnes)	815	1,651	1,421	11.87	24.05	20.69
	Total	-	-	-	16,215.93	16,439.76	15,200.69

ii) Non-timber Forest Products:

Besides timber, the forests of Himachal Pradesh are rich in fodder, grass and other grazing plants, organic manure and fibre, gum, resins, medicinal plants/herbs and other products including fruits. The Himachal Pradesh State Forest Corporation is the only agency responsible for extracting resins from the state forests. The state Forest Department issues permits for the collection of other non-timber products. Medicinal and aromatic plants are of special value. Table 5.65 details various non-timber products which are extracted and their value. Such produce was worth Rs. 12.29 crore in 1999-2000, of which medicinal herbs alone accounted for 57.43 per cent, that is Rs. 7.06 crore. Some of these herbs are found only in Himachal Pradesh and there might be many still undiscovered. The main concern at present is the unscientific harvesting and excessive and ruthless exploitation of these resources by private pharmaceutical companies, whose sole motive is to maximize their profits. These companies have no or very little interest in the regeneration and management of the forest. This has resulted in several species of medicinal and aromatic plants either becoming extinct or being listed as endangered species *Pinus gerardiana*, which yields Chilgoza nuts, is facing extinction and has already been listed as an endangered species.

Medicinal and aromatic plants have the potential of earning foreign currency and these need to be exploited scientifically using modern management methods. A total of 21,982 quintals were exported outside the state in 1998-99. The main products were *muskbala/nihani*, *pathin*, *rakhal*,

Table 5.64 Forest Produce of Himachal Pradesh from 1991-2004

Year & Forest Produce Agencies	1991-92			1995-1996			1998-1999			1999-2000		
	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)
Government Extraction	2,521	49	176	907	27	605	824	12	96	1,779	11	66
Forest Corporation	227,699	1,346	295	325,220	834	364	244,842	281	8	206,750	506	8
Right Holders	113,735	152	-	96,274	6	-	100,310	118	-	96,572	313	-
Free Grants	7,693	91	350	2,981	350	-	9,316	-	-	7,181	122	-
Other Agencies	4,731	490	-	402	5	-	161	-	-	149	121	-
Total	356,379	2,128	821	425,784	1,222	969	355,453	411	104	312,431	1,073	74
Year & Forest Produce Agencies	2000-2001			2001-2002			2002-2003			2003-2004		
	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)	Timber (M ³)	Firewood (Qtl.)	Charcoal (Qtls.)
Government Extraction	1,230	5	60	255	-	89	274	1,133	159	385	59	226
Forest Corporation	243,153	19	-	275,140	3,749	-	287,319	3,369	236	233,361	4,514	109
Right Holders	87,835	127	-	87,182	594	14	69,841	277	35	90,026	676	-
Free Grants	9,429	-	-	9,022	-	-	8,107	-	-	10,211	219	-
Other Agencies	119	2,545	-	-	2,548	-	1,789	174	3	102	1,163	27
Total	341,766	2,696	60	341,599	6,891	103	367,330	4,953	433	334,085	6,631	362

dorighas and *neoza*. Recently, the state has introduced Lavender, which yields high value aromatic oil at Salooni in Chamba district along with setting up of an oil extraction unit. A Lavender bush remains productive for 15 years and starts yielding flowers for oil extraction in the second year of its cultivation. The processing of Lavender oil and its consequent use in production of *agarbati*, *dhoop* and cosmetic creams could earn additional income, as the current Indian demand for Lavender oil is 40 tonnes annually. Sea buckthorn is another wild plant, of immense medicinal and environmental value that can be grown in abundance in Lahaul & Spiti, Pangi and Kinnaur. China has successfully used its Sea buckthorn treasure. As such, some medicinal plants which are not regularly cultivated are being collected from the wild and becoming scarce and threatened with extinction.

NTFPs that is resin, bamboos, bhabbhar grass, fodder and medicinal plants extracted and this value from 1995 to 2003-2004 is given in the Table 5.65.

5.11 Responses - Plantations raised by HP Forest Department :

Regeneration of forests becomes essential as more and more forest areas become degraded because of social and economic causes, forest fires and other natural phenomena. Large-scale afforestation programmes undertaken by the HP Forest Department in selected areas in the recent past, also involving such institutions as Joint Forest management, have yielded good results. The equation between forest degradation and forest regeneration should be maintained, to ensure that forest cover does not get depleted. Local factors are important for natural regeneration of forest species. Natural regeneration of khair, chir, shisham, eucalyptus and bamboo has been going on in the state. Natural regeneration is not the only way of afforestation and should be supplemented with artificial regeneration.

Artificial Regeneration is the main method adopted to increase the forest cover of the state. Plants of economically as well as ecologically important species, such as Chil, Khair, Deodar, Robinia, Poplar, Fir/Spruce and Kail are being planted. Seeds of some of these species are also being developed by the state. For example, in 1998-1999, an area of 137.33 km² was regenerated mainly through artificial methods, compared to only 14.74 km², mainly through natural methods. Artificial regeneration can also be employed for afforestation. Himachal has so far carried out plantation activities in a total area of 9288.56 km² as part of its afforestation programme (Table 5.66) mostly on forest land and on community lands to supplement regeneration efforts and to increase the forest cover. Both the government and foreign donor institutions fund this activity. As the framework of a particular project being carried out determines plantation, it may sometimes result in heavy planting of some species, ignoring its cost-benefit to society.

The planting activities of selected species are often undertaken on specified targeted areas. Due to lack of adequate fencing, and indiscriminate visits of scrub animals in the planted areas, the damage is often great and rarely recorded. Even the community participation in newer plantings and their conservation is lacking which often results in the patchy growth of trees. Table 5.66 shows plantation achievements in Himachal Pradesh from 1950-1951 to 2003-2004. On average, an area of 172.5 km² was planted every year.

Table 5.65: NTFPs of Himachal Pradesh from 1995 to 2003-04 Quantity in Tonnes and Value in '000 Rs.

S. No.	Name of Produce	1995-96		1998-99		1999-2000		2000-2001		2001-2002		2002-03		2003-04	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1.	Resin	8,783	62,644	7,201	53,739	8,725	-	7,357	47,504	7,354	49,559	8,495	55,659	8,254	47,682
2.	Bamboos	-	-	-	-	-	-	-	-	-	438	-	846	-	1,129
3.	Bhabbar grass	536	1988	511	343	671	-	40	20	351	78	428	50	925	116
4.	Fodder/ Grazing	-	908	-	1590	-	-	-	1342	-	651	-	412	-	877
5.	Medicinal herbs														
a.	Dhoop	202.5		69.2		78.0		39.9		39.3		13.5		14.6	
b.	Muskbala/ Nihani	148.7		162.4		93.9		102.3		50.5		71.1		52.7	
c.	Chukri/ Rewardchini	83.2		49.1		40.9		46.2		22.8		64.6		46.5	
d.	T/Patters	29.2		15.3		27.4		31.3		8.4		21.8		18.7	
e.	Dorighas	56.1		100.8		142.3		102.7		149.9		78.1		6.0	
f.	Brahmi	50.0		-		6.3		27.5		-		3.5		-	
g.	Kaur/Karu	43.0		12.0		4.6		6.8		4.1		28.1		16.9	
h.	Guchhie	36.3		16.0		10.6		5.0		8.5		15.6		2.8	
i.	Tej Patra	30.8		53.4		45.9		68.0		43.3		10.5		8.0	
j.	Thuth	25.9		10.9		13.6		8.7		18.8		23.3		2.6	
k.	Bankakri	22.4	5,59,621	1.1	89,823	0.9	70,579	0.3	66,714	0.3	71,807	1.9	1,05,706	5.3	44,862
l.	Kuth/Diosorea	26.4		0.1		14.2		0.9		-		13.5		18.0	
m.	Efdra	12.7		60.2		-		34.9		-		-		-	
n.	Barberries roots	11.1		7.0		-		613.5		1345.2		524.0		717.4	
o.	Birch/ Bhoj Patra	6.5		5.3		15.6		2.0		-		7.2		-	
p.	Banaksha	3.9		0.9		0.5		0.4		-		-		-	
q.	Kakarshingi	2.6		0.4		2.4		1.0		0.4		0.9		6.5	
r.	Chora	1.2		12.3		43.0		5.1		10.4		9.0		0.2	
s.	Baryan	8.0		11.0		3.0		7.7		22.2		2.3		1.5	
t.	Mithi Patties	5.2		14.3		16.9		-		-		-		-	
u.	Blukesi	3.2		8.0		5.9		1.2		2.3		6.2		6.6	
v.	Others	646.9		1588.3		835.6		866.5		764.9		901.5		442.2	
6.	Other Produce	-	94	-	113	-	2245	-	1,25,792	-	7,700	-	2,586	-	4,595
	Total	-	1,25,255	-	1,45,608	-	1,22,894	-	1,25,792	-	1,30,233	-	1,65,259	-	99,261

Table 5.66: Plantations of different species raised in Himachal Pradesh under various schemes

Plantation Period	1951-52 to 1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999- 2000	2000- 2001	2001- 2002	2002- 2003	2003- 2004	Total Plantation up to 31-03-04	% age
Deodar	79,078	3,154	3,360	3,918	3,322	3,926	4,253	6,218	3,631	1,993	1,802	2,614	117,269	12.63
Kail	8,934	328	354	613	351	235	250	210	168	262	218	143	12,066	1.30
Fir/Spruce	13,635	761	412	445	382	265	461	289	151	214	162	228	17,405	1.87
Chir	218,344	8,088	9,813	8,025	6,647	5,129	5,059	4,394	3,871	2,854	1,904	1,330	275,458	29.66
O. Coniferous	113	-	-	-	-	-	-	-	-	-	-	-	113	0.01
Walnut	3,399	13	31	38	7	11	113	63	88	45	38	69	3,915	0.42
Willow	5,785	486	837	585	392	339	365	331	204	205	196	198	9,923	1.07
Mapple	100	-	-	-	-	-	-	-	-	-	-	-	100	0.01
Khair	122,850	4,697	4,941	3,770	3,350	4,175	3,962	3,769	3,728	3,141	2,299	1,734	162,416	17.49
Shisham	7,712	296	533	971	865	1,159	1,024	1,264	1,592	1,280	745	513	17,954	1.93
Bamboo	2,129	91	85	361	85	309	170	293	702	815	437	464	5,941	0.64
Mulbery	1,378	-	-	-	-	-	-	-	-	-	-	-	1,378	0.15
Poplar	9,185	485	578	619	455	552	856	722	344	256	208	209	14,469	1.56
Robinia	27,380	2,526	2,334	2,226	2,140	2,291	2,171	1,770	1,206	960	997	631	46,632	5.02
Leucenea	-	-	-	-	-	-	-	-	1,058	780	408	420	2,666	0.28
O. BL, Spps.	153,742	6,880	7,408	8,658	7,995	8,860	11,112	10,123	8,179	7,630	5,703	4,861	241,151	25.96
Total	653,764	27,805	30,686	30,229	25,991	27,251	29,796	29,446	24,922	20,435	15,117	13,414	928,856	100.00

Recent trends show a continuous decline in the area planted each year, because of paucity of funds and a ban on silviculture and working plan operations in the state except for the rights-holders under an order of the Supreme Court dated 12 December 1996. However, dry and fallen trees (salvage) can be removed through the HP State Forest Corporation. Chil is the single largest species with about 29.66 percent of the area planted by the department. Deodar forms only 12 per cent of the total area planted during this period. Recently, a large number of broad-leaved species, including walnut, poplar and shisham, were planted under different projects. Cultivating bamboo has great potential for the state as it is highly versatile, lending itself to distinct and unique furniture designs, to new generation building materials, and to a vast range of items, thereby generating countless jobs. Since the state has a lot of degraded soils, bamboo holds the premise for their regeneration. At present, two bamboo species namely, *Bambusa* and *Dendrocalamus*, are found in the state, whereas new fast growing species suitable to specific agro-climatic regions could be introduced based on the requirement of end objectives such as making paper pulp, furniture, building material. The National Mission on Bamboo Technology and Trade Development has elaborated upon the use of bamboo for cultivation in different regions of the country and has given suggestions for its commercial and environmental benefits.

5.12 Historical Perspective of Forest Management in Himachal Pradesh:

The development of a historical timeline of forest management in HP has been shown through eight generations:

- **1st Generation - Prior to 1850s. (Period of usage and customary rights)** - Era of princely states: the kings and local rulers are the decision-makers. No role of communities' rights enjoyed at the pleasure of the king, though traditional institutions of PFM existed.
- **2nd Generation - 1850-1950 (Period of codification of rights)** - Era of British Rule: British replace the kings as outsider decision-makers. Customary rights are recognized and codified in forest settlements and given official sanctity. Still all decisions made by the British, though communities consulted during the settlement of rights. Involvement of people in PFM is sought through the setting up of Forest Cooperative Societies in Kangra district from 1940 onwards.
- **3rd Generation - 1950-1975 (Period of metamorphism)** - Indiscriminate use of rights after Independence: The local forest officers replace the British as the implementing agency. Period of no-decision. People continued exercising the rights on increasing levels. Forest resources start showing signs of depletion and degradation.
- **4th Generation - 1975-1980 (Period of awakening)** - Beginning of social forestry. The FDs prefer forestry schemes with the involvement of people and communities. Still no participation of communities. The HP State forest policy of 1980 comes into effect.
- **5th Generation - 1980-1990 (Period of donor-driven social forestry)** - Donor-led social forestry projects are launched. FDs and donors seek involvement of local people and communities: however, much of decision-making transferred to donors, though alienation of communities continues.

- **6th Generation - 1990-1993 (Period of seeking participation of communities)** - National Forestry Policy 1988 and Gol circular of June 1990 on participatory forest management issued. The FD attempts participation of people in formulation of forestry schemes. People (Forest Users) given limited decision-making powers within existing classical framework of the FD.
- **7th Generation - 1993-2001 (Period of institutionalization of PFM)** - Role reversal of foresters and communities in decision- making sought. Foresters to act as catalysts and enablers. Registration of VFDC under the state government. JFM Order of 1993 initiated.
- **8th Generation - 2001 onwards (Linking Rural Livelihoods and Panchayati Raj Institutions with Forest Management)** - Participatory Forest Management Regulations, 2001 and empowerment through village forest development societies begins. Livelihood-focused JFM initiated and Link with Panchayati Raj institutions.

5.13 Evolution of Participatory Forest Management in Himachal Pradesh:

Traditional initiatives in PFM and regulated use of forests through the *deota* (village deity) institutions exist in several villages of HP. There are numerous cases of people's active participation in forest resource management, especially in the regulation, collection and distribution of forest products. Such traditional systems existed long before the advent of the present day Joint Forest Management. The initial efforts to develop joint arrangements for forest management were initiated prior to independence through Cooperative Forest Societies (CFS) in the Kangra district of Himachal Pradesh. After Independence in 1947 and until about the early 1970s, the sole emphasis was on the consolidation of the FD, establishment of forest-based industries, and afforestation on all types of land. The report of the National Agriculture Commission (1976) emphasized the need to start forestry programmes for meeting the daily needs for fuel wood, fodder and timber of the rural people. Subsequently, in the 1980s, many donor agencies supported the implementation of people-oriented forestry programmes through social forestry projects. The 1988 Forest Policy gave a boost to the social forestry programme by recognizing the fact that rural people's economy and livelihood was dependent on forests and, therefore, the people had first charge on the use of forest resources for their sustenance. The Gol's memorandum of 1990 laid the foundation for (re) introduction of PFM in the states. The Government of Himachal Pradesh (GoHP) issued its order on PFM on May 12, 1993. Since then JFM has been the main thrust of all forestry programmes in the state.

The following gives a brief description of the main initiatives involving PFM in the past few decades.

Cooperative Forest Societies (CFSs):

Experiments with CFSs began after the state took over control of the forests following forest demarcation and settlement procedures. The concept behind forest cooperatives was based on the realization that the FD would be unable to control the resultant rapid deforestation of the forests. In order to find alternative management strategies for degraded areas of Kangra district, intense discussions took place between the FD, the district administration and the Revenue

department during the year 1932. The objective was to hand over UPFs, unclassified forests and *shamlat* (village common) lands to the village *Panchayats* for management and income generation. The Panchayats were to appoint their own staff for protection. David in a forester, in 1932, argued that forest guards should not be allowed to interfere. Revenue from sale of trees should be used for conservancy and regeneration of forests on the presumption that the Panchayat would close part of the forest handed over to it for the purpose of regeneration. Chaudhry in 1945 stated “The forest-society’s scheme is one of the first of its kind to be introduced in India in which government forests are being handed over to the villagers for management and for enjoying their income.”

The other argument was that forests were to be managed as Village Forests (VFs). The FD should work for the Panchayats and carry out all measures in cooperation with them. The FD should not impose its decisions on the Panchayat, especially with regard to closure, but in silvicultural measures, for example, the marking of trees. The Panchayat should abide by the decision of the FD (Kangra district records, 1932).

- In 1935, in a National Forest Conference held in Madras (now Chennai), a resolution on finding alternative management strategies for degraded areas of Kangra district was passed. The resolution described: “That the conference is firmly of the opinion that the state of the undemarcated forests is so deplorable that the recent policy for their management must be changed. The practicability of forming VFs should be examined, and the government may be asked to appoint a committee to decide what particular steps should be taken in each district of the outer Himalayas.”
- In 1937, the Garbett Commission was set up by the Punjab government to enquire into the difficulties experienced by ‘those who live in and near the forests, and to suggest strategies for enlisting their cooperation with the FD. The Commission found that 20.4% of the forests of Kangra were under scientific management, and the remaining 79.6% was burdened with heavy rights.
- The other argument was that forests were to be managed as village forests. The FD should work for the Panchayats and carry out all measures in co-operation with them. The FD should not impose its decisions on the Panchayat especially with regard to closure, but in silvicultural measures e.g. marking of trees, the Panchayat should abide by the decision of FD (Kangra DC records, 1932). The commission recommended that :
 - *The villagers should agree to management according to simple working plans approved by the government, which would involve closing, where closures were demonstrably necessary.*
 - *In order that this demonstration may be convincing, government should associate themselves with the management of the forests and the representatives of the people.*
 - *An effort is made to teach the villagers that whatever profits may accrue from the management of the shamlat and the reserves will be to their benefit.*
 - *In order that the people may have qualified representatives, Panchayats must be formed to whom the details of the forest management of the area in which the village is situated could be explained.*

- *For this purpose a working scheme of management for each village must be prepared. The scheme would envisage management of not only the shamlat, but also of the protected and reserved forests to which the village had rights, in such a way as to secure the maximum crop of forest produce for the benefit of the villagers.*
- *If possible, the cost of management was to be met from the proceeds of sales, but the value of these provisions of securing the catchment area was felt to be far greater than some small expenditure on the staff, which was to be paid for, in part or wholly by the government. This was a major shift as it accepted the maximum priority to be given to soil and forest conservation and that this was not possible without the involvement of the communities.*

Formation and Working of CFSs:

The Punjab Government ordered FD to draw up a scheme on the recommendations of the Garbett Commission in 1938, and the FD launched the Co-operative Forest Society scheme in the same year. The scheme was sanctioned in 1940 and conditions and terms of grants-in-aid along with CFS rules were notified in 1941. The CFS schemes were sanctioned initially for a period of five years with an annual grant-in-aid of Rs. 50,000/-. The scheme was extended for another five years in 1945 with total of 63 CFS formed by then. By 1956, seventy Co-operative Forest Societies were operational managing 23,556.29 ha of forestlands forming about 10% of the total forestland of District Kangra.

In 1961, the scheme extended by 10 years but grant-in-aid limit to Rs, 50,000/- was cancelled and the income from CFS was to be given back to them as grant after making the necessary service deductions. In 1969, Rawal's integrated working plan (WP) covering 70 the CFSs came into effect with the merger of Kangra district in HP in 1966. In 1971, scheme was not extended and FD withdrew its technical support. The FD took over working of the CFS forest area based on Rawal's WP as the income from CFS reduced to insignificant sums. HP Government passed orders for extending the scheme for two years, but the above situation continued. In 1972, 29 CFS were found to be in poor condition. In 1972 with the promulgation of 'HP Common Lands Vesting and Utilization Act', the control of shamlat lands was taken from the Panchayat and the Deputy Commissioner. In 1983, Rawal's WP period expired and the FD included the CFS forest areas in a revised territorial Working Plan for respective Divisions. Although the grant-in-aid to CFSs were discontinued in 1971, there is evidence to suggest that people in many villages are still using the forest resources within the framework of a CFS.

The EC of the societies worked with the FD to implement Working Plans, which mainly comprised closing forestlands for regeneration, detecting offences, and settling disputes. Membership in CFSs was limited to all heads of households paying land revenue and did not include women, the landless, village artisans, and other non-agriculturists. The management of the society centered on landholders (not user groups), thereby alienating a large section from participating in the protection and management of forests.

Historical Overview of Participatory Development Process in Himachal Pradesh:

The significant experimentation with participatory planning has been done by Forest Department in the following schemes, projects/events:

1976-80	Three Dimensional Forest Farming
1980-89	Indo-German Dhauladhar Farm Forestry Project
1984-93	National Social Forestry (Umbrella) Project
1991-93	Van Lagao-Rozi Kamao Scheme
1993	HP Government JFM Resolution
1993-2004	Indo-German Eco-Development Changer Project
1991-2005	Integrated Watershed Development Kandi (Hills) Project
1994-2001	Indo-UK Himachal Pradesh Forestry Project
1998 onwards	Sanjhi Van Yojna (Community Action in Forestry)
1999-2000	Himachal Pradesh Forest Sector Review
2001	Himachal Pradesh Participatory Forest Management Regulations
2002-2006	Himachal Pradesh Forest Sector Reforms Projects
2002 onwards	Forest Development Agencies through GOI schemes

Three Dimensional Forest Farming:

Experiments involving the local people in forest conservation and development began in earnest with the introduction of the concept of Three-dimensional Forest Farming (TDFF) in 1976. The TDFF had three objectives, soil conservation, and production of timber and fodder for domestic cattle. With the enunciation of the State Forest Policy in 1980, people's participation in afforestation programmes was highlighted. For synergy, TDFF was later merged with social forestry/farm forestry schemes.

The PFM Initiatives through Donor Funded Projects:

In the 1980s many donor agencies started supporting the implementation of people-oriented forestry programmes through forestry projects. People's participation in forest management was sought in the 1980s under two externally aided projects. The Indo-German Dhauladhar Project (1980-1989) and the World Bank aided National Social Forestry (Umbrella) Project (1985-1993).

Indo-German Dhauladhar Project (1980-1989):

The first externally aided Integrated Forestry Project in Himachal Pradesh was launched in 1980. This project was initiated with German assistance and was titled as "Indo-German Dhauladhar

Farm Forestry Project” (IGDP). The project ended in 1989 and paved the way for enlisting local communities in forestry development schemes. The IGDP was conceptualized around the assertion that problems in the Himalayas have an interdependent environmental and socioeconomic character. This multi-sectoral integrated project covered about 100 villages of the project covering 260 km² in the upper catchment of the Binwa River in Kangra, at the base of the Dhauladhar mountain range, from 1980 to 1989.

The objectives of the project were to develop forest resources, horticulture and animal husbandry in the *Dhaluladhar* area to meet the demand for fuel, fodder and small timber of local communities. The significant achievement of the project was the development of a fuel efficient “*Chullah*” which saves fuel consumption by 40%. Preparations of Integrated Village Development Plans in the project also laid the foundations of the people’s participatory management concept in Himachal Pradesh.

The Indo-German Dhaluadhar Project did have a positive impact on forestlands and increased the availability of fodder and grass to local communities. However, the impact was short-lived and gains were not sustained in the post-project period although 2822 ha of plantations were raised and 532 ha of grasslands were treated during the project period.

The importance of social village organization in forest conservation was too, realized and experimented in Indo-German Dhauladhar Project. The project initiated a strategy for securing people’s participation called TRUCO (Trust and Confidence). A separate social development section played the main role in reaching out to village communities through village motivators. The IGDP accepted village level institutions (VLIs) as the best agents for change in mountain systems and helped form and strengthen 53 Village Development Committees (VDCs) and 73 Youth clubs and *Mahila Mandals* (MMs).

At the beginning, a series of meetings was held in each ‘key village’. Thereafter, the local community had to request the project to take it as a partner. With the help of IGDP staff, each selected village formed a VDC. Gaining trust in itself and confidence in its abilities, the VDC gradually took up planning and implementing IGDP programmes. The notable achievements were:

- Planting of broad-leafed trees to serve as future fodder banks, and the establishment of village nurseries to provide saplings continuously to communities;
- Plantation of community orchards and fodder crops;
- Popularizing stall feeding and developing an equitable system for the distribution of grass from strips within closed and planted belts;
- Upgrading breeds and reducing non-productive livestock, thus increasing farmers’ returns;
- Promoting smokeless ‘Dhauladhar Chulhas’ for better kitchen hygiene and women’s health; and
- Increasing agricultural production due to better agricultural awareness and extension.

Building the trust and confidence of local VLIs in their ability to undertake community-based management of local resources was a remarkable and significant step for PFM in Himachal Pradesh. However, no government department (including the Forest Department, IGDP's major partner) recognized these IGDP-created institutions as focal points for mobilizing village communities, so they were neglected and eventually became defunct after the project ended. Although the FD was the main stakeholder behind the experiment, it apparently failed to internalize any lessons from the success of this community-managed forestry.

Indo-German *Changer* Eco-development Project (1993-1999, 1999-2006):

Indo-German Eco-development Changer Project (IGECP), Palampur, a sub-division of Kangra District, is a bilateral integrated multi-sectoral project between Govt. of India and Federal Republic of Germany, which started in 1993 with a planned implementation period of 15 years supported by German Technical Cooperation (GTZ). It was initiated to replicate and modify the experiments of the earlier *Dhauladhar* Project. It covers an area in Kangra district of a little more than 400 km² with 570 villages. It is an integrated development project that includes forestry as one component. The emphasis has been on strengthening village self-help organizations followed by participatory integrated land use planning.

The project followed the “*key micro-watershed and key village*” approach through formation of village development committees registered under the HP government JFM notification. 316 VDCs were formed under the IGECP till November 2001.

Highlights of Phase II (1999-2006) of IGCEDP:

Based on the experiences gained during first phase (1993-99), the project has initiated an active process of bringing local communities together with technical experts, government departments, administrators, R&D organizations of different levels. The main focus is to:

Increase villager's livelihood options through diversification and better productivity, accessibility and management of natural resources,

Participatory evaluation and development of natural resource management technologies,

Empowerment of resource users for decision making, implementation and monitoring and evaluation, and

Development of linkages between villagers, GO's, NGO's and Research & Development Institutions.

Eco Development is a long term effort, which must become part of the mainstream development activities supported by many governmental and non-governmental actors. The project, therefore, tests different institutional arrangements from direct implementation in a somewhat parallel structure to the full integration in the *Panchayati Raj* Institutions. The latter approach emerges as more promising because decentralization of power and funding has become a declared policy of the H.P. Government. Integration and improvement of the existing systems has more chance for long-term survival and is therefore the project's chosen path.

From Forestry to Community Forestry:

Forestry in *Changer* has lost its keystone role as the dominant feature of the Farming Systems and therewith that of local livelihoods. In the *Changar* scene where change in local lifestyles is brisk and externally oriented dependency of local livelihoods substantial, the rehabilitation of degraded community and forest lands is not necessarily seen as a potential development arena. The track of degradation has led to a situation where local forest users are not able to cope with changing socio-demographic and economic scene or new demands on sustainable forest management (for example erosion of indigenous knowledge, increased workload on women, absence of working men folk). Current forest management does not tap the multifunctional potential of forests (for example conservation, short-term economic benefits, watershed development). Further degradation of natural resources including forests cannot be avoided due to social and economic compulsions and inequities and local institutional and governance weaknesses. Therefore, the sustainable development oriented interventions have to be socially just, economically attractive and viable, and ecologically sound. Forests have a paramount role in effecting conservation in degraded areas through enhanced productivity and bio-diversity, and in addressing the livelihood needs of local communities. Therefore the bedrock philosophy of IGCEDP since 1994 is based on eco-development. The prime elements of the eco-development concept are:

- Participatory planning, implementation and management.
- Development of natural resources.
- Development of local expertise.
- Functional-link oriented supportive institutional mechanisms in the post-project era.

However, forestry in IGCEDP started off with traditional forestry that is based on a few species, pure stands, timber-oriented and a rigid technical frame of mind. It is only through community-based experience and the ecological needs of the local ecosystem that a progressive shift can be made to community forestry. It is not only planned and managed with local communities but also addresses the cross-cutting issues of ecological rehabilitation and multifunctional role in terms of socioeconomic and socio-institutional development support to local livelihood needs.

Pillars of Community Forestry in IGCEDP:

The key objective of community forestry in IGCEDP is to fulfill the multifunctional role assigned to it. However, it cannot happen on its own unless capacity-building and empowerment of local communities is initiated through local institutional strengthening and management of community assets such as multipurpose forests is well-conceived, effective and technically backed-up. Hence the pillars of the Community Forest Approach in sequence are:

- Problem and potential-oriented planning of forestry resources on communal and private lands with village communities/ user groups.

- Identification of area, selection of species and design of plantations and adjustment of species to given site and micro-sites according to the needs of local communities/ users groups.
- Design of Community Forest Management Plan (CFMP) based on :
 - Objectives of forestry interventions
 - Plantation area description
 - Users and their ownership details
 - Local Management rules and regulations
 - Technical Management details with plantation map
- Memorandum of Understanding (MoU) consisting of rights and responsibilities of the main stakeholders such as the VDCs/user groups, Panchayat and Forest Department.
- Forest Management technical trainings with user groups and building local-level animators.
- Training of Forest Department and linkage of CFMP with Forest Management Working Plan of the department.
- Active focus on advocacy on policy changes by disseminating project learning.

Learning from IGCEDP:

i) Social :

- Consensus among community members is necessary prior to planting on a site.
- Good growth and survival of plantations is a reliable indicator of social acceptance.
- Successful plantations increase local community's interest and cohesion.

ii) Institutional:

- Local Institutions such as VDCs/User groups are ideal to prepare the ground for long-term management. However, their post project linkage to Forest Department and Panchayat is a must.
- Grassroots institutions (e.g. user groups) are important for generating local interest in forestry.
- Community Forest Management can be facilitated by such grassroots institutions in socio-technical terms (local management rules, protection against fire).

iii) Economic:

- Grass production increases substantially after the plantation enclosure and has good economic potential (e.g. through sale of grass) provided that technical management interventions are timely. Unhindered development of vegetation enhances bush growth for use as fuel wood especially by resource poor. In good older plantations (after 6/7 years) fuel wood sale up to Rs.1000/ hac is easily possible consisting of bushes and pruned/ lopped tree material.

- Proactive *silviculture* treatment in many plantations can deliver major economic yields by Year 15 (e.g. small timber, fuel wood).
- Natural regeneration of various plants (e.g. medicinal herbs and trees, fruit species) enhances the economic value spontaneously.

iv) Ecological:

- Quality and timely planted mixed plantations (i.e. in early monsoon, with good technical standards and right choice of species with local community's consent) are most effective to achieve rehabilitation and conservation objectives in a short span of time (i.e. five years).
- Protected plantations, even on the most degraded areas within few years enrich biodiversity (e.g. seventy new plant species, 30% rare plant species, increased wildlife population).

v) Socio-technical Management:

- Even on the inhospitable sites, if technical standards are maintained, replacement of dead saplings is not necessary unless it really is less than 40%.
- On community lands the initial number of planted trees can be kept at 700/ha since the invasion of natural regeneration is spontaneous and compensates for any mortality within two or three years.
- Early silviculture treatments are necessary to enhance the growth of trees and optimum grass production. These include preventive measures of fire management and the suppression of infesting weeds.
- In combination with other monitoring aspects (e.g. surface run-off, water recharging) plantation monitoring is a good tool for impact monitoring on overall watershed treatment.
- A considerable amount of money can be saved by simply protecting enclosures and working with natural regeneration.
- In well-established plantations (e.g. higher stocking, dense crowns and bush growth) controlled grazing can be practised with benefit (e.g. weed suppression) (in *Changar Charcha*, 2002).

National Social Forestry (Umbrella) Project (1985-1993):

National Social Forestry (Umbrella) Project was launched in 1985 with USAID and IDA participation in HP. This project had the objective of increasing the production of fuel, fodder and timber to provide enhanced income opportunities to the landless and other villagers and to strengthen forestry institutions. In this Umbrella Project, the plantations were to be carried out after consultation with VDCs and preparing 'Integrated Resource Management Plans (IRMPs).

The VDCs were charged with the responsibility for:

- Assisting in preparation of the Integrated Resource Management Plans (IRMPs).

- Identifying areas for raising fuel, fodder plantation and grassland development.
- Selecting the species to be raised and encouraging the villagers to raise *Kisan* nurseries.

During the project period, the local people were involved in the various programmes, under different components of the project. The response of the local people was quite encouraging, and the various VDCs formed under the project worked well towards the protection and development of forests. With the termination of the project in 1993, these committees also stopped working. The main reason for these committees becoming defunct in the absence of project aid appears that the main thrust was given on achievement of targets. Sustenance of the programme, which started during the project period, was not given attention. The thrust was on implementation of the scheme, so the training aspect was not given importance to the level required for the changed working. So, during the project period the scheme produced very good results, but these could not be sustained after the project ended.

During Phase II of the social forestry project, beginning in 1991, the HP government launched the *Van Lagao Rozi Kamao Yojna* (Plantation and Employment Scheme). It had the twin objectives of providing employment to the poorest of the poor and greening the barren hills with tree cover. The aim was to provide employment to 75,000 families and raise plantations of species required by the farmers on 140,000 ha of degraded land during the eighth and ninth Five-year Plans. The programme envisaged providing on lease 2 ha of contiguous village lands to each household below the poverty line. The beneficiary households were expected to plant trees and protect them. A good beginning was made in this direction. The poorest of poor beneficiaries were selected and employed as *van sewaks*. Linking the payments with survival percentage of the plantations ensured their involvement in forest protection. The people, on the basis that it was de-facto privatization of their common grazing lands, however, opposed the scheme. The scheme had to be abandoned because of objection from the Gol on legal grounds, that keeping in view the Forest Conservation Act, 1980, plantation by individuals on government land is a violation of the Act and, therefore, cannot be allowed. The scheme closed with the culmination of the project in 1993.

This project covered all of HP's 12 districts and attempted to implement its activities through villagers or in consultation with villagers. The FD started the dialogue with the villagers' gram panchayats' (GP) or other existing VLIs such as MMs. Village forest development committees (VFDCs) were set up in many villages for the first time to implement the scheme. However, attempts to seek the active participation of an entire village community by including one woman (from the MM), one representative from the scheduled castes, and one from the GP, were not very successful (Sood 1994).

The VDCs evolved neither participatory mechanisms nor bottom-up systems for planning and management. The lack of representation of local forest users and domination by the elite reduced the experiment to pro forma 'involvement' of the people. As ex-officio member secretary of the VDC, the FD forest beat guard formulated the integrated resource management plan (IRMP) for the village, leading to FD rather than community ownership. While on paper the social forestry

programme succeeded in planting over 100,000 ha of plantations, community participation was limited and the FD continued choosing the species to be planted (like eucalyptus), without reference to the needs of the community – leading many communities to call it ‘un-social’ forestry.

Integrated Watershed Development (*Kandi*) Project (1991-1999, 1999-2005):

Integrated Watershed Development Project in Kandi areas of the *Shiwalik* region of HP was launched in 1991 with World Bank assistance. The project followed an integrated approach and harmonious development of forestry, agriculture, horticulture and animal husbandry in order to raise the economic conditions of people and also to ecologically rehabilitate the *Kandi* area. The focus was on providing technical input and resource creation through integrated micro-level development plans. The Project was implemented on an integrated watershed development approach in the Kandi area whose aim was the holistic development of all the resources for the benefit of the people whilst ensuring the sustainability of the resource base. The IWDP was implemented in 5 Districts in 36 sub-watersheds covering 40,785 households in 835 villages having 2.40 lakh population. The total expenditure was 171.99 crores out of which Rs 117.24 Crore (68.5%) was World bank share, 25.99 Crore (15.1%) state share and beneficiaries share was Rs. 28.26 Crore (16.4%). In the project, 143 VDCs, 258 Self-help groups and 455 user groups were formed on a watershed basis. Additional arable land of 3597 ha was brought assured irrigation due to construction of 1136 village ponds, 64 lift irrigation schemes, 39 kms Flow irrigation schemes, 493 water harvesting structures and construction of 56 earthen run off Dams. The IWDP has resulted in increasing by 40% the wheat and maize crops, 19% fodder production, 30% vegetable production and a 45% to 51% increase in milk production. The project efforts have led to a reduction in open grazing by 26 % and 22% of the silt load. The estimated value of land saved and reclaimed along the stream bank is 17.00 Crores.

Indo-UK HP Forestry Project (1994-2001):

JFM in its modern form was introduced through the Indo-UK Himachal Pradesh Forestry Project (HPFP) launched in 1994, with assistance from the Overseas Development Agency (ODA) now Department for International Development (DFID). The formal process of JFM was started in the Kullu and Mandi forest circles. The project focused on institutional and governance issues. The project was different from other projects in being a process project, in which there was flexibility of incorporating changes on the basis of experience gained during working with an approach. This approach, called Joint Forest Planning and Management (JFPM), was adopted to elicit people's participation and operational participatory mechanism for sustainable forest management. The pilot phase of the project, for three years, aimed at testing the JFM approach in selected locations for replication in the whole of Mandi and Kullu circles and then in the whole of HP. The project laid emphasis on capacity building of staff and attitudinal change. The focus of HPFP was to involve local forest users in forest management, integrated planning and the development of strong self-sustaining groups.

It was envisaged that joint forest planning and management would build the participation of people into the activities of the Department of Forest Farming and Conservation (DFFC) and thereby

begin to change the present unsustainable and demand-led mode of exploiting natural resources. The Himachal Pradesh Forestry Project aimed at the development and implementation of sustainable systems of forestland management, which would strike an optimum balance between the needs of local people and environmental concerns. This necessitated an attitudinal reorientation among the departmental staff and the user communities, and a functional shift in the role of the department from one in which it is perceived as a policing/adversarial body to that of an enabler and a provider of technical guidance. The approach emphasizes both developing genuine 'bottom-up' and participatory planning with the emphasis on user communities rather than on individuals, and large-scale capacity building within the FD itself to reorient staff and train them in communication and facilitation skills.

As a sequel to the GoHP order of 12th May 1993 on JFM, the HPFP supported the Forest Department's efforts in managing the forest resources in participation with local people. The pilot phase of the project with financial assistance of £s 3.094 million was approved for three years, i.e. 1994 to 1997. Its purpose was to establish the viability and cost effectiveness of new approaches to sustainable forest land management including JFM in Kullu and Mandi districts and their potential for copying elsewhere in HP. The main thrust of the pilot phase was to support the introduction of JFM in degraded forest areas by establishing village forest development committees (VFDCs) to share, with the forest department, responsibility for managing forest land. Based on the experiences of this phase, the second phase of this project (Oct. 1997 – March, 2000) i.e. ***Consolidation & Design phase*** (£s 3.225 million) was recommended for supporting wider replication of phase one throughout the state. The C&D phase has been framed to test the implementation of the processes developed in the pilot phase and will promote new client focused systems in less degraded areas. In the C & D phase, the project also supported the forest management plan in less degraded areas. These plans were to be drawn up through a process of informal consultation with the local communities.

Specific achievements of the Phase I were:

- The establishment of VFDCs and the preparation of micro plans through participatory planning processes in 17 villages in degraded areas of Kullu and Mandi.
- Most of the staff in Kullu and Mandi districts have been provided with basic training skills in participatory approaches.
- New teaching curricula have been developed for forest training centers in Sundernagar and Chail.
- Special short courses on JFM for front line field staff and communities members have been conducted at Forest Training Centres.

As an extension of the pilot phase, the consolidation and design phase began in October 1997 and came to an end in March 2001. This phase aimed at consolidating the experience gained during the pilot phase and also to further design the extension phase of the project on the basis of this experience. During II phase, three types of activities were primarily undertaken:

- Extending micro-planning process and VFDC formation in more locations.
- Improvement and management of selected forest areas through forest management plans.
- In order to have all information at Range Level for holistic management of ranges, a Range Management Information System (RaMIS) was developed.

VFDCs are the institutions created through a process approach and registered under the JFM Notification of the HP government. The VFDCs share responsibility for managing the degraded forestlands. The focus of HPFP was to involve local forest users in forest management, integrated planning and the development of strong self- sustaining groups. Under HPFP, 153 VFDCs were formed in Kullu and Mandi districts.

The management of forests is to be done as per the GoHP JFM order:

- Microplans cover all areas that fall under the prescription of the JFM government orders. Microplans are prepared in consultation with all stakeholders and are being implemented with participation of the local people.
- Forest Management Plans (FMPs) cover all other areas of forest both with and without rights, such as DPFs and RFs. FMPs were meant for the improvement of existing forests. In Mandi circle, 35 FMPs and in Kullu circle, the end of HPFP formed 21 FMPs.
- Site-specific plans establish the institutional arrangements for management of a particular area (VFDC or forest) and describe the management objectives that have been agreed and negotiated with members of the VFDC.

Table 5.67: Number of VFDCs formed in Mandi and Kullu in HPFP (Growth of JFM)

Year	Kullu VFDCs (No.)	Mandi Area (ha.)	VFDCs (No.)	Area (ha.)	Total / area (No. / ha)
1995 – 1996	4	1870	-	-	4 / 1870
1996 – 1997	4	2685	8	3110	16 / 5795
1997 – 1998	12	8930	13	5537	25 / 14467
1998 – 1999	21	12426	35	7134	53 / 19560
1999 – 2000	14	7000	42	21174	59 / 28174
Total	55	32911	98	36955	153 / 70166

Sanjhi Van Yojna (Community Action in Forestry) 1998 onwards:

The lessons learnt and experiences gained during the implementation of the earlier projects led to the institutionalization of the PFM process. A regular scheme of the FD, Sanjhi Van Yojana (SVY) was initiated in December 1998 to involve communities in afforestation activities. SVY

was modified in August 2001, combining all state plan afforestation schemes such as '*Apna Van and Apna Dhan*' and '*Parishram Hamara Van Hamara*'.

Under these rules the funds are provided directly to the Village Forest Development Societies (VFDSs) registered under the Societies Registration Act, 1860, for carrying out micro-plan activities.

This scheme is being implemented with the following objectives :

- Involvement of grass roots institutions such as gram panchayats, mahila mandals, yuvak mandals, schools, village development committees (VDCs) and NGOs.
- Regeneration of degraded forest areas through community involvement.
- Creation of social assets for the benefit of the local communities.
- Creation of employment opportunities in rural areas.

Thus, the Sanjhi Van Yojna scheme is a new effort in PFM somewhat similar to JFM but financed from the state budget. It was launched with an initial outlay of 100 million rupees. This scheme adds the gram panchayat to the list of social institutions that can be involved. It aims both to regenerate degraded forest areas and to increase social, non-forest related, infrastructural assets (up to 25% of the total budget), although these two seem to be mutually exclusive. The scheme also promised that the village forest development committees (VFDCs) to be formed will be registered by the DFO as welfare societies (VFDS) (non-government organizations) under the Societies Act of 1860. One step forward has been made in the provision to send the grant money for the approved micro-plan by cheque to the official joint account of the VFDC. Also there was a new 'usufruct-sharing' model at the time of the final harvest. The sale proceeds from plantations on government lands will be distributed as follows :

- 25% to the VFDC executive committee - to be distributed amongst members
- 25% to be deposited in the joint account of the VFDS and village development fund
- 10% to the gram panchayat within which the VFDS falls
- 40% to the government treasury
- 364 VFDS have been formed under SVY throughout HP.

5.14 Institutionalization of Participatory Forest Management:

Experiments on involving local people in forest management started with the introduction of a village CFS in Kangra district in Himachal Pradesh before independence. The VDCs were formed during the Social Forestry (Umbrella) Project in 1986. Himachal Pradesh became one of the pioneering states in India by introducing Sanjhi Van Yojna in 1998 to be implemented through VFDS. By channelling government grants to a VFDS, the GoHP and FD have put full faith in people's institutions in forestry development through JFM. By issuing the HPPFM Regulations 2001, the GoHP has shown its full commitment to the JFM principles.

Although the rights of forest access and use of villages and individual right holders in forests are well coded and formalized through forest settlements in HP, yet following a process approach, new institutions are being created on JFM principles by developing community partnerships. PFM represents a growing concern inside the FD with several schemes and projects being implemented with the involvement of people. However, the sustainability of village level institutions will depend on the means of income for these institutions after project completion.

Participatory approach to forest management in the state has been introduced by establishing village level institutions: VDCs, VFDCs, and VFDS. Although these institutions were set up under different projects and had different mandates specific to the projects, the common denominator was the mobilization and enabling of the communities to undertake sustainable forest management. At present, the structural organization of these committees is primarily fund-driven and there is a need for uniformity in these institutions.

The primary responsibility of these VFDCs, VDCs and VFDSs is to develop and implement a micro-plan for the forest areas around the villages. These institutions are also active in forest protection, controlling forest fires and grazing, TD certification, nursery plantation construction works. However, in terms of accountability the executive committees have a key role to play but in many committees the issue of active involvement of 'General house' is still an area of concern due to the large size of committees/societies.

Another issue is the active involvement of the 'general house'. It is seen that due to the large size of committees/societies, the EC rather than the general house take most key decisions.

Institutionalization of PFM:

Name of Project	Project Period	Name of Institution	No. of Committee	Registered under
HP Forestry Project	1994 -2001	Village Forest Development Committee (VFDC)	153*	JFM Notification dated 12.05.1993
<u>Indo-German Changer Project</u>				
Phase-I	1993-1999	Village Development Committee (VDC)	258	JFM Notification dated 12.05.1993
Phase-II	1999-2006	VDC	71	PFM rules 2001 as VFDS
<u>IWDP Kandi (Hills) Project</u>				
Phase-I	1993-1999	Village Development Committee (VDC)	32	Societies Registration Act, 1860
Phase-II	1999-2005	Village Development Committee (VDC)	143	Societies Registration Act, 1860
Sanjhi Van Yojana (Community Action in Forestry)	1998-2005	Village Forest Development Society	364	Societies Registration Act, 1860
Great Himalayan National Park	1993	Village Eco-Development Committee	18	Director GHNP

The salient outcomes of these trials on Participatory Forest Management are:

- Prior to the HPFP and SVY scheme, village communities were organized into informal Village Development Committees (VDCs).

- Community based planning of forest resources was started and supportive entry point activities were also taken up for implementation.
- Village level plans were prepared.
- Based on direct financial allocation to them, VDCs took up implementation, by passing the conventional allocative mechanisms of the government.

Linkage with Panchayati Raj Institutions:

The structure for linking PFM with Panchayati Raj Institutions was provided in the HPPFM Regulations 2001 issued under Sections 80 and 81 of the Indian Forest Act 1927. The *Panchayat* ward will be the basic unit for setting up of the VDC. The state Panchayati Raj Act, 1994, includes forests in its list of 29 activities. The GoHP order in 1997 entrusted supervision and monitoring responsibilities related to 15 departments, including the FD to PRIs. It includes social and farm forestry, minor forest produce, watershed development, land improvement and soil conservation, and fuel and fodder. Members of Panchayats (Pradhans / Panch) are nominated/ex-officio members of the VFDC/ VFDS / VDC executive Committee. There is normally one Society for a Gram Panchayat ward, but where the ward is not compact and the hamlets within it do not have common land or common rights and concessions, more than one Society may be formed for each cluster of hamlets. The regulation entitles the society to some benefits of NTFP collection and a share in the sale proceeds of all intermediate harvests, subject to protection of forests and plantations for at least three years from the date of agreement. The Society will also be allowed to expand the area after a period of five years. After twenty years from the date of agreement, 75% of the net sale proceeds from the selected area will be put into the accounts of the Society) and the remaining 25% will go to the concerned Gram Panchayat. The notification also mentions that at least 40% of the net sale proceeds should be used on forest management activities, including soil and water conservation.

Himachal Pradesh Forest Sector Review (1999-2000):

The Himachal Pradesh Forest Department carried out a comprehensive review of the forest sector (FSR) in 1999/2000. The review aimed at providing basic information and a consensus on which to build future policies and strategies of the department and other key institutions to meet the needs of key forest stakeholders and ensure sustainable management of forest resources, integrating forest sector planning with socio-economic development.

The FSR analysis and discussion raises three groups of related issues:

- participation in forest management for livelihood needs,
- increasing the goods and services available through improving forest management, and
- coherence in governance, law and policy to achieve the above.

The FSR studies and consultations have revealed a convergence of opinion towards four key principles for making the transition to SFM, and a system for achieving SFM based on ten related policy objectives that need to be adopted in HP as a basis for defining policies and programmes towards sustainable forest management.

The four key principles for SFM in HP are:

- **Multiple forest values** – The many forest values that sustain local livelihoods and economic growth – from energy, food, and fibre production to cultural values and environmental services – should be recognized in order to allow a continuous flow of benefits for different stakeholders.
- **Multiple forest stakeholders** – The many stakeholders involved in the forest sector must be recognized – from those dependent on forests for subsistence needs, through state-level institutions charged with looking after HP forests, to national and international stakeholders. Good policies and programmes should be implemented to give them access to information and decision-making processes, and to emphasize participation in sharing the costs and benefits of forest use.
- **Changing conditions** – Since economic, environmental, social, and institutional circumstances and needs are changing rapidly, both within HP and outside, policies and programmes need to be capable of regular review and adaptation, and should include a precautionary approach to protect important forest assets.
- **The need for a lead agency to coordinate the transition to SFM** – This is necessary because all stakeholders expect the FD, as the recognized authority, to coordinate the transition to sustainable forest management, therefore the department must be given considerable support. Also necessary is a regular, equitable, participatory system through which stakeholders themselves can meet, debate strategic issues, consider optional solutions, and form partnerships – facilitated by the FD itself.

Ultimately, these principles imply a significant renegotiation of forest stakeholder roles that are both realistic and acceptable to all. Already a recognized need, this cannot occur without a shared vision of SFM, based on a participatory policy process.

This re-negotiation is likely to herald the beginning of a significant institutional change over the coming years, and will possibly be the main outcome of the forest sector review. A process of decentralization of forestry is needed to handle local complexities, but there must be enough centralization to ensure greater policy coherence both within and outside the state.

The four key principles are amplified below in ten inter-related policy objectives:

1. Institute a multi-stakeholder HP Forest Consultative Forum.

The establishment of an HP Forest Consultative Forum would create a platform for continued discussion of issues such as those raised during the FSR. It is proposed that the forum be positioned at a high level. It should include good representation of all the stakeholder groups, especially those at local level which are most dependent on forests, and sectors with a strong economic interest in forests a e.g. tourism and water supply. It would benefit from being composed

of progressive, expert, respected individuals rather than ex officio members. Such a forum is enabling both ‘horizontal’ coordination - strategic coherence between sectors, and ‘vertical’ coordination - linking villages to the centre in terms of improving both policy and its implementations. Thus a ‘tiered’ approach of local forest for a building on village forest institutions and federations of them, would be one option for ensuring the state forum deals with real local interests. The forum approach is central to most of the following recommendations.

2. Cross-sectoral coherence towards SFM, with an early emphasis on agreeing criteria and indicators (C&I) of SFM for Himachal Pradesh.

Economic development and rural livelihoods in forested areas are the concern of many departments, and not just the Forest Department. There is a need for greater inter-sectoral coherence and coordination between departments both at the state level and at the village level and experiments in effective and workable mechanism to support these. One option is to develop, in a participatory manner, core principles, criteria and indicators for SFM, and to apply them to government, private and community forest operations and to environmental impact assessments of activities that might impact on forests.

3. Strengthen village-level institutions.

The various types of village forest institution all hold great promise for fulfilling local needs from forests and – provided the regulations and incentives are right – for contributing to the production of state, national and global forest values as well. However, there is need for:

- Harmonization of the any types of local institution, whilst allowing for local differences and innovation;
- Institutional arrangements to support coordination rather than conflict between neighboring village forest institutions;
- Clarification of the roles and links between village forest institutions and PRIs, based on analysis of what has been working well;
- Mechanisms for monitoring and safeguarding the interests of marginalized groups with within the village institution; and
- Wider scope to be given to villages in terms of land use and forest management decisions they are empowered to make.

4. Liberalize forestry off-reserve, i.e. plantation/ farm forestry on private lands.

The HPFD needs to undertake a technical support/ enabling role, encouraging a thriving private sector to produce forest goods efficiently. Private sector codes of practice might be encouraged, based on C&I for SFM (above), and forms of independence certification that forests are actually managed to these C&I might ultimately be considered. However, certain controls are also needed as a complement to such a voluntary approach.

5. Improve investment in the public benefits from forests.

In general, state forestry should focus on public benefits; a case could be made for the HPSFC to invest in improving the quantity and quality of public forest assets. This would mean ensuring HPSFC is a pioneer in best-practice forestry which includes environmental and social benefits. Thus HPSFC should demonstrate's of any new HP C&I for SFM.

6. Undertake organizational change and capacity development in the HPFD to support other stakeholders, and especially village-level institutions, to take up sustainable forestry roles.

The HPFDS will need continued support to be able to work in partnership with all the institutions which should be playing a part in SFM. Its roles may shift towards analysis, advice, facilitation and monitoring, rather than heavy field enforcement presence. Capacity building will be needed to enable the HPFD to work in partnership with other institutions, as well as to ensure participations of all levels within the department. An HPFD Change Management Steering Committee is suggested to help the HPFD through the process of change over the next few years. It should report to the HP Forest Consultative Forum, to ensure that changes reflect the principle of the HPFD supporting other stakeholders' needs.

7. Develop a vision for balanced land use.

At the state level, the challenge is to establish what types of forest are needed to meet current and future needs for forest goods and services wherever they are (state or other land), how to encourage their development if there is not enough, and what legal backing may be necessary for the different forest management categories of a 'permanent forest estate'. The HP State Land Use and Wasteland Development Board (SLUWDB) could be empowered to administer the necessary multi-disciplinary procedures (possible as a wing of the State Planning Department).

8. Ensure biodiversity values are factored better in to land use.

A better system of protected areas is called for, to meet the requirements of the convention on biodiversity and to capitalize upon tourism and scientific potentials; this would include certain area rationalizations and links between particular protected areas that have been identified in the FSR biodiversity study. However, biodiversity conservation outside protected areas also needs to be improved: this might include encouragement of traditional land husbandry practices, complemented by incentives where necessary. For HPFD, HPSFC and private operators who are involved in production forestry, there is a need for guidelines and training in the latest approaches to biodiversity conservation within forest management.

9. Develop a transparent information system on forests, to inform stakeholders.

It is recommended that a basic Forest Information System (FIS) is established. It should be accessible to all stakeholders and ensure a flow of good, quality information reflecting the overall vision for HP's forest sector, whilst cutting back on unnecessary information. This could produce

a regular 'state of the forests and forest stakeholders' report. An FIS should improve transparency; but for particularly contentious or pressing issues, a further option to consider might constitute an independent Forest Watch Group which would also make its information freely available. Ultimately, a broader land information system might be desirable.

10. Greatly improve efforts to spread awareness of forest values, objectives, rights and responsibilities, increasing political commitment to SFM.

The findings and recommendations of this FSR need to be widely disseminated and feedback sought. Mechanisms for assuring public review and comment on major new plans for the forest sector would lead to greater public awareness and 'ownership' of new rules and laws, increasing acceptance and improving compliance. Improved political commitment and institutional changes are key needs, but will require a continued process to achieve them.

The FSR has recognized most of the factors that can help PFM and forest management in general to become a sustainable and profitable option for the state and the communities involved. It identifies the fact that this can happen only through policy and institutional change within the FD, but fails to define adequately what factors would lead to such a change.

Himachal Pradesh Forest Sector Reforms Project (HPFSRP) 2002-2006:

Based on the recommendation of the Forest Sector review and learning from Himachal Pradesh Forestry Project (Phase I), DFID is supporting the the transition to livelihood focused JFM by providing £ 8.247 million (cash prizes) over 4 years (2002-2006) to the Himachal Pradesh Forest Sector Reforms Project. This comprises:

- £ 5.247 million as a financial aid grant to GOI to support relevant livelihoods-related microplan activities throughout the project period, the development of policies and strategies and to provide modest institutional and infrastructural support to enable the target institutions to fulfil their project roles.
- £ 3.0 million of TC funds to support the development of policies, strategies and institutions.

The HPFSRP purpose is to establish and implement an integrated and cost effective strategy for sustainable forest management and enhanced livelihoods of the poorest forest-dependent women and men in Himachal Pradesh. The following project components are addressing the mandate of HPFSRP:

- Developing a multi stakeholder forest sector policy and strategy for Himachal Pradesh (Output 1), which builds from FSR and is formally adopted by GoHP.
- Strengthening government and non-government institutions, especially HPFD (Outputs 2 and 3), to enable them to provide integrated livelihood support mechanisms at community level, working through the Panchayati Raj institutions (PRIs).

- Developing a cost effective model for empowering and supporting the poorest forest-dependent women and men to strengthen their own livelihoods (Output 4) in ways which will include managing the forest resources in a sustainable manner, and increasing value-addition from product collection.
- The dissemination of project experience and lessons (Output 5) through reports, process documentation, workshops and networks both within the state and at the national level.

The expected benefits from the project are that an overall strategy for management of forest lands would be in place and HPFD would have the capacity to implement it, seeking investments from elsewhere if necessary. Community institutions of forest resource users would be empowered to address livelihood needs, particularly through linkages with local government, and other government departments.

The project would directly benefit poor forest-dependent women and men in Himachal Pradesh by enabling them to improve their livelihoods through increasing sustainable yields from forest lands, and through developing other livelihood alternatives which will ultimately reduce their dependence on the resource. The livelihoods of ‘downstream’ beneficiaries will also be strengthened as the forest resource will continue to support the water supply, agricultural and industrial production and hydro-electric power production.

The HPFSRP is expected to maximize and sustain impact by:

- Developing sustainable institutional frameworks and capacity at both state and community levels.
- Creating an appropriate policy and legal framework which remedies the numerous policy failures which have led to unsustainable and inequitable exploitation of forest resource.
- Improving the sustainable financial basis for the forest sector through exploring the potential of green accounting and the capture of watershed values.

Forest Development Agencies:

The Ministry of Environment and Forests, Government of India, under a national afforestation programme, is implementing a centrally sponsored scheme which is participatory in approach to sustainable development of forests through Forest Development Agencies in the tenth five year plan. The operational guidelines have been issued which form the basis for implementation of JFM programmes in the country. The scheme is being implemented by the following state agencies under the two-tier set up namely the Forest Development Agencies (FDAs) and Joint Forest Management Committees (JFMCs) through State Forest Departments or the FDAs as the case may be. At present, 38 FDAs are functioning in the state of Himachal Pradesh under new guidelines of GOI.

5.15 Policy, Strategy and Legislative Framework for PFM: JFM Order 1990:

The highlights of 1990 Resolution by Ministry of Environment and Forests are summarized as below:

- Developing partnership: between communities and Forest Departments, facilitated by Non Governmental Organizations;
- Access and benefits: only to organized communities undertaking regeneration, with equal opportunity based on willing participation;
- Right to usufruct: all non-wood products and percentage share of final tree harvest to communities, subject to successful protection and compliance with conditions approved by the state;
- Ten years Working Scheme: microplans detailing forest management institutional and technical operations to be developed by community management organizations with local foresters and NGOs;
- Funding: from Forest Department programmes with encouragement to communities to seek funds from other agencies too.

However, the outcome of the programme was largely influenced due to the following constraints:

- Attitude and ethos of the forest bureaucracy;
- Lack of understanding of Socio-economic and cultural value system of the locals;
- Gender issues and women's representation;
- Inter - and Intra-village conflicts;
- Lack of statutory authority to local institutions;
- Inadequacy in meaningful people's participation;
- Coverage of only degraded forests under JFM;
- Donor-driven rather than need-driven programme;
- Target-oriented rather than people-oriented programme; and
- Sustainability (of productivity and consumption).

Subsequently in 1995, the 1990 Resolution was slightly modified to incorporate women and landless households as well as usufruct-sharing by the committee.

Joint Forest Management Resources 21 February 2000:

Following decade of JFM notification of Government of India, June 1990 again revised on 21 Feb 2000 (enclosed as Annexure-iii). The circular, inter alia, contemplates:

- Legal backup to JFM committees,
- 50% members of the General Body should be women, and
- Extension of JFM in to good forest areas also with sharper focus on activities concerning NTFP management.

Joint Forest Management Resources, 24 December 2002: Strengthening of Joint Forest Management (JFM) Programme.

The Government of India has received considerable feedback from the states on various issues contained in JFM guidelines issued on 21 February 2000. To incorporate these suggestions, following guidelines on were issued 24 December 2002 to the strengthen further the JFM programme in the field by incorporating.

- Memorandum of Undertaking (MOU).
- Relationship with panchayats.
- Capacity building for the management of Non-Timber Forest Products (NTFPs).

Salient Features of HP Participatory Forest Management Regulation 2001.

HP Participatory Forest Management Regulations were issued on 23.8.2001, is a major improvement on 1993 administrative order for JFM as these are issued under Sections 80 and 81 of Indian Forest Act 1927.

The salient features of HP Participatory Forest Management Regulation 2001 are that:

- It is applicable to all forest areas, and any government forest and government land including common land may be brought under participatory forest management, based on an application made to the Divisional Forest Officer signed by at least 50% of the voters of a Gram Panchayat ward.
- It considers and recognized the majority of stakeholders, such as migrant graziers, self help groups, user groups.
- It brings in total community control, as the Secretary will be from the community and Forest Guard's role of facilitator or any other government functionaries.
- It balances gender with a 50% reservation to women and Joint Secretaries will be women.
- The legal back-up is provided to VFDS which are to be registered under the Society Registration Act 1860.

In accordance with the wider objectives and plans of government for sustainable forest management, the Village Forest Development Society and the Forest Department will manage the selected area jointly.

Linkage with *Panchayati Raj Institutions*:

The Interface at National Level:

The 73rd Constitutional Amendment Act paved the way for democratic decentralization at the grass-roots (i.e. at the village, block and district levels) and enabled PRIs to function as institutions of Local Self Governments for ensuring active and sustainable people's participation. It provides for the devolution of power and responsibilities to PRI institutions. PRIs have thus been touted as the mechanism that has greater powers to the villages and thus helped the cause of participatory governance.

The HP Government put these guidelines into action in 1994 by amending its Panchayati Raj Act and holding elections in 1995. The following significant policy directions have been issued:

- 15 line Departments directed to work through PRIs.
- LDs to design schemes and programmes for PRIs.
- Field level staff of some departments placed under the PRIs, the administrative structure under PRI is strengthened.
- Gram Panchayat to make Panchayat Micro Plans through participatory processes involving natural resource based planning. Guidelines were issued and training started.
- Up-Gram Sabha constituted at ward levels.
- Consistent failure of Panchayat Gram Sabhas to attract the majority of voters made it a non-functional platform for people to plan and verify implementation.
- In hill areas of HP, the village is the natural cultural and resource use unit and so Up-Gram Sabha were made the unit for planning and implementation. Thus Panchayat as functional unit of integration.

Linkage of HP Forest Management Regulations and Panchayati Raj Legislation:

The structure of linking PFM with *Panchayati Raj* Institutions has been provided in the Himachal Pradesh Participatory Forest Management Regulations 2001 issued under Sections 80 and 81 of the Indian Forest Act, 1927. The 'Village Forest Development Society' or "Gram Van Vikas Samiti" will be registered under Section 3 of the Societies Registration Act, 1860 for Participatory Forest Management (JFM). The *Panchayat* ward will be the basic unit for setting up the VDC.

The HP Panchayati Raj Act, 1994, includes forests in its list of 29 activities. GoHP Order in 1997 entrusted supervision and monitoring responsibilities relating to fifteen departments including FD to PRIs. It includes social and farm forestry, minor forest produce, watershed development, land improvement and soil conservation, fuel and fodder.

Members of Panchayats *Pradhan/Panch* are nominated/ ex-officio members of VFDC/ VFDS/ VDC Executive Committee. There will normally be one Society for a gram *Panchayat* ward where the ward is not compact and the hamlets within it do not have common land or common

rights and concessions, more than one Society may be formed for each cluster of hamlets. The regulation entitles the Society to some benefits of NTFP collection and a share in the sale proceeds of all intermediate harvests, subject to the protection of forest and plantations for at least three years from the date of the agreement. The Society will also be allowed to expand the area after a period of five years. After twenty years from the date of the agreement, 75% of the net sale proceeds from the selected area will be put into the accounts of the Society and the remaining 25%, shall go to the concerned Gram Panchayat. The notification also mentions that at least 40% of the net sale proceed should be used on forest management activities, including soil and water conservation.

As per the notification issued, any government forest and government land including common land may be brought under participatory forest management, based on an application made to the Divisional Forest Officer signed by at least 50% of the voters of a gram Panchayats ward. In accordance with the wider objectives and plans of government for sustainable forest management, the Village Forest Development Society and the Forest Department shall manage the selected area jointly. There shall normally be one Society for a gram Panchayat ward and where the ward is not compact and the hamlets within it do not have common land or common rights and concessions, more than one Society may also be formed for each cluster of hamlets. The regulation entitles the Society of some benefits of NTFP collection and a share in the sale proceeds of all intermediate harvests, subject to protection of forest and plantations for at least three years from the date of agreement. The Society will also be allowed to expand the area after a period of five years. After twenty years from the date of agreement, 75% of the net sale proceeds from the selected area shall be put into the accounts of the Society and the remaining 25%, shall go to the concerned gram Panchayat. The notification also mentions that at least 40% of the net sale proceed should be utilized on forest management activities, including soil and water conservation.

5.16 Future Trends (Beyond 2005):

Through the Forest Policy (1988) the erstwhile management approach gave way to participatory facilitation. The Participatory Joint Forest Management approach assumes the greater involvement of community at all stages of the project cycle, that is, planning to evaluation. This basically meant a shift from commercialization to addressing the needs of the community related to environmental conservation and day to day requirements of fuel wood, fodder, NTFPs. The shift assumed the power centre to move towards people, meaning thereby a fundamental change in attitudes and practices of the forest personnel towards the community. Community Participation is characterized by transition of the people from passive to active, individual to group, knowledge to action, external to internal, learner to teacher, receiving to giving. It is imperative to involve the community to:

- Create an environment that is conducive to PFM;
- Prepare the community to accept and promote PFM;
- Strengthen the inter-links of community structures like PRIs, User Groups, Mahila Mandals, CBOs and VFDCs with the Forest Department;

- Enhance their awareness about programme and strengthen capacities in implementation, management, monitoring and evaluation of the programme;
- Ensure ownership and sustainability.

Committed to the need for comprehensive change in response to the changing scenario through a Vision, Mission and Value statement by Himachal Pradesh Forest Department:

“The HPFD aims to be a committed organization of excellence in forestry, serving communities and the nation for harmony between people, environment, conservation and development. Working in partnerships, we manage and protect the unique Himalayan biodiversity for the future. Creative and dynamic, we aspire to be the best forestry service.” Non Wood Forest Products (NWFP) are an important source of supplementary income for rural households. Its sustainability and management are thus crucial to rural livelihoods. Medicinal and Aromatic Plants (MAPs) constitute an important aspect of NWFP management. Regulation of collection and trade in certain medicinal and aromatic plant (MAP) species has been entrusted to the panchayats. The Forest and Ayurveda Departments will build capacity and provide other support to manage this activity effectively in a sustainable and equitable manner.

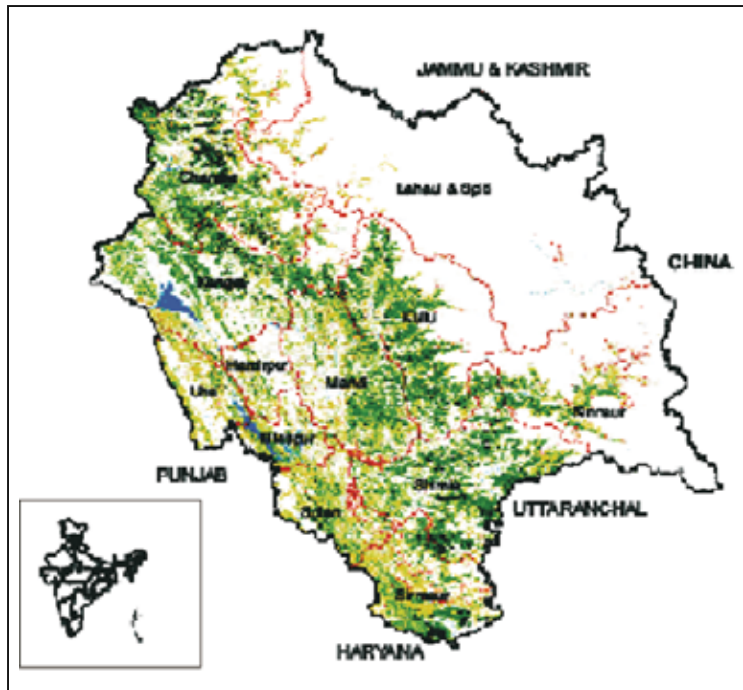
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Shimla Water Supply Catchment Forest

A forest with modern management practices in India

Introduction:

Shimla water supply catchment forest, in 1015 ha size is located in the state of Himachal Pradesh. The forest demonstrates management practices evolved over years traced back to beginning of scientific forest management in India. It typifies the process followed in organizing scientific forest management. It includes activities like leasing, settlement of rights, survey and demarcation, classifying legal status, preparation and periodical review of working plans, and redefining objectives as per management needs.



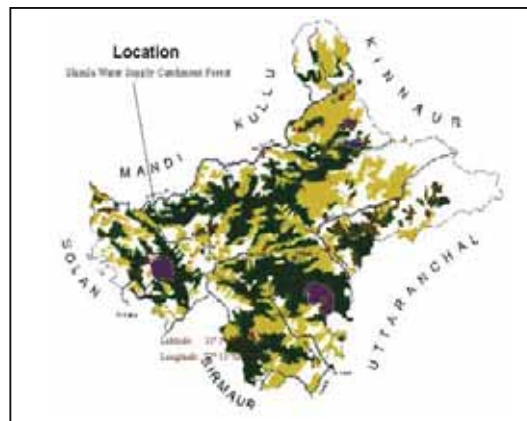
Study Objectives:

To demonstrate multi-functional management of forests primarily for water conservation and supply for urban use.

Description Study Area:

Location	:	8 kms East of Shimla
Latitude	:	31° 5' to 31° 7½' North

Longitude	:	77° 13' to 77° 16' East
Area	:	1025 ha
Compartments	:	33
Altitude	:	1915 to 2750 meters
Aspects	:	East to North West
Climate	:	Temperate
Temperature	:	-5.4°C to 32°C
Annual Rain Fall	:	1600 mm



Forest Management Features:

Boundaries	:	Defined by 167 pillars
Motorable Road	:	9 kms
Inspection Paths	:	7 inspection paths covering 26 kms
Bridal Path	:	2.5 kms (2.3 m width)
Fire Lines	:	20 kms



Forest Types:**Group 12 Himalayan Moist Temperate Forest**

12/ C I a *Ban* Oak Forest (*Quercus leucotricophora*)

12/ C I b *Mohru* Oak Forest (*Quercus dilatata*)

12/ C I c Moist Deodar Forest (*Cedrus deodara*)

12/ C I d Western mixed Coniferous Forest

12/ C 2 a *Kharshu* Oak (*Quercus semicarpifolia*)

Deodar mixed with Blue Pine (*Pinus wallichiana*),

Spruce (*Picea smithiana*) & Fir (*Abies pindrow*).

Wild Life Sanctuary:

- Forest sustains diverse wildlife including Himalayan herbivores, carnivores and bird species.
- A Wildlife Sanctuary for the locally threatened leopard and koklas pheasant (*Pucrasia macroplopha*) and other species such as barking deer, macaque, sambhar, goral, langur, squirrel, civet, porcupine, red jungle fowl, weasel and marten.
- Sustaining and developing local culture and economy through participation in eco- tourism activities.

**Management History:**

Prior to 1878	:	Poor or no management by local ruler.
1878	:	Leased in perpetuity by Shimla municipality.
1891	:	McIntire's Working Plan.
1896	:	Hart's detailed Working.

Plan objectives were:

- To maintain ground cover to protect the forest & catchment for water harvest.
- To sustain supply of timber and firewood for use in municipal works.

1932	:	Modification of Hart's plan by Prem Nath working.
1958	:	Notified as Wildlife Sanctuary.
1964	:	K. C. Sharma Plan valid from 1963-64 to 1982-83.
1982	:	Intention to constitute "Water Supply Catchment Sanctuary".
1999	:	Declared as sanctuary for ecological, faunal, geo-morphological, natural and Biodiversity significance.

Present System of Management:

- Forest conservation for multiple use.
- Water regulation and recharging of ground water.
- Soil conservation.
- Protection of habitat and wildlife.
- Biodiversity.
- Sustainable livelihood resource for local communities.
- Consumptive and non consumptive commercial use.
- Ecosystem Services and micro-climatic functions.
- Carbon sequestration.

Multi-functionality: A global concept for forest management



Rosa brunonii

Prunus cerasoides

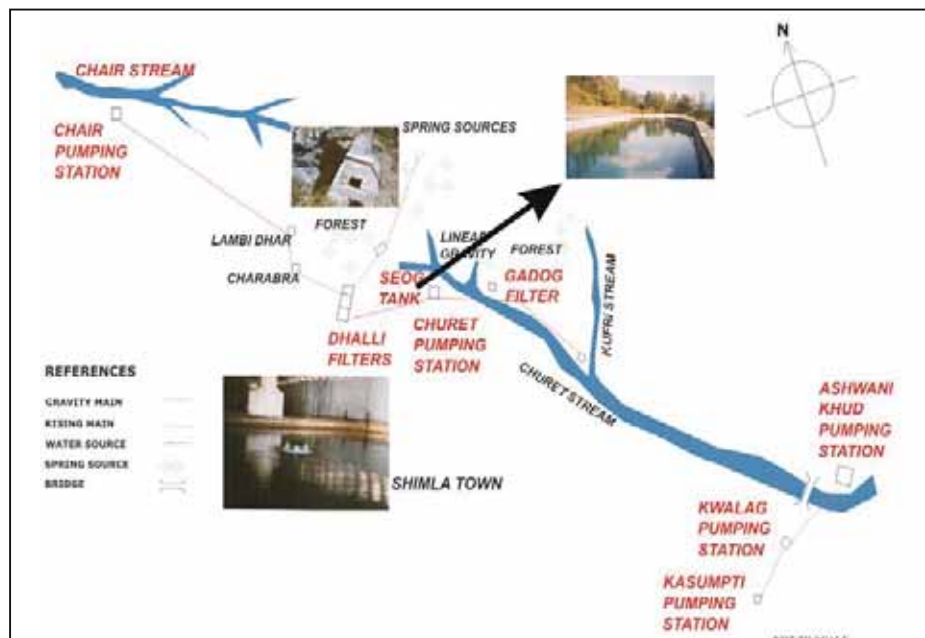
Spiraea canescens

*Daphnae
cannabina*

Saxifraga ligulata

Water Production & Supply:

- Water- renewable but finite resource.
- Shimla largely dependent on surface water sources such as springs and streams.



Location Plan of Natural Water Sources in Shimla Water Catchment Area

- Systematic water supply for Shimla since 1875 through gravity line.
- 21 intakes and 2 streams in the catchment area.
- Gravity line of 12.85 km long and 150 mm diameter with a balancing reservoir constructed in 1875.
- Variable discharge ranging from 0.23 million litres per day (mld) in summer to 6.81 mld in monsoons.
- Source augmented in 1965 by adding supply line of 225 mm diameter.
- Initial filtering at intakes followed by slow sand filtering and distribution.

Conclusion:

Evolution from management for timber production to multifunctional management and integrated land use planning that includes regular water supply and other watershed functions, biodiversity, cultural and eco-tourism over a period of 140 years.

The forest is managed for protective, productive, cultural and amenity functions by reconciling interests of many different stakeholders who derives benefits from it. It is a multipurpose forest which enhances scenic beauty of landscape and increases stability of ecosystem. Thus, it is an example of *multifunctional* forest management which is a global concept.

* * * * *

SOCIETY AND ENVIRONMENT

Society and Environment

6.1 Status:

In Himachal Pradesh, there is evidence of early human presence in the form of stone tools that have been found in various places of district Una, Bilaspur, Kangra, Sirmour and Solan – the areas that form the Shiwalik Hills and are the outer fringes of the State's territory. There are also inferences of Harappan and subsequent ancient civilisations. The ancient Indian epic, the *Mahabharata* records the region to have held small tribal republics - 'Janapadas' - and these are regarded to be the successors of the 'Mavanas' which were territorial units controlled by local strongmen. Coins and excavations stand testimony to large and prosperous communities in the centuries before Christ - a hoard of punch-marked coins from Kangra has been dated between the seventh and eighth century BC.

And as we come through the years, migration seems to have been the main reason for settling in the area that is now Himachal Pradesh. Almost visibly, quite like geological formations of the area, where one layer has superimposed itself over another (or even wormed under), human beings have come to Himachal in successive waves. The earliest are considered to be the Kolarian people who were pushed out of the Gangetic plains by the Khashas – who in turn are regarded to be pre-Vedic Aryan migrants from Central Asia. With the arrival of the Indo-Aryans in c. 2000 BC in the Indian Sub-continent, another wave of migration the hills began a new, the Khashas began feeling the pressure and moved away. And this was a pattern that was to remain throughout Himachal's history. As kingdoms grew and collapsed over the centuries in the plains of North India, they sent out either people looking for refuge or seeking fresh patronage. At different points, there were several other migrations too – for example, the arrival of the Tibeto-Mongoloid people along the northern boundaries of the State and the Rajputs pushed out by the establishment of the Mughal empire – or the post-Partition influx of refugees from west Punjab.

Today's Himachal is still predominantly rural and agrarian, and ninety percent of its population lives in villages – and these small clusters of houses still form the overwhelming bulk of human settlements. Culturally and also geographically, the state has three well-defined zones. The 'tribal belt' that holds the districts of Kinnaur and Lahaul - Spiti is largely Buddhist and the language belongs to the Himalayan belt of Tibeto-Burmese. The mid-belt hugs this closely and is characterized by forested hills and cultivated valleys – with hamlets, farms and orchards interspersed over the slopes.

People Concerns

The problem of stray animals (Cows) especially in the lower regions of the Pradesh was highlighted during the district level meetings. It was pointed out that on one side these stray animals are destroying the agriculture fields and on the other side are being starved and hurting the religious beliefs of the people.

It was suggested that Gaushala and Gausadan especially by the Mandir Trust may be constructed where such type of animals can find shelter as well as their fodder requirements being taken care of by the Mandir Authorities.

Himachal's sub-montane dwellers practise settled cultivation and this is the area that has traditionally held the greatest concentration of population. The people of the latter two sections of the state, are speakers of Pahari.

The structure of the settlements of the Himalayan region, both rural and urban, can usefully be viewed within the context of its environmental backdrop: topography and the river systems, altitude and mountain face, geology and winds, it would be difficult to make an all-embracing description, for although the settlements evolved within the framework of its geography, the various communities who settled here worked upon and adapted to its features. The imperatives of political exigency, markets, trade, defence, mining, pilgrimage, were all determinants in the size and location of towns."

Municipal governance was introduced as early as 1851, piped water was available from the 1880s, hydro-electric power was available in the early 20th century, an engineering marvel of its time, the Kalka - Shimla railway line was completed in 1903 and one of the world's early 'automatic' telephone exchanges began functioning in Shimla in 1922.

All traditionally large clusters of habitation in Himachal, and the towns as they were, had existed along the valley floors. With the coming of the British, it was for the first time that something so big was pushed up the hill. With this change came a powerful alteration in the urban norm. Now, civic amenities were no longer at hand but had to be created – for example, as Shimla grew and its springs and *baolis* could no longer discharge their functions, water had to be piped in from some miles away.

It would be appropriate to begin by seeing the growth of Shimla – as it was then spelt.

- 1822 – First European house built in Shimla.
- 1830 – 30 houses.
- 1831 – 60 houses.
- 1841 – Over 100 houses.
- 1866 – About 290 houses.
- 1881 – Population in February is 13,258. The number of occupied houses in summer is 1,141.
- 1921 – Summer census places population at 43,333 (4,803 Europeans and 38,530 Indians).

Table 6.68: Census of 1881 gives the following reading regarding the princely states and their populations

Name of the State	Population	Area (in square miles)	Town (s)
Bushahr	64,345	3820	Rampur, Sarahan, Rohru
Keonthal	31,154	112	Junga
Baghal	20,622	124	Arki
Jubbal	19,196	57	Jubbal, Chopal
Baghat	8,339	60	Sabathu
Kumharsein	9,515	94	–

contd. ...

Name of the State	Population	Area (in square miles)	Town (s)
Bhaji	12,106	94	Seoni
Mahlog	9,169	53	
Theog	6,300	144	Sanj, Parala
Balsan	5,190	50	Ghorna
Dhami	3,320	26	Halog
Kuthar	3,648	19	
Kunihar	1,923	9	
Mangal	1060	13	
Bija	1158	4	
Darkoti	590	4	
Tharoch	590	4	
Sangri	2593	16	
Patiala	40,000	152	Haripur
Shimla	35,235	101	
Nalagarh (Hindur)	53,373	249	Nalagarh
Sirmour	112,371	1,045	Nahan, Trilokpur
Bilaspur	86,540	448	Bilaspur
Mandi	147,017	1,200	Mandi, Gumma
Suket	52,484	420	Pangana
Kangra (including Kullu, Lahaul and Spiti)	7,30,845	9,978	Kangra, Jwalamukhi, Nadaun, Sujanpur, Tira, Nurpur, Haripur.

The population of Himachal has also been steadily growing over the past few decades. The current situation is depicted below –

1. Population	1991			2001		
	Total	Male	Female	Total	Male	Female
	51,70,877	26,17,467	25,53,410	60,77,248	30,85,356	29,91,992
2. Percentage of Urban Population to total Population	8.69%			9.79%		
3. Density of Population (Persons per km ²)	93			109		
4. Decadal Growth Rate (Percentage)	1981-1991 (+) 20.79%			1991-2001 (+) 17.53%		

Table 6.69: Gender-based Rural-Urban Structure of Population

Age Group	Rural			Urban			Total
	Persons	Male	Female	Persons	Male	Female	
0-14	1700492 (36.01)	867350 (36.56)	833142 (35.51)	202546 (30.62)	137452 (29.54)	65094 (31.92)	1903038
15-59	2610881 (55.30)	1287369 (54.27)	1323512 (56.40)	284916 (63.43)	158408 (64.58)	126508 (62.04)	2895797
60+	395597 (8.38)	209161 (8.82)	186436 (7.95)	24406 (5.43)	13081 (5.33)	11325 (5.55)	420003
Age not mentioned (ANM)	14711 (0.31)	8313 (0.35)	6398 (0.27)	2332 (0.52)	1337 (0.55)	995 (0.49)	17043
Total	4721681	2372193	2349488	514200	310278	203922	523588

Note: Figures in parentheses, rounded off to 2 decimal places indicate percentage of corresponding (column) total.

Source: Based on Statistical Outline of Himachal Pradesh, 1998.

Table 6.70: District Profile (Census 2001)

District	Population			Literacy Rate			Sex Ratio (Females per 1000 Males)	% age Urban Population	Population Density Persons per Sq. Km.	Population Growth Rate 1991-2001
	Persons	Male	Female	Persons	Male	Female				
1	2	3	4	5	6	7	8	9	10	11
Bilaspur	340735	171074	169661	78.80	87.13	70.53	992	6.44	292	(+) 15.35
Chamba	460499	234812	225687	63.73	77.22	49.70	961	7.50	71	(+) 17.09
Hamirpur	412009	195971	216038	83.16	90.96	76.41	1102	7.32	369	(+) 11.62
Kangra	1338536	660224	678312	80.68	88.19	73.57	1027	5.39	233	(+) 14.01
Kinnaur	83950	45353	38597	-	-	-	851	-	130	(+) 17.79
Kullu	379865	197035	182830	73.36	84.55	61.24	928	7.92	69	(+) 25.60
Lahaul & Spiti	33224	18413	14811	-	-	-	804	-	2	(+) 6.17
Mandi	900987	447271	453716	75.86	86.67	65.36	1014	6.77	228	(+) 16.05
Shimla	721745	380244	341501	79.68	87.72	70.68	898	23.12	141	(+) 16.90
Sirmour	458351	241109	217242	70.85	79.73	60.93	901	10.38	162	(+) 20.72
Solan	499380	269451	229929	77.16	85.35	67.48	853	18.26	258	(+) 30.64
Una	447960	224299	223668	81.09	88.49	73.85	997	8.80	291	(+) 18.43
HP	6077248	3085356	2991992	77.13	86.02	68.08	970	9.79	109	(+) 17.53

Table 6.71: District-wise Basic Village-level Data (1991)

Sr. No.	Name of the District	Total No. of Villages	No. of Inhabited Villages	No. of uninhabited Villages	No. of Villages with Drinking Water facilities	No. of Villages approach by Pucca Road	No. of Villages Electrified	No. of Census villages
1	2	3	4	5	6	7	8	9
1.	Bilaspur	1044	950	94	950	303	931	111107
2.	Chamba	1591	1144	447	1144	161	1036	145334
3.	Hamirpur	1650	1617	33	1617	431	1615	144408
4.	Kangra	3869	3620	249	3619	1142	3587	397728
5.	Kinnaur	662	228	434	228	49	187	39351
6.	Kullu	172	172	-	172	60	170	123455
7.	Lahaul & Spiti	403	272	131	270	53	240	14521
8.	Mandi	3338	2818	520	2818	428	2746	313362
9.	Shimla	2630	2311	319	2311	326	2262	266871
10.	Sirmour	968	965	3	965	207	961	150990
11.	Solan	2501	2348	153	2347	505	2343	139261
12.	Una	600	552	48	552	296	550	129538

Table 6.72: Families Below the Poverty Line for the 9th Five Year Plan

S.No.	District	No. of Rural Households	No. of Rural Families Below Poverty Line				%age Families
			Total	SC	ST	Women	BPL
1	Bilaspur	65532	17448	6649	505	2222	26.62
2	Chamba	76418	47165	9863	13650	6328	61.72
3	Hamirpur	83505	20179	7826	0	3902	24.16
4	Kangra	265740	63972	21432	37	10421	24.07
5	Kinnaur	10899	2896	1326	1570	334	26.57
6	Kullu	59227	11432	5335	197	1630	19.30
7	L & Spiti	6446	2445	197	2248	542	37.93
8	Mandi	169863	42012	18469	422	5254	24.73
9	Shimla	94316	21755	14839	152	4686	33.67
10	Sirmour	58618	13418	6416	272	1569	22.89
11	Solan	65418	17951	9155	52	2461	27.44
12	Una	81014	15439	5550	0	2401	19.02
	Total	1036996	286112	107057	19105	41850	27.59

6.2 Issues:

- The population of Himachal has been steadily growing over the past few decades. Most of growth continues to be in the geographically 'Most Habitable Zone'.
- The former colonial towns like Shimla have expanded considerably and there are newer towns that have expanded from small villages to large settlements such as Kullu and Manali.
- Towns like Parwanoo, Baddi, Nalagarh, Kala Amb and Una that have an industrial base have come along the borders of the State and are growing rapidly. New growth has accelerated in the districts of Solan, Sirmour and Una after the announcement of the 'central concessional industrial package' which has drawn an investment of approximately Rs.1,200 crores in the last two years.
- Factors like the growth of communications through roads, telephones and the internet are creating major alterations in the pattern of human settlements and have increased the rural-urban interface.
- The steady spread of education, better medical facilities and increased non-agricultural employment have also altered both urban and rural settlement patterns.
- Pressures on the natural and built environment have increased.

6.3 Pressure:

i) Population and Urbanization:

While population is rising, urbanisation also seems to be on the increase. This urbanisation is not necessarily drawn towards the large towns like Shimla. Smaller towns are also growing rapidly. Our understanding of the causes and long term effects of this urbanisation is still imperfect. While inferences may be made, it is still not wholly clear if the rural to urban movement is the result of some form of attrition or attraction.

"Every day in Asia, the urban population increases by the equivalent of one city of 140,000 people. In fact, the urban population is expected to double over the next 20 years. Cities have so far absorbed their growing numbers in settlements with a varying quality of living, mostly located on the urban fringe. However, the shortcomings of present land management systems have gradually become obvious as the urban growth has resulted in negative impact such as sprawling squatter settlements and traffic chaos. Although appropriate land for housing exists, sometimes in relatively central locations, it is not accessible to vast sections of society because of factors such as land speculation and lack of public investment in infrastructure and transport facilities. A major revision of current policies and practices regarding land and its planning, development and control are called for in most Asian countries. Such a revision requires bold action in many areas including land-use planning, zoning, infrastructure provision and property taxation to mention only a few."

ii) Poverty:

The issue of poverty is one that the towns and cities of every developing country face. Poverty is considered to have three aspects - the poverty of money, the poverty of access and the poverty

of power. In the urban situation, the poorer are more vulnerable to less than satisfactory living conditions. In this context – and what is valid for Himachal Pradesh – the United Nations declares, “(The urban poor) are forced to live in illegal and informal settlements because they cannot enter formal land and housing markets ... because of the way formal markets are regulated and structured, the poor are unable to afford the choices offered to them in these markets. In contrast, the informal and illegal housing markets of slums and squatter settlements are specifically geared to (them).”

This compels us to look long and hard at the fact that any housing for the poor other than illegal slums or squatter colonies - that have strong negative connotations for both their residents and for the environment of a town at large - is there at all? And within these colonies, are basic levels of civic facilities there and to what extent are their occupants subject to various forms of insecurity and exploitation?

Simultaneously, there are certain services provided by the non-organised sector that are used by practically everyone living in a town – vegetable and fruit sellers, *dhobis*, mechanics. Their presence is rarely, if ever integrated in the planning process of a town. The presence of motor vehicle repair shops mars the entrance to practically every town in Himachal and streets are choked by the presence of various vendors. This leads to the erosion of the quality of life of all concerned.

The above issue leads to the fact that land management practices need to be reviewed. In this context, the ESCAP has a very relevant remark to make, “(Most studies and publications) have not had a significant impact on government land development and management policies, perhaps because they concentrated on the technical aspects of land development and management rather than its political aspects. Moreover, in most cases their target audience were technical staff and experts involved in urban planning, development, management and policy formulation. However, decisions on to how to implement a policy vigorously or whether to implement it at all, are taken not by experts but by generalists, who are either elected or appointed, often on political rather than technical grounds.”

With all these pressures, urban forest covers continue to remain under threat. In the context of Shimla, it is already under the active consideration of the state government to transfer the forest management to the Forest Department. Here, it is pertinent to mention that Shimla has the distinction of having what may well be one of the last surviving ‘urban forests’ anywhere in the world – and this fact is made all the more important as this is a forest of a temperate to alpine nature in what is otherwise a tropical zone.

iii) Industrialization:

Industrial pockets of Himachal are expanding rapidly. Civic amenities are under pressure in them. Simultaneously, there is a large quantum of migrant labour in these places, slums are increasing with all their implications in terms of health, water, sewage and the overall quality of life. In these industrial pockets and in most towns, this has led to encroachments which are either of a speculative ‘land-grabbing’ nature or are of the poor who encroach on government or forest

land out of compulsion. This issue needs sensitive and careful handling. The three basic markets in an urban economy are the urban land market, the urban capital market and the urban labour market. Of these markets the land market most directly affects the urban environment and the quality of life in cities and towns. Land market distortions are caused by poor land development and management policies - including poor planning, slow provision of infrastructure and services, poor land information systems, cumbersome and slow land transaction procedures, as well as under-regulation of private land development, leading to unplanned or ribbon/corridor development of land on the urban periphery.

There are no comprehensive studies or mechanisms for disaster management. For example, take the case of Shimla. Apart from being the seat of government, this is an important tourist destination that received over 16, 52,000 domestic and foreign visitors in 2004. Today, the town has a population of approximately 1, 65,000 people, while the district has a population of about 7,22,000. The older sections of town are built largely of wood and lath and plaster, and the newer ones employ RCC. The town is especially vulnerable to seismic activity as it falls in Zone IV and the probability of having the maximum peak ground acceleration (PGA) ranges from 0.16g to 0.4g. Fire is the other hazard and the older 'heritage' structures are particularly vulnerable to this.

Ribbon and Corridor Development:

Himachal has a serious issue in the ribbon and corridor development taking place along the highways. This is adversely affecting not only the environment but also has serious implications for the future growth of those areas. We repeatedly talk about 'sustainable development', but the moment this phrase is raised or pursued to a logical end, it also raises several hackles. For by implication, when we use this phrase, we say that development so far has not been sustainable. In certain matters, we have no choice but to accept the collateral damage that may have been caused by, say, the construction of roads. But in other areas, the fact is inescapable that development – if it can be called that – has been less than sustainable, if not wholly undesirable and inappropriate.

6.4 Impact:

Most of the people in Shimla-town live in scattered but dense clusters, for example the Lower Bazaar area and Sanjauli – and both form what may be considered among the most densely populated hill slopes of the world. Access to most of the town's populated areas is limited to a single road and between most structures there are only narrow lanes. These limited means of ingress and egress makes them especially vulnerable in the event of a mishap. This is also likely to hamper any relief and rescue operations within these pockets and in other parts of the district and state, as important arterial roads pass through the town. Recent events like the large landslides, cloudbursts and the rise of river waters in various parts of the state highlight this issue.

The almost unconscious ability of humans to coalesce as groups and then create systems of interaction and stability seems to have been a part of our evolutionary process. As we have

become ‘civilized’, this process seems to have steadily become more formalised with the emergence of social, economic and political structures. Going back to the dawn of human history, one of the earliest benchmarks that have determined the appellation ‘civilisation’ has been the presence of settlements. This constituted a major shift from the hunter-gather to the agriculturist-trader. It also indicates how people – some earlier than others – moved from vagrancy (as distinct from transhumance), to settled lives and an ability to put down roots and shape a social system within a geographical parameter.

Agricultural holdings were rarely held in a consolidated piece and it was more the norm than the exception that an agriculturist would have his fields at different places. There could be something higher up the hill and something lower down near the valley floor. While there was normally one ‘permanent’ house, it was also possible that there would also be a temporary one too - where the family moved in either summer or, more often, in winter to a warmer valley floor. Rice, millet and wheat were the main crops grown. Naturally, the best land under cultivation was owned or controlled by the ruling classes.

Forest produce included fuel, herbs and fodder – while timber was the core product. Ruhi Grover of the University of Virginia in her paper entitled ‘Beyond Forest Boundaries Peoples, Markets, and the State in Himalayan Punjab, 1850-1925’ states :

“As forests and pastures formed an important component of the village economy’s resource base, boundaries between villages evolved to demarcate their access. These boundaries were not permanent but altered with the changing contingencies of the period. In general, the village society in Himalayan Punjab was not isolated, topographically marked, or bounded by maps, but fluid with adaptable social complexes that harvested trees, collected forest products, grazed livestock, and lopped trees. It used timber for domestic and agricultural purposes (cut branches, collected leaves and fallen wood for fodder and fuel, and harvested honey), grazed its livestock in wasteland for manure, meat, and wool, and used local herbs and flowers for fodder and general use. Local artisans made ropes from bhabbar grass, brushwood, and the bark of small elm trees. They earned revenue by selling fruits (walnut, apricot, and peach), medicinal roots (karu, patis).

The various land settlements by C.G. Barnes and J.B. Lyall resulted in the creation of new bounded village communities, grazing rights in common lands, and land revenue as the prime determinant for access to forests. Tenants and non-landholders were left out of this new distributive system. Since the state viewed most local rights in forests as incidental to their proprietorship in the soil, they stipulated various categories of rights-holders. The first class of rights-holders was the proprietary body of the villages that had complete rights in the common lands in proportion to the revenue they paid. The second class of rights-holders was purchasers of the rights to wasteland from the first-class holders; they were not required to pay any revenue. Most of the recent settlers in Kangra, including the tea-settlers, came under this category. The third class of rights-holders was revenue payers who had been accessing demarcated forests and wasteland for decades. In other words, their rights were not based on the ownership of property, but that of use.”

By these years, centres of pilgrimage like Jwalamukhi in Kangra had evolved into substantial permanent settlements as a result of economic activity (this was an important centre of the ascetic trading community, the Gosains) and also had land and other endowments. Nurpur, also in Kangra, grew as a weaving centre of fine shawls. In Kangra, the thriving town of Nadaun's importance as a commercial centre had been lost after the Gurkha wars and changes in the trade routes. In 1820, the traveller Moorcroft passed through this settlement that had drawn the oft quoted phrase, *Aye Nadaun, jaye kaun*, which loosely translates as no one who has visited Nadaun would like to leave. Moorcroft found it depopulated with its traders either engaged listlessly, or asleep. A few decades later, it was declared that tigresses whelped on the streets. The market town and capital of Mandi however, continued to maintain an important position.

A clearer situation of the nineteenth century can be generated over the three enumerations of 1881, 1891 and 1901 – apart from other data –

Regarding Kangra, a picture emerges from the Gazetteer of Kangra, 1883-84. This provides the following data regarding the population - which also includes the areas of Kullu, Lahaul and Spiti.

Table 6.73: Indicators of Kangra District during Nineteenth Century

Enumeration	Persons	Males	Females	Density per sq mile
1855	718955	391389	327566	79
1868	753882	393571	350311	82
1881	730845	380867	349978	81

Also supporting the hypothesis that the Most Habitable Zone had the greatest population, readings may be made regarding Kangra district from the data of the Census of 1911. Kangra's climate and soil allowed the cultivation of three crops a year so had a population of 6, 44,038 in an area of 2,544 square miles taking the density to 253.1 per square mile. The areas of Lahaul and Spiti with their high altitudes of over 3,000 metres had a population of 11,389 in an area of 4,695 square miles and a resulting density of a mere 2.4 per square mile.

Data regarding the Shimla district informs us that the population of the district in 1868 was estimated at 27,169 persons. This rose by 32.9% between 1868 and 1881 and the increase was exclusively attributed to Shimla town which on 1 March 1901, had grown into a bustling township of 13,960 residents (It is also appropriate to mention that had this census been taken in say May, the figure would perhaps have been higher. There are major variations in summer and winter figures regarding Shimla as the town was heavily depopulated during the winter months).

The population of Shimla's suburb of Kasumpti stood at 170 and the four cantonments of Sabathu, Dagshai, Jutog, and Solan had 4,772 persons. The remaining rural population stood at 24,089 against the total population of 40,351. The density of rural population was 429 persons per square mile on culturable land and 1,430 on cultivated land.

In what were termed the 'Shimla Hill States (including Bilaspur and Nalagarh) there was a total population of 3, 37,998 in 1881. This rose to 3, 70,200 in 1891 and to 3, 89,399 persons in 1901. There were a total of 1,527 villages and the average population of each was 249.

Chamba, one of the largest native states in the Punjab, had 49.9 persons to the square mile. The population figures were – 1, 15,773 in 1881, 1, 24,032 in 1891 and 1, 27,834 in 1901. The capital of Chamba was the only town and held 5% of the total population.

In Mandi the population was 1,47,017 in 1881, 1,66,923 in 1891, 1,74,045 in 1901 and 1,81,110 in 1911. The state capital was the only town and had a population of 7896.

In Sirmour the three enumerations of 1901, 1911 and 1921 returned the figures of 1, 35,687, 1, 38,520, and 1, 40, 448 respectively. The rise between 1891 and 1931 was 20% and this was partly due to immigration for permanent settlement on the newly reclaimed Paonta valley.

In Suket the population rose from 52,484 in 1881 to 54,676 in 1901 and to 54,928 in 1911. Between 1881 and 1891 there was a marginal decrease.

In these years, the nature of the economy and the socio-political structure remained largely unchanged and retained its pastoral-agrarian nature. The best agricultural land continued to remain with the rulers, though small portions were given as royal assignments (*jagirs*) to kinsmen. *Muafis* of lands were given for services rendered to the ruler while religious grants or *sasans* were given to temples or the priests. In the valleys of Beas and Satluj valleys, the *khas* or *basa* or *jagir* lands were invariably cultivated by *bethus*, who were usually landless Kolis. In return, a family was normally given a revenue-free piece of land, invariably inferior in productivity, on the outskirts of the *basa* land to cultivate for self-subsistence. In some cases *bethus* worked the land in exchange for meals and clothes. A large population of Rajputs and *halbahak* Brahmans were agriculturists as well. In terms of numbers, the smallest group was of the artisans who held poor and un-irrigated land and were marginal farmers. They also worked for others at harvest time. All in all, resource sharing was complex and inequalities of various natures were grounded for the benefit of those with power, wealth – or of higher caste.

The Declaration (S-25/2) of the United Nations General Assembly on its 6th plenary meeting held on 9 June 2001 is on cities and human settlements in the new millennium. Its core points are that all human settlements should be economically productive, socially just, politically participatory, ecologically sustainable and culturally vibrant.

The post-colonial period in Himachal in the context of human settlements has been characterized by various factors and the prominent ones among these are –

- The population of Himachal has been steadily growing over the past few decades. Most growth continues to be in the geographically 'Most Habitable Zone'.
- The former colonial towns like Shimla have expanded considerably and there are newer towns that have expanded from small villages to large settlements, such as Kullu and Manali.

- Towns like Parwanoo, Baddi, Nalagarh, Kala Amb and Una that have an industrial base have come up along the borders of the state and are growing rapidly. New growth has accelerated in the districts of Solan, Sirmour and Una after the announcement of the 'central concessional industrial package' which has drawn an investment of approximately Rs.1,200 crores in the last two years.
- Factors like the growth of communications through roads, telephones and the internet are creating major alterations in the pattern of human settlements and have increased the rural-urban interface.
- The steady spread of education, better medical facilities and increased non-agricultural employment have also altered both urban and rural settlement patterns.
- Pressures on the natural and built environment have increased.

Over the years the facts cited by S.C. Bose that habitation has always been correlated to a bio-physical zone has not altered, as may be seen from the tables below.

Table 6.74: Biophysical Zones of Himachal Pradesh

Zone	Biomes	District	Total Area (Sq. Km.)	Population*
A.	Sub Arctic, Alpine, Cold Temperate	Kinnaur, Lahaul & Spiti	20,236	1,17,174**
B.	Alpine, Cold Temperate, Warm Temperate	Kullu, Chamba	12,031	8,40,364
C.	Cold Temperate, Warm Temperate	Shimla, Kangra	10,870	20,60,281
D.	Warm Temperate, Sub Tropical	Sirmour, Solan, Bilaspur, Una, Hamirpur, Mandi	12,536	30,59,429

Table 6.75: District-wise Geophysical Profile of Himachal Pradesh

District/State	Altitude (height from MSL in mts.)	Climate	Biome/Zone
1. Bilaspur	300 to 600 and 1200 to 2100	Warm temperate and Sub tropical	D
2. Chamba	1000 to 5000	Alpine, Cold temperate and Warm temperate	B
3. Hamirpur	300 to 600 and 1200 to 2100	Warm temperate and Sub tropical	D
4. Kangra	500 to 1000 and 3000 to 6000	Cold temperate and Warm temperate	C
5. Kinnaur	1800 to 4800	Sub Arctic, Alpine and Cold temperate	A
6. Kullu	1500 to 4800	Alpine, Cold temperate and Warm temperate	B
7. Lahaul & Spiti	3000 to 4500	Sub Arctic and Alpine	A
8. Mandi	1200 to 3000	Warm temperate	D
9. Shimla	1500 to 3200	Cold temperate and Warm temperate	C
10. Sirmour	300-450 to 3000-3300	Warm temperate and Sub tropical	D
11. Solan	300-2100 to 150 to 1500	Warm temperate and Sub tropical	D
12. Una	300 to 600 to 1200 to 2100	Warm temperate and Sub tropical	D

An analysis of the recent past reveals that the decennial growth rate of population rose a little from 23% in 1961-71 to 23.7% over the subsequent decade, but declined to 20.8% in 1981-91 and declined further to 17.5% in 1991-2001. Correspondingly, the average annual exponential growth rate of population of the state also came down from 2.2 % in 1971-1981 to 1.9% in 1981-91, the latter being lower than the average of 2.14% for the country as a whole. Crucially, the population growth rate is determined by the fertility rate and this showed a consistent decline over the period 1971-94. The NFHS had studied in detail the fertility behaviour of married females in different states, including Himachal Pradesh. It compared the current fertility, measured by the total fertility rate (TFR) , for the three years prior to the survey - the years 1990 to 1992 - with cohort fertility which measures the mean number of children ever born to women aged 40-49 years at the time of the survey. Since the NFHS found the current fertility (total fertility) rate to be lower than the cohort fertility rate, it concluded that “a substantial fertility decline has taken place in Himachal Pradesh”. According to NFHS-2, the State had the lowest TFR in the Northern Region and the third lowest in the whole country. As elsewhere in India, in Himachal Pradesh the TFR has been lower in urban areas than in rural areas at all relevant ages.

The rise in urban population to total population indicates a rise between 1991 and 2001. There are indicators that, on present trends, the next census may show a still higher figure. Simultaneously, the interface between the rural and urban areas has also increased – and this has largely been the result of better road connectivity. In this context, the United Nations resolution on Human Settlements states, “... rural and urban areas are economically, socially and environmentally interdependent and cities and towns are engines of growth contributing to the development of both rural and urban human settlements.”

The role of roads and transport in this movement of people is of considerable importance in the growth and character of human settlements as they stand today in Himachal. These have been largely responsible for the removal of geographic isolation of the state’s several pockets. This has also led to greater economic freedom as the movement of goods and services has improved. In the administrative state of Himachal as it stood in 1948, there were only 37 miles of metallic roads and 183 miles of unmetalled roads – and these too were in unconnected patches. There were 500 miles of bridle paths. In 1950-51, this figure altered to 5.3 miles of surfaced roads per lakh of population. Today, there is an estimated road length of over 25,000 km in the state.

Also in 1951-52, Himachal figured at the bottom among all states of the country in the matter of vehicles of all types averaged per lakh persons. There were only 66 vehicles including 2 motorcycles and 11 private cars were registered with the transport authorities. In addition, the nationalized transport department had only 202 buses and trucks plying in the state.

Impacts

Expectedly, the pressure on land and its services altered. While, in comparison to other towns in the growth of numbers per se, the population of Shimla has not risen as dramatically as has been the case with several other towns of India and is approximately four fold in six decades. It is the

components of this increase that have created the greatest alteration. As has been mentioned above, the services and civic amenities of Shimla were targeted at the Europeans and the Indian elite; the menials and other Indians lived in cramped quarters with little utilisation of the facilities that the town was famous for. This changed after Independence and now, the spread was wider – say, provision of a water and sewage connection to every home.

Yet, certain factors cannot escape attention. There has been a large scale deterioration of the town at large and both its natural and built heritage has been eroded and even what remains is also under threat. It is saddening that much has gone only to be replaced with houses and buildings that have drawn an enormous amount of investment and still force their occupants into less than optimum conditions. The example may be cited of Sanjauli, once a suburb and now an integral part of Shimla. Its once bare slopes now hold upwards of three hundred large buildings which are primarily residential. Taking a conservative estimate of Rs. 10 lakh spent on the construction of each, the figure one arrives at is quite overwhelming. This means an investment of well over Rs. 300 crores has gone into an area that has poor infrastructure, no open spaces and limited vehicular road access or parking in most pockets. This has expressed itself in the poor quality of life that has come into play. In turn, this has led to only a minimal appreciation in the value of public or private investment. On the other hand, the few old estates that remain in town now command a substantial premium.

There has also been visible growth of the smaller towns for example, Mandi and Sundernagar – and in practically every district headquarters in the state. Along with the growth of these towns, there has also been considerable ‘ribbon development’ along the highways of the state – including the National Highways. In certain ways, the highways have started acting as the river beds once did and have become a support line for this activity.

6.5 Responses:

- Positive measures such as the banning of plastic bags, have altered the overall garbage profile of the towns and there is a smaller amount of non-biodegradable refuse. This measure now needs to be taken a step further with the appropriate segregation of garbage and its disposal and recycling. In the urban areas, debris generated by construction activity is still creating problems and continues to choke various pockets and water run-offs.
- Housing, both urban and rural is an important issue. In the rural context, the Gandhi Kutir Yojna and the Indira Awas Yojna are centrally sponsored housing schemes. The Indira Awas Yojna is being funded by the central and state government on a 75:25 sharing basis. As per the revised guidelines of the Government of India, an assistance of Rs. 22,000/- will be provided for conversion/ up-gradation of a ‘Kutchha’ house into ‘semi Pucca’ or ‘Pucca house’. The following criteria have been laid down for the selection of eligible families living below the poverty line - priority will be given to the totally houseless families and divorced women. The second priority will be given to the families who have lost their houses in fire, floods or any other natural calamities. The third priority will be given to families whose houses are damaged and are not safe to live in, families living in slums and sheds, and those families who do not have adequate living space for family members. The Jawahar Gram Samridhi

Yojna is targeted at the creation of durable assets / infrastructure at village level, creation of productive assets exclusively for SC / ST for sustained employment and generation of supplementary employment to the un-employed poor living below the poverty line.

- For rural sanitation, financial assistance of Rs. 1700/- and Rs. 2000/- is being provided to the beneficiaries of the general category and schedule caste / schedule tribe/ below poverty line beneficiaries respectively, for the construction of latrines. Under a restructured CRSP, a subsidy of Rs. 500/- is being given to a beneficiary for the construction of sanitary latrines.
- In a democracy where responsive and responsible government and governance are required, local government and local bodies hold a very important position as far as human settlements are concerned. A three Tier Panchayati Raj System arrived with the enactment of the Himachal Pradesh Panchayati Raj Act, 1994. The first elections were held in 1995. At present there are 12 Zila Parishads, 72 Panchayat Samitis and 2,922 Gram Panchayats.
- At a time when the idea of 'satellite townships' is well past the initial stages, this question has to be honestly addressed. Are the satellite townships going to be self-sustaining and will they draw pressure away from the 'mother town'? Will they help in protecting the environment? Critically, will they improve the quality of life of the people? In the post colonial period we are analysing patterns of the colonial and pre-colonial periods. It may be a good idea to create a prism to look at what we are doing from a perspective, of say, fifty years hence and try and analyse what we are doing right and what is wrong.

Table 6.76: Municipal bodies in the State

	District	Municipal Corporation	Nagar Parishad	Nagar Panchayat
1.	Shimla	Shimla	1. Rampur 2. Theog	1. Jubbal 2. Kotkhai 3. Sunni 4. Rohru 5. Narkanda 6. Chaupal
2.	Solan		3. Solan 4. Nalagarh 5. Parwanoo	7. Arki 8. Baddi
3.	Sirmour		6. Nahan 7. Paonta	9. Rajgarh
4.	Bilaspur		8. Bilaspur 9. Naina Devi	10. Ghumarwin 11. Talai
5.	Una		10. Una	12. Gagret 13. Daulatpur 14. Santokhgarh 15. Mehatpur
6.	Hamirpur		11. Hamirpur	16. Sujanpur 17. Nadaun 18. Bhota

contd. ...

	District	Municipal Corporation	Nagar Parishad	Nagar Panchayat
7.	Kangra		12. Kangra 13. Dharamsala 14. Nurpur 15. Palampur	19. Nagrota 20. Dehra 21. Jawalamukhi
8.	Chamba		16. Chamba 17. Dalhousie	22. Chawari
9.	Mandi		18. Mandi 19. Sundarnagar	23. Jogindernagar 24. Sarkaghat 25. Rewalsar
10.	Kullu		20. Kullu	26. Manali 27. Bhuntar 28. Banjar
Total	49	1	20	28

6.6 Duties and Formalities of the Town and Country Planning Department:

To constitute Planning/Special Areas.

To prepare existing land use and development plan of planning Areas.

To implement the approved/notified Development Plan/ IDP.

To prepare Sectoral Plans and Town Planning Schemes.

Carry such surveys and inspections and obtain such pertinent reports from government departments, local authorities and public institutions as may be necessary for the preparation of the plans.

Perform such duties and functions as are supplemental, incidental and consequential to any of the foregoing functions or as may be assigned by the state government for the purpose of carrying out the provisions of this Act.

6.7 Duties and Functions of Special Area Development Authority:

To prepare existing land use maps and development plan.

To implement the approved/notified Development Plans/ Interim Development Plans.

For implementing the provision of approved Development Plans/ Interim Development Plans acquire, develop and dispose of the land.

To do construction work and provide water, electricity, sewerage and drainage services.

To do all such works which are given by the government from time to time.

Encroachments.

Disaster management.

Slums.

HEALTH AND ENVIRONMENT

Health and Environment

7.1 State:

7.1.1 Health Care Scene in Himachal Pradesh:

The attempt of the Himachal Pradesh Government in providing health care to the people of the State has been to follow the determining principle of the World Health Organisation meet held at Geneva in 1979. It was “with the objective of continually improving the state of health of the total population, every individual should have access to primary health care and through it, to all levels of a comprehensive health system.” The government is aware that primary health care has to be the hub of the health system. It has to be comprehensive addressing the main health problems in the community providing promotive, preventive, curative and rehabilitative care. These services include:

- Health education and its promotion
- Promotion of nutrition
- Adequate supply of safe water
- Basic sanitation
- Maternal and child care and family welfare services
- Immunization against the major infectious diseases
- Prevention and control of the locally endemic diseases
- Appropriate treatment for common diseases and injuries

Achieving the above may not be a distant dream for the State with 1640 Health Centres – 1135 with the Department of ISMH and 505 (439 PHCs and 66 CHCs) with the HFWD- functioning at the Primary Health Care level. The coverage of rural population by the Primary Health Care Institutions speaks for itself.

Table 7.77: Average Rural Population covered by Health Institutions on 31 March 2005

Institutions	GOI norms for plains	GOI norms for hills	Rural population covered
SUB-CENTRE	5000	3000	2651
PHC	30000	20000	12488
CHC	1.20 lakh	80,000	83066

The second factor that helps in assessing the impact of Primary Health Care is the median distance of the Health Institutions from the villages. According to NFHS -1 (1992), median distance of a sub-centre and PHC was 3.5 and 6.9 km respectively in the state. A remarkable achievement for the state was that at the time of NFHS-2 (1998-99), the median distance of Sub Centres was

reduced to 1.5 km. The distance of a Primary Health Centre also underwent a little change. It reduced from 6.9 km to 6.4 km. But with the conversion of some of the Civil Dispensaries into Primary Health Centres during 2000-2001, the median distance for a PHC would definitely be further reduced.

Table 7.78: Distance from the Nearest Health Facility

Distance	Health Facility					
	S/C	PHC	PHC or S/C	Hospital	Disp/Clinic	Any health facility
Within village	46.3	13.1	47.7	7.1	40.7	60.2
Less than five km	37.1	25.2	39.1	17.4	34.7	32.2
5-9km	9.8	29.5	11.2	25.8	13.2	7.5
10 km	6.8	32.2	2.0	49.7	11.4	0.0
Median distance (km)	1.5	6.4	1.3	9.9	2.3	0.0

Source: NFHS - 1998-99

7.1.2 Modern System of Medicine:

A survey has shown that though the Indian System of Medicine draws a larger percentage of people here than in the neighbouring States of Punjab and Haryana, a considerable chunk of the population, about 93% prefer the modern system of medicine. The state has a fairly extensive network of public health institutions on the allopathic side. The position as on 31st March 2005 is reflected in Table 7.79.

Table 7.79: District-wise Allopathic Public Health Institutions

Sr. No.	District	C.Hs	CHCs	PHCs	CDs	S/Cs
1	Bilaspur	2	5	27	2	117
2	Chamba	4	7	40	0	169
3	Hamirpur	2	5	24	0	152
4	Kangra	8	13	78	2	434
5	Kinnaur	2	3	17	0	33
6	Kullu	2	5	17	0	100
7	L & Spiti	1	3	14	0	35
8	Mandi	6	9	59	0	311
9	Shimla	11	6	77	9	260
10	Sirmour	5	3	34	3	148
11	Solan	5	3	32	5	178
12	Una	2	4	20	1	131
	Total	50	66	439	22	2068

CH: Civil Hospital; CHC: Community Health Centre; PHC: Primary Health Centre; CD: Civil Dispensary; S/C: Sub-Centre

(Source: Health at a Glance 2005)

The above chart does not include the number of Civil Dispensaries run by different departments (Police, University); Boards (HPSEB); Projects like NJPC, BSL; Central Govt. Organizations (Railways, Defence, and Cantonment Boards) and semi-government organizations. In addition to the above, there are two Teaching Hospitals, two Leprosy Hospitals, two TB Hospitals, two Medical Colleges and three Dental Colleges.

Total bed capacity in the public sector is 8747

7.1.3 Indian System of Medicine:

A survey on the utilization of health care services across the systems of medicine in Himachal Pradesh vis-à-vis the neighbouring states and India reveals that the percentage of treatments in the allopathic system in rural Himachal Pradesh (93%) is slightly lower than that in the neighbouring states of Punjab (97.8%) and Haryana (97%) when the Indian average is (95.91%). It means that more people than those in the neighbouring States have faith in the Indian System of Medicine and Homeopathy. It is because the state government had been playing a pro-active role in promoting the Indian System of Medicine.

Table 7.80: Utilization of Health Care Services: by Systems of Medicine

	Allopathic	Homeopathic	Ayurvedic	Unani	Any combination
RURAL					
Himachal	93.00	1.93	4.30	0.09	0.39
Punjab	97.80	0.21	1.12	0.39	0.06
Haryana	97.00	1.91	0.35	0.04	0.04
India	95.91	1.78	1.53	0.27	0.07
URBAN					
Himachal	97.39	0.41	0.45	1.41	0.00
Punjab	97.80	0.92	0.64	0.44	0.00
Haryana	98.24	0.74	0.61	0.15	0.26
India	96.31	2.09	1.03	0.27	0.05

Source: Sarvekshna, April-June 1992

The ISM institutions as on 31.3.2005 were:

Table 7.81: District-wise Public Health Institutions

Sr.No.	District	Hospitals	AHC	HHC	UHC	AC	NCC	Total
1	Bilaspur	2	65	2	-	-	-	69
2	Chamba	2	100	2	-	-	-	104
3	Hamirpur	3	69	1	-	-	-	73
4	Kangra	5	228	1	1	-	-	235
5	Kinnaur	1	40	1	-	2	-	44

Sr.No.	District	Hospitals	AHC	HHC	UHC	AC	NCC	Total
6	Kullu	1	65	1	-	-	-	67
7	L & Spiti	1	20	1	-	2	-	24
8	Mandi	2	163	1	-	-	-	166
9	Shimla	3	144	1	1	-	-	149
10	Sirmour	1	78	1	-	-	-	80
11	Solan	1	77	1	1	-	-	80
12	Una	3	69	1	-	-	1	74
	Total	25	1118	14	3	4	1	1165

AHC: Ayurvedic Health Centre; HHC: Homeopathy Health Centre; UHC: Unani Health Centre; AC: Amchi Clinic; NCC: Nature Cure Centre

Source: Department of ISMH

Besides the above, there are one Ayurvedic College at Paprola (Kangra) and two Panchkarma Units at Bilaspur and Paprola.

The total bed capacity in the Department is 410.

7.1.4 Private Sector:

This is a developing sector in the state. A large number of private clinics, nursing homes and hospitals have sprung up mainly at Shimla and other district towns. A few private hospitals have been set-up at sub-divisional level, too. Total bed capacity of the private sector in the state is about 500. In order to establish a better co-ordination between the public and private sectors, Health Vision 2008 prescribes the following steps:

- i) Enact legislation to regulate the private sector (private clinics, nursing homes) and put a check on quackery.
- ii) To establish norms and standards for space, equipment and human resource for private medical care institutions.
- iii) Involvement of genuine private sector in the preventive and promotive health care activities like immunization, special campaigns, IEC activities, control of epidemics.
- iv) To establish a foolproof mechanism for coordinating the activities of the two sectors at the state, District and Block levels.

7.1.5 NGO and Voluntary Sector:

It is unknown as far as the curative care services are concerned. A large number of NGOs are, however, coming forward to mitigate the sufferings of humanity in collaboration or under the guidance of the Department of Health and Family Welfare. A charitable hospital at Bhota in Hamirpur District being run by a religious organization is exemplary for the state. The contribution of Chinmaya Tapovan Trust, Kangra, in running training programmes for 11 village health guides, 20 traditional birth attendants, 20 bal sevikas, 18 mahila mandal workers, 9 multipurpose health workers and 3 adolescent field workers is laudable. There are a few NGOs extending support in the Health Care.

A few of them may be named as Himachal Pradesh Voluntary Health Association (HPVHA) at Shimla, Society for Social Uplift through Rural Action (SUTRA) at Jagjitnagar, Solan, People's Action for People in Need (PAPN) at Sirmour, Society for Environmental and Rural Awakening (ERA) at Kangra.

7.1.6 Human Resource Development

The biggest challenge to the health-care education institution is not just technical, managerial or financial development but quality human resource development that includes:

- formation of young health professionals and supportive staff who are responsible to social, technical, scientific and management abilities to work effectively in a comprehensive health system;
- development of a faculty consisting of not only good teachers but good role models with social vision, commitment to ethical norms and values that inspires the community; and
- Development of a team of supportive staff that complements with skill and dedication the faculty in the educational institutions.

There are quite a few basic and in-service training institutions in the state as follows:

7.1.7 Health and Family Welfare Training Centres Shimla and Kangra:

These training institutions are meant to impart in-service training to Medical Officers and Para-medical staff of the health department regularly according to the needs of the department. A Principal, who is assisted by an Epidemiologist, Medical Lecturer and other faculty heads, each training centre. Guest faculty is also invited from H&FW Directorate, other institutions and departments. Both these Institutes need to be developed to be the nodal centres for all training programmes in health in the state. These need to be upgraded to become Institutions of Excellence and the Centre at Shimla should be the apex Centre with an officer of the rank of Joint Director heading the Institution to be designated as Director (Training). Health Vision –2008 prepared by the Health and Family Welfare Department has following to say about the training:

- i) In-service training will also focus on management issues in the health sector.
- ii) Induction training for Medical Officers, with a focus on management, will be started on priority basis.
- iii) It will be ensured that high quality training is provided.
- iv) Private training institutions will be encouraged.
- v) A basic pre requisite for the development of a training system will be the creation of a separate cadre of trainers.

7.1.8 Para-medical Training Schools:

There are facilities for pre-service and in-service trainings for all categories of staff in the department. Given below is the detail of training facilities:

- a) General Nursing Training Schools = 5 (Total capacity 230 per batch)
- b) Female Health Workers Training Schools = 7 (Total capacity 420 per batch)
- c) Male Health Workers Training Schools = 6 (Total capacity 360 per batch)

Indira Gandhi Medical College Shimla and Zonal Hospital Dharamsala also train Operation Theatre Assistants (20), Lab. Technicians (75) Radiographers (20) and Para Medical Ophthalmic Assistants (20). Training is given only when there is a need to fill the departmental vacancies.

7.1.9 Medical and Dental Colleges:

There are two Medical Colleges and one Dental College in the government sector besides four more Dental Colleges at Sundernagar, Paonta, Solan and Baddi, in the private sector. The Medical College at Shimla has an intake capacity of 65 and that at Tanda has an intake of 50. The Dental College at Shimla has 30 seats. The Medical College Shimla also has facilities for 16 post-graduate degrees and 8 diploma specialties. The Departmental Head of Medical Education is also the Secretary in the Health Department but it is a separate Directorate as is the Directorate of Dental Services.

7.1.10 Training Facilities in ISM&H Department:

There are two institutions which impart training:

- a) Ayurvedic College at Paprola (Kangra) has an yearly intake of 50, for five and half years course of BAMS.
- b) Pharmacy Training School at Jogindernagar has the capacity to train Ayurvedic Pharmacists in a two year course and training is conducted as per the needs of the department.

7.1.11 Vanaspati Van (Herbal Gardens):

The Western Himalayas have about 1350 herbal and aromatic plants. Half the number is available in the hills of Himachal Pradesh. The State has also been considered ideal for growing the following seven plants: Shatavari, Daru Haldi, Vatsnabh, Atees, Chirayata, Kuth and Kutki. A herbal-medicine board is functioning in the state with the Chief Minister as its President and the Director of ISMH as its Secretary. The Vanaspati Van at Jogindernagar has made its mark. A number of medicinal herbs are being grown there for demonstration purposes. The annual production of herbs is worth Rs.1.00 lakh. A Herbarium, visited by foreigners and natives, has also been established here.

7.2 Issues Related to the Health Sector:

- a) Inaccessible remote areas
- b) Lack of awareness in health care
- c) Malnutrition, poverty and unhygienic living conditions
- d) Little access to clean drinking water
- e) Improper sanitation in rural and urban areas

- f) Pollution in urban areas due to improper sewerage treatment, municipal effluents treatment and industrialization and use of chemicals in agriculture.
- g) Growth in number of vehicles causing increased air pollution
- h) Inadequate infrastructure facilities
- i) High energy living styles

Pressures

- a) Growing number of patients in the hospitals
- b) Decreasing per capita quantity of water
- c) Demand for a safe drinking water increasing due to growth in population and improvement in living standards

Impact

- a) Emergence of new diseases
- b) Growing incidence of epidemics
- c) Demand for more infrastructural facilities
- d) Disturbance in doctor patient's ratio
- e) Shortage of paramedical personnel

Responses

- a) Programme of mass immunization
- b) Strengthening of health services
- c) Medical/ Ayurvedic colleges
- d) Pharmacist Training Centres
- e) Health Policy

7.3 Health Vision 2008:

The Government of Himachal Pradesh has drawn up a Health Vision 2008. The purpose is to have a directional movement towards better health of the people of the state. Better health does not signify merely the absence of disease. WHO defines health as a “complete state of physical, mental, and social well being.” The state of health of the individual, or the community, is a function of the socio-economic environment and the Health Vision takes care of all those, but the apathy and cynicism that are widely present everywhere including the Health Department has to be changed with;

- a stake in a change of the system;
- a hope in a more concerted effort to tackle problems;
- a vision for more people responsive to health care.

When compared with the national figures, Himachal Pradesh has a definite edge. The profile given in Table 7.82 tells the story:

The Health Vision gives the vital rates to be achieved by 2008 as given in Table 7.82.

Table 7.82: Vital Health Rates for Himachal Pradesh

Health Indicators	Existing SRS-2002	Vision 2008
Birth Rate	20.7	19.00
Death Rate	7.5	7.0
Infant Mortality Rate	52	45
Neonatal Mortality Rate	31	20
Child Mortality Rate	13	10
Total Fertility Rate	2.3	2.0

SRS: Sample Registration System.

Source: Health Vision 2008

In order to achieve these rates in a short span of five years, the health department geared itself by undergoing a reform process. A brief of the reforms undertaken is given below:

7.4 Structural Reforms:

- There were 139 Civil Dispensaries functioning in the rural areas of the State that were doing the job of dispensing medicines. These were brought to the mainstream of providing preventive, promotive and curative health care.
- To increase the number of Institutional deliveries, 24 hour service in selected Institutions has been started. These Institutions have been working since 2002 and the results have been encouraging. 13210 deliveries were conducted in these Institutions during the year 2004. Maximum number of 6283 was in Hamirpur District and the lowest at 134 was at Sirmour District. The following Table gives the District-wise position of such Institutions:

Table 7.83: Institutional Deliveries – 24 hour Service in Selected Institutions

District	Hospital	CHC	PHC	Total
Bilaspur	-	5	5	10
Hamirpur	-	6	2	8
Kangra	1	11	6	18
Shimla	-	6	9	15
Sirmour	1	3	1	5
Solan	1	3	8	12
Una	1	3	2	6
Total	4	37	33	74

Source: Health and Family Welfare Department

- Appointment of ad-hoc and On contract Doctors to fill the vacant posts of Medical Officers in PHCs.

7.5 Functional Reforms:

a) Efficiency Related:

- Functional integration of department of Indian system of medicines and the department of health and family welfare to follow standard protocol in national health programmes. The ISMH earmarked 661 Institutions in the state for the purpose. The training of ISMH Medical Officers started in the year 2005.
- Decentralisation of administrative and financial powers right up to the PHC level.
- Capacity building of Medical Officers in correct of the powers is being done along with the RCH refresher courses held in the two training centres of the state at Shimla and Kangra.
- Merging of all health and family welfare societies into one at the state and the District levels.
- Interconnectivity for MIS for collecting data for NHP/disease surveillance and manpower planning. To begin with, the field data is being collected in the revised and consolidated Forms 6, 7, and 8. This has considerably reduced the paperwork in the field. More attention is being given to health related problems.
- Privatization of support services in health institutions: Three support services; viz., scavenging, laundry, and diet are being transferred to the private sector, wherever possible.
- Rationalization of drug use: essential drug list, drug formulary and standard treatment guidelines have been prepared after forming the Essential Drug Policy. Capacity building of Medical Officers in the use of generic drugs is a continuing process and is on before generalizing their use.
- Confidential report writing is an annual feature. It was a centralised process and for want of latest ACRs, promotion of deserving candidates used to be held up. Channel of writing such reports has now been squeezed and the nearest possible authority has been given the powers to express his opinion

b) Resource Related:

- Establishment of society under the Registration of Societies Act called ROGI KALYAN SAMITI at all Hospitals up to the CHC Level. These Samitis would improve:
 - System efficiency;
 - Service quality;
 - Patient satisfaction;
 - Local decisions and so initiative of the officers;
 - Accountability at hospital level;
 - Resource utilization;
 - The hospital itself;

Resource generation through community financing and user's charges.

- Provision of seed money is there to improve such facilities that add to resource generation in the hospitals.

c) Governance Related:

- Roles and responsibilities have been given to Panchayati Raj Institutions: Health and Family Advisory Committees have been formed at the three levels of the Panchayati Raj Institutions. These have been named PARIKAS (Parivar Kalyan Salahkar Samiti). Their composition and works have been defined.
- Policy formulation: A Health Vision for 2020 has been developed for the State.
- Burden of disease survey was conducted for the first time in Himachal Pradesh through PGI Chandigarh. The findings of the report present a detailed picture of the diseases in this State. A brief of the findings is given hereunder.

7.6 Top Ten Causes of Disease Burden:

The top ten causes of diseases burden in different age group in males and for females are shown in Tables 7.84 and 7.85. Among children of 0-4 years still diarrhoeal diseases, low birth weight and lower respiratory infection are leading causes of diseases burden. Among the reproductive age group, road accidents and other unintentional injuries, iron deficiency anemia, tuberculosis, chronic obstructive pulmonary diseases and upper respiratory infections are the leading causes of diseases burden. Abbreviations commonly used in the Tables concerned with the Burden of Diseases are DALY, YLL and YLD. DALY has two components namely years life lost due to premature mortality (YLL) and year life lost due to disability (YLD). The local data essential for the mortality (YLL) component of disability-adjusted life years (DALY) are the number of deaths by age, sex and average age at death within respective age groups.

Table 7.84: Top Ten Causes of Burden of Diseases (DALYs) among Males in Himachal Pradesh

Rank	0-4 yrs	5-14 yrs	15-44 yrs	45-59 yrs	60 +yrs
1	Diarrhoeal diseases	Iron-deficiency anaemia (IDA)	Other unintentional injuries (OUI)	Chronic Obstructive Diseases	Chronic Obstructive Pulmonary Disease
2.	Low birth weight	OUI	Road accident	OUI	OUI
3.	Lower Respiratory Infectious	Asthma	Iron –deficiency anaemia	Ischaemic heart disease	OUI
4.	Other infectious diseases	Other infectious diseases	Chronic Obstructive Pulmonary Diseases	Tuberculosis	Ischaemic heart disease
5.	IDA	Diarrhoeal diseases	Self-inflicted injury	Road accident	Tuberculosis
6.	Dental caries	Otitis Media	Tuberculosis	Other infectious diseases	Road accident

Cont...

Rank	0-4 yrs	5-14 yrs	15-44 yrs	45-59 yrs	60 +yrs
7	Upper Respiratory Infections	Dental caries	Asthma	Peptic ulcer	IDA
8.	Asthma	Upper Respiratory Infections	Other infectious diseases	IDA	Cataracts
9.	Otitis Media	Lower Respiratory Infections	Upper Respiratory Infections	Asthma	Asthma
10	OUI	Vitamin A Deficiency	Dental caries	Dental caries	Dental caries

The overall top ten causes of burden of diseases among males and females are shown in Table 7.85. Respiratory infections, diarrhoeal diseases, iron deficiency anaemia, tuberculosis, chronic obstructive pulmonary diseases and road accidents are six major causes of disease burden in both sexes. The disease burden on account of iron deficiency anaemia and tuberculosis in both the sex is mostly in the age group 15-44 years. This calls for early diagnosis and treatment for both the conditions.

Table 7.85: Leading Causes of Disease burden (DALY) in Male and Female of Himachal Pradesh

Male	%	Female	%
Chronic Obstructive Pulmonary Disease	15.22	Iron deficiency anaemia	12.95
Iron deficiency anaemia	8.28	Chronic Obstructive Pulmonary Disease	11.03
Other unintentional injuries	7.14	Diarrhoeal diseases	8.39
Dental caries	4.13	Other unintentional injuries	8.16
Diarrhoeal diseases	3.59	Other infectious diseases	7.48
Asthma	3.46	Dental caries	4.70
Other infectious diseases	3.05	Asthma	3.77
Upper Respiratory Infections	2.80	Tuberculosis	3.61
Lower Respiratory Infections	1.89	Road accident	3.46
Otitis media	1.33	Upper Respiratory Infections	3.07

The leading causes of DALYs lost in different age group are shown in Table 7.86.

1. Lower respiratory infection, diarrhoeal diseases and low birth weight predominantly affects infants and children.
2. Tuberculosis continues to be the leading cause of death in group I diseases.
3. Among the non communicable diseases ischemic heart diseases, COPD and digestive disorders were the leading causes both among the males and females. Other causes include cerebrovascular diseases and asthma as well as the cancers.
4. Falls, roads accidents and other unintentional injuries were the leading causes of death among injuries and accidents.

Table 7.86: Leading DALYs lost in Different Ages

Rank	0-4 yrs	05-14 yrs	15-44 yrs	45-59 yrs	60+ yrs	All age group
1	Diarrhoeal diseases	Iron deficiency anaemia	Iron deficiency anaemia	Chronic Obstructive Pulmonary Diseases	Chronic Obstructive Pulmonary Diseases	Chronic Obstructive Pulmonary Diseases
2	Lower birth weight	Other unintentional injuries	Other unintentional injuries	Other unintentional injuries	Other infectious diseases	Iron deficiency anaemia
3	Other infectious diseases	Diarrhoeal diseases	Road accidents	Ischaemic heart diseases	Other unintentional injuries	Other unintentional injuries
4	Lower Respiratory Infection	Other infectious diseases	Chronic Obstructive Pulmonary Diseases	Iron deficiency anaemia	Ischaemic heart diseases	Diarrhoeal diseases
5	Iron deficiency anaemia	Asthma	Self inflicted injury	Tuberculosis	Cataracts	Other infectious diseases
6	Dental caries	Otitis Media	Tuberculosis	Other infectious diseases	Iron deficiency anaemia	Road accidents
7	Upper Respiratory Infection	Dental caries	Asthma	Road accidents	Tuberculosis	Dental caries
8	Otitis Media	Upper Respiratory Infection	Other infectious diseases	Dental caries	Dental caries	Asthma
9	Asthma	Road accidents	Upper Respiratory Infection	Asthma	Road accidents	Tuberculosis
10	Other unintentional injuries	Upper Respiratory Infection	Dental caries	Peptic ulcer	Ischaemic heart diseases	Diarrhoeal diseases

Table 7.87: Leading Causes of Premature Mortality (YLL) in Males and Females in Himachal Pradesh

Male	%	Female	%
Road accident	12.75	Diarrhoeal diseases	13.25
Diarrhoeal diseases	10.77	Other unintentional injuries	11.32
Other unintentional injuries	9.34	Road accident	9.67
Ischaemic heart diseases	9.09	Lower birth weight	9.23
Tuberculosis	6.54	Tuberculosis	8.32
Lower birth weight	5.85	Ischaemic heart diseases	7.87

Cont...

Male	%	Female	%
Self inflicted injury	5.78	Self inflicted injury	7.44
Other unintentional injuries	5.48	Other unintentional injuries	6.23
Chronic Obstructive Pulmonary Diseases (COPD)	4.12	Other digestive diseases	4.82
Other digestive diseases	3.32	COPD	3.55

The common leading causes of disability (YLD) in both sexes of Himachal Pradesh are obstructive pulmonary disease, iron deficiency anaemia diarrhoeal disease, and other unintentional injuries as shown in Table 7.88.

Table 7.88: Leading Causes of Disability (YLD) in Males and Females in Himachal Pradesh

Male	%	Female	%
Chronic Obstructive Pulmonary Diseases	26.09	Iron deficiency anaemia	20.13
Iron deficiency anaemia	14.19	Chronic Obstructive Pulmonary Diseases Other unintentional injuries	17.15
Other unintentional injuries	12.24	Diarrhoeal diseases	13.04
Dental caries	7.08	Other unintentional injuries	12.68
Diarrhoeal diseases	6.15	Other infectious diseases	11.64
Asthma	5.92	Dental caries	7.31
Other unintentional injuries	5.23	Asthma	5.87
Upper Respiratory Infection	4.80	Tuberculosis	5.61
Lower Respiratory Infection	3.24	Road accident	5.38
Otitis media	2.28	Upper Respiratory Infection	4.78

An acquaintance with the burden of diseases in the state takes one to the patient population of the state and it is surprising to note that in the year 2004, there were 1,61,63,768 patients under treatment of either ISMH or HFW. This does not include the lakhs of people who go to the private practitioners. It appears rather strange that one crore people more than that of the total population of Himachal Pradesh attended one or the other Health Institutions which means that a person – child or old- man or woman-visits a Health Cure Centre 2.65 times in a year.

The gap in their Information Collection System is that they do not collect the disease-wise information. They have identified 42 different types of illness under seven main heads – 1.Nervous System; 2. Digestive System; 3. Blood Flow System; 4. Respiratory System; 5. Skin System; 6. Fevers; and 7. Eye Diseases. The following Table gives District-wise number of patients attending the ISMH Institutions for treatment.

Table 7.89: Number of Patients Treated by ISMH, Comparison of two years –District-wise

S.No	District	2003			2004		
		Outdoor	Indoor	Total	Outdoor	Indoor	Total
1	Bilaspur	407650	12743	420393	408266	10728	418994
2	Chamba	200463	3535	203998	313604	3156	316760
3	Hamirpur	395386	2684	398070	391543	4376	395919
4	Kangra	1221428	6384	1227812	1048070	11868	1059938
5	Kinnaur	62610	2801	65411	63444	1706	65150
6	Kullu	283815	194	284009	281569	83	281652
7	L&S	29790	-	29790	59883	-	59883
8	Mandi	699385	2324	701709	684149	1999	686148
9	Shimla	471234	314	471548	447271	17060	464331
10	Sirmour	271284	1736	273020	279305	1695	281000
11	Solan	301467	3009	304476	310777	3801	314578
12	Una	406200	9716	415916	398603	4782	403385
13	RAH Paprola	47189	2375	49564	47340	2773	50113
14	RAH Shimla	30551	4702	35253	30903	409	31312
	TOTAL	4828452	52517	4880969	4764727	64436	4829163

RAH: Rajkiya Ayurveda Hospital

Source: ISMH Department

The attached Table 7.90 reflects the number of patients – outdoor as well as indoor - that went to the Institutions run by HFW. It gives the figures for six years from 1999 to 2004. It also shows no unusual or disturbing trend.

Table 7.90 : Patients Treated from 1999 to 2004 in HFW Institutions

Year	Outdoor			Indoor			Total		
	New	Old	Total	New	Old	Total	New	Old	Total
1999	7181755	2339358	9521113	256368	1142745	1399113	7438123	3482103	10920226
2000	6935854	2144187	9080041	256652	1145051	1401703	7192506	3289238	10481744
2001	7175041	2163166	9338207	273573	136106	1409679	7448614	3299272	10747886
2002	7262338	2088000	9350338	284734	1114900	1399634	7547072	3202900	10749972
2003	7494032	2091433	9585465	294096	1111253	1405349	7788128	3202686	10990814
2004	7674236	2193077	9867313	314878	1152414	1467292	7989114	3345491	11334605

The Table 7.91 reflects the District-wise number of cases that reported in Hospitals as Indoor admission. The number of Indoor patients in the two tables is not likely to match because in the first Table all patients who were admitted to the CHC or PHC for indoor treatments are included whereas in the second one those admitted to the Hospitals only are reflected.

Table 7.91 : District-wise number of cases reported in Hospitals Admission (Indoor)

Selected Diseases	Bilaspur						Chamba						Hamirpur						Kangra						Kinnaur							
	1995		2000		2002		1995		2000		2002		1995		2000		2002		1995		2000		2002		1995		2000		2002			
	Case	D.	Case	Dt.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.		
Stomach Cancer	1	0	0	0	1	0	3	0	2	0	2	0	0	0	1	0	0	0	0	0	0	6	0	4	0	0	1	0	5	0		
	3	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	0	0	0			
Prostate Cancer	0	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0		
Lymphoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Parkinson's diseases	16	0	0	0	0	0	45	0	37	0	23	0	42	0	11	0	15	0	155	0	40	0	155	0	35	0	35	0	27	0	0	
Cirrhosis of the liver	43	4	3	2	1	0	3	0	8	0	2	0	1	0	0	0	5	1	15	0	20	17	34	0	0	3	0	9	2	0	0	
Nephritis & Nephrosis	6	0	145	0	90	0	149	0	296	4	249	2	16	0	59	2	143	2	174	0	604	1	423	0	4	0	61	0	97	0	0	
Congenital abnormalities	0	0	0	0	1	0	0	0	0	0	6	0	12	1	5	0	0	0	4	0	5	0	6	0	4	0	0	1	1	0	0	
Unintentional poisonings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Diarrhea Diseases	1313	5	1073	1	1072	0	906	15	999	7	1190	3	1195	5	1091	1	1618	0	3033	2	2433	0	2651	0	167	6	146	3	224	1	0	0
Polio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hepatitis	5	0	12	0	63	0	13	0	23	0	31	0	40	1	10	1	16	0	66	0	52	0	143	0	4	0	1	1	5	0	0	
Malaria	13	0	8	0	0	0	15	0	0	0	0	0	12	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	
Filariasis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Trachoma	3	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	
Intestinal Helminthes	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	216	0	0	0	0	0	0	0	0	
Protein energy malnutrition	1	0	0	0	0	0	0	0	4	0	115	0	0	0	0	0	0	15	0	10	0	0	0	15	0	0	0	2	0	0	0	
H. Pylori (peptic ulcers)	33	1	41	1	3	0	21	2	178	1	176	1	35	0	35	0	61	0	1661	0	12	8	103	0	10	0	5	0	5	0	0	
Other Digestive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Acute respiratory infections	661	0	502	0	130	0	174	24	156	0	32	0	1047	3	203	8	296	0	5701	7	532	8	115	0	100	0	11	0	19	0	0	
Cronic respiratory diseases	100	4	180	16	70	0	204	21	60	0	275	10	327	0	16	0	14	0	3281	0	107	0	124	0	110	5	3	0	0	0	0	
Lung & related cancers	0	0	1	0	3	0	2	0	2	0	2	0	0	0	1	0	0	0	0	0	3	2	4	0	0	0	0	0	0	0	0	
Cardiovascular disease	9	0	0	0	0	0	17	0	17	2	0	0	17	0	2	0	0	0	0	0	210	5	410	10	6	0	2	0	3	0	0	

contd....

Selected Diseases	Kullu						L&Spiti						Mandi						Shimla						Sirmaur											
	1995			2000			2002			1995			2000			2002			1995			2000			2002			1995			2000			2002		
	Case	D.		Case	Dt.		Case	D.		Case	D.		Case	D.		Case	D.		Case	D.		Case	D.		Case	D.		Case	D.		Case	D.				
Stomach Cancer	0	0	3	0	0	0	0	0	0	0	0	0	10	1	0	0	0	0	0	0	0	40	8	60	12	71	16	0	0	8	1	8	0			
	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	8	2	14	3	23	4	0	0	34	8	0	0					
Prostate Cancer	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	2	49	3	47	3	0	0	6	0	5	0					
Lymphoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Parkinson's diseases	3	0	21	0	149	0	0	0	2	0	1	0	511	0	387	0	842	0	238	0	413	0	219	0	52	0	612	0	561	0						
Cirrhosis of the liver	0	0	4	0	5	0	0	0	0	0	1	0	0	0	445	1	20	0	43	4	80	3	85	2	4	0	75	2	65	0						
Nephritis & Nephrosis	7	0	60	0	347	14	6	0	3	0	1	0	178	0	1986	1	1555	0	125	2	315	0	433	0	13	0	276	4	304	1						
Congenital abnormalities	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	168	0	3	0	0	0	0	0	0	0	2	0						
Unintentional poisonings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Diarrhea Diseases	843	0	2387	0	1108	0	50	0	115	4	87	1	3102	11	2684	3	3188	0	2941	26	2401	14	2151	4	1362	13	1459	1	1615	1						
Polio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Hepatitis	47	0	13	0	17	0	4	0	2	0	2	0	103	6	44	0	85	0	85	3	44	0	40	1	1	0	0	0	0	0						
Malaria	0	0	0	0	0	0	0	0	3	0	0	0	77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Filariasis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Trachoma	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	136	0	0	0	0	0	0	0	0	0	0	0						
Intestinal Helminthes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	0	11	0	0	0	16	0	0	0	14	0	19	5						
Protein energy malnutrition	0	0	0	0	0	0	0	0	5	0	4	0	290	1	0	0	18	0	53	11	76	0	92	0	0	0	10	2	22	0						
H. Pylori (peptic ulcers)	60	0	76	0	31	3	0	0	28	0	7	0	938	2	602	0	915	0	723	8	492	7	660	5	4	0	108	0	123	0						
Other Digestive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						
Acute respiratory infections	324	0	117	0	111	0	0	0	0	0	83	0	2273	0	1695	0	446	0	340	17	142	7	198	8	535	1	261	0	276	2						
Cronic respiratory diseases	311	0	59	3	145	50	0	0	0	0	0	0	548	5	1028	0	361	0	1159	22	74	4	86	5	361	2	86	0	165	1						
Lung & related cancers	0	0	1	0	0	0	0	0	0	0	0	0	4	2	0	0	0	0	83	6	107	16	130	21	0	0	10	1	2	0						
Cardiovascular disease	0	0	21	0	16	0	0	0	0	0	0	0	333	0	682	14	88	0	80	0	27	0	50	2	32	0	66	3	82	1						

contd....

Selected Diseases	Solan						Una						HIMACHAL PRADESH					
	1995			2000			1995			2000			1995			2000		
	Case	D.	Dt.	Case	D.	Case	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.	Case	D.
Stomach Cancer	0	0	0	0	0	0	0	0	0	0	2	0	0	0	54	9	83	13
Liver Cancer	0	0	0	0	0	0	0	0	0	0	1	0	0	0	15	2	53	13
Prostate Cancer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	2	61	3
Lymphoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Parkinson's diseases	0	0	0	0	0	0	0	0	0	0	18	0	0	0	1097	0	1576	0
Cirrhosis of the liver	0	0	0	0	0	0	0	0	0	0	12	0	0	0	109	8	654	25
Nephritis & Nephrosis	0	0	0	0	0	0	0	0	0	0	58	2	0	0	678	2	3967	14
Congenital abnormalities	0	0	0	0	0	0	0	0	0	0	4	0	0	0	189	1	20	0
Unintentional poisonings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diarrhea Diseases	1189	0	0	1107	0	162	0	0	0	0	462	1	591	1	16263	83	17242	35
Polio	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hepatitis	7	0	0	2	0	4	0	0	0	0	4	0	17	0	379	10	210	2
Malaria	3	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0	16	0
Filarisis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trachoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	208	1	0	0
Intestinal Helminthes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	14	0
Protein energy malnutrition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374	12	105	2
H. Pylori (peptic ulcers)	17	0	0	78	0	8	0	0	0	0	139	0	0	0	3510	13	1800	17
Other Digestive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acute respiratory infections	129	0	0	181	0	94	0	0	0	0	199	2	0	0	11378	52	4018	25
Chronic respiratory diseases	95	0	0	115	0	166	0	0	0	0	141	1	0	0	6662	59	1880	24
Lung & related cancers	0	0	0	0	0	0	0	0	0	0	3	2	0	0	89	8	128	21
Cardiovascular disease	0	0	0	20	0	0	0	0	0	0	15	0	0	0	494	0	1069	24

Secondly, gives the figures of 23 selected diseases. The patients of diseases not covered by the selected ones are not shown in the Table. The figures under Column D mean the patients who died in the Hospital.

7.7 Challenges for the Health and Family Welfare Department:

1. Environment related:

- Unclean houses and unhealthy style of living;
- So far unknown infectious diseases;
- Microbiological and chemical contaminants;

2. Society related:

- Increasing accidents;
- Violence and molestation;
- Increasing geriatric population;
- Decreasing female population especially in the 0-6 age group;

3. Public Health:

- Unsafe drinking water;
- Poor sanitation;
- Unhygienic food;
- Unhealthy life style.

7.8 Health and Environment:

Himachal Pradesh has entered an era in which, as a result of the spread of education and enhanced awareness, the public is expressing increasing concern about protecting human health and preserving the quality of our environment. Hospital waste generated during patient care is its latest concern. It is a potential health hazard to the health care workers, the public and the flora and fauna of the area. Emission of gases by incinerator such as Furan, Dioxin, Hydrochloric acid have compelled the Department of Health and Family Welfare to think seriously about the matter and the diseases transmitted through improper disposal of hospital waste. The Central Government has already passed an Act in 1996 and Bio-medical Waste (Handling and Management) Rules were introduced in 1998.

The State Government in the Department of Health and Family Welfare has brought out a Hospital Manual and its Chapter XIII is on Prevention of Hospital Acquired Infection and Hospital Waste Management. The confessional point is that during hospitalization or after the discharge of the patient from the hospital, he or she may develop an infection called Nosocomial Infection. This occurs as a result of:

1. Improper asepsis of the environment due to accumulation of untreated hospital waste and the unscientific way in which this waste is disposed of;

2. Improper asepsis of equipment, instruments;
3. Poor sterilization/ disinfection techniques;
4. Invasive monitoring and therapeutic procedures;
5. Transmission of infection by staff carriers;
6. Consumption of infected food, milk and water;
7. An epidemic arising in the community and spreading to the hospital.

The Manual prescribes an adequate surveillance programme for constant reporting and investigation of infections, the first being the formation of HIFCOM (Hospital Infection Control Committee), the other steps that are to be taken to check the menace are:

- a. adequate sanitation and disinfection of the environment;
- b. adhere strictly to aseptic techniques while performing surgical and instrumentation procedures;
- c. segregate contaminated instruments;
- d. provision of source isolation;
- e. discourage indiscriminate use of antibiotics.

7.9 Hospital Waste Management:

On an average, a Hospital in India generates 1.5 kg of waste per bed per day while the quantity for U.K. is 2.5, USA is 4.5, France is 2.5 and for Spain it is 3.0 kg per bed per day. Out of this waste, hazardous is 15%, hazardous but non-infective is 5% and infective is 10% whereas the non hazardous waste is 85%. The composition of waste by weight is: plastic 14% combustible out of which dry cellulosic solid is 45% and wet cellulosic solid is 18%. Non-combustible waste is 20%.

An idea about waste generation in Himachal Pradesh can be had from the Table given below:

Table 7.92: Waste Generation in Major Hospitals of Shimla Town

S.No.	Name of the Hospital	Quantity of bio-medical waste/bed in kg.	Total quantity in kg.
1	Indira Gandhi Medical College	0.858	450.0
2	Kamala Nehru Hospital	1.95	295.02
3	Deen Dayal Hospital	0.644	128.80
4	Indus Hospital	1.3	130.0
5	Army Hospital at Tutu	0.386	38.56
	Total	-	1062.48

Source: Report on Solid Waste Management in Shimla Town

The Health and Family Welfare Department has issued detailed instructions in the Manual for managing the Hospital Waste. The brief of the same is placed below:

1. Constitute Waste Management Committees with MS as Chairperson. Matron / Nursing Superintendent or seniormost sisters will be the Waste Disposal Officer (WDO) and be the Secretary of the Committee. It will meet once in four weeks. The WDO will develop a Waste Disposal Plan.
2. The Plan will include:
 - Detailed specification of container's bags for waste collection;
 - Paths for waste collection trolleys through the hospital;
 - Timetable of frequency of collection of waste from the various areas;
 - Defining the duties and responsibilities of various health personnel;
 - Procedure for segregation, pre-treatment, storage and handling of waste requiring special treatment before disposal.
3. The waste will be segregated at the point of generation and stored in coloured containers as per the colour code prescribed in the Bio-medical Waste (Management and Handling) Rules 1998. The prescribed colour code is:
 - **Black** : General waste, peels, paper, and wrappers;
 - **Yellow**: Human anatomical tissue, blood, body fluids, waste contaminated with blood, dressing and soiled cotton and all other wastes to be incinerated waste; or deep burial
 - **Red**: Laboratory waste same as yellow but needs deep burial / autoclaving
 - **Blue / Grey**: Sharps and plastic waste for shredding / autoclaving / chemical treatment to be micro waved.
4. The Manual also mentions the disinfectants to be used for disinfecting sharp waste, disposable infectious plastics, infectious glassware, blood and body fluids. It says that the most economical and effective disinfectant is Sodium hypochlorite. The other disinfectants mentioned in the Manual are, Methylated Spirit (70%), Alcoholic hand wash (70% methyl alcohol to which 1% glycerin is added), Gluteraldehyde (2%) and Savlon (1%).
5. The duties of MS have been defined in the Manual as the officer who would apply to the H.P. Pollution Control Board for authorization for the handling of bio-medical waste and see that the new waste bags and containers are ordered on a regular basis to maintain continuous supply.
6. The H.P. State Pollution Control Board gives this report on bio-medical waste. Up to March 2005 in all 580 Govt. and 194 private health institutions have been identified. Out of these 774 health institutions 346 have been exempted from seeking authorization under Rule-8, of the Bio-medical Waste (Management and Handling) Rules, 1998. 401 health institutions have applied for authorization and 129 have been granted authorization. 108 defaulting institutions have been served with show cause notice under the Bio-medical Waste (Management and Handling) Rules, 1998. These health institutions have installed twelve incinerators. Municipal Corporation, Shimla and Municipal Committee, Kullu have Common Waste Treatment Facility Incinerators.
7. Information on housing characteristics by residence is always a reliable source on the health of household members. The following Table 7.93 shows the percent distribution of households by housing characteristics according to residence, Himachal Pradesh, 1999.

Table 7.93: Percent Distribution of Households by Housing Characteristics according to Residence, Himachal Pradesh, 1999

Electricity	Urban	Rural	Total
Yes	99.7	96.9	97.2
No	0.3	3.1	2.8
Total percent	100.0	100.0	100.0
Source of drinking water			
Piped	90.7	65.7	68.4
Hand Pump	4.7	9.5	9.0
Well water	4.4	18.6	17.1
Surface water	0.2	5.7	5.1
Other 0.0	0.4	0.4	
Total percent	100.0	100.0	100.0
Time to get drinking water			
Percentage < 15 minutes	90.6	69.0	71.3
Median time (minutes)	0.0	9.1	4.9
Method of dinking water purification*	Urban	Rural	Total
Strains water by cloth	1.8	2.5	2.4
Uses alum	0.5	0.5	0.5
Uses water filter	30.5	3.0	6.0
Boils water	21.7	3.6	6.0
Uses electronic purifier	1.6	0.2	0.4
Uses other method	1.1	2.1	2.0
Does not purify water	53.9	89.2	85.5
Sanitation facility			
Flush toilet	80.3	17.6	24.2
Pit toilet / latrine	3.8	2.3	2.5
Other 0.2	0.3	0.3	
No facility	15.7	79.8	73.0
Total percent	100.0	100.0	100.0
Main type of fuel used for cooking			
Wood 6.2	70.8	63.9	
Crop residues	0.0	0.0	0.0
Dung cakes	0.0	0.0	0.0
Coal / Coke / Lignite / Charcoal	0.1	0.0	0.0
Kerosene	9.4	4.5	5.0
Electricity	0.4	0.0	0.1
Liquid Petroleum Gas	82.9	24.5	30.7
Biogas 0.6	0.0	0.1	
Other 0.3	0.0	.1	
Missing	0.1	0.0	0.0
Total percent	100.0	100.0	100.0
Type of house			
Kachha	6.2	30.6	28.0
Semi pucca	27.7	45.0	43.1

Pucca 66.1	24.3	28.7	
Missing	0.0	0.1	0.1
Total percent	100.0	100.0	100.0
Persons per room			
<3	88.4	82.8	83.4
3– 4	8.6	12.9	12.4
5– 6	2.9	3.0	12.4
7+	0.1	1.4	1.2
Total percent	100.0	100.0	100.0
Mean number of persons per room	1.6	1.8	1.8
Number of households	366	3077	3443

8. Totals add to more than 100.0 because households may use more than one method of purification.

Water sources and sanitation facilities are two important factors that have an influence on the health of the people. The above Table shows that 86 percent of the households do not purify drinking water. It is strange that 54 % of the people living in urban areas also do not purify the drinking water. It is not that they are not aware of the necessity of purifying the water but, because of lethargy, they just ignore it.

Regarding sanitation facilities, a large urban-rural difference has been disclosed by the Survey. Eighty percent of the households in the urban areas have flush toilets whereas 80% of the households in the rural areas still resort to the old practice of going to jungle in the morning. Women prefer to go early in the morning when it is already dark and risk their lives to be the prey for wild animals.

Of the fuels, wood is still the most used fuel in the rural areas. 71 % of the households still cook their meals on wood fires. It has an adverse effect on the eyes of the person who cooks the meals and those who sit with him or her for chit-chat in the kitchen, a common practice in the hills. Smoke coming out of wood fire affects their eyes and ultimately the eyesight.

7.10 Road Accidents and other Unintentional Injuries:

The Burden of Diseases discussed in the Medical Scenario in H.P. shows that deaths due to accidents and other unintentional injuries is on the increase in this hill state.

Accelerated development and opening up of interior areas have led to an alarming increase in the rate of accidental injuries, crime and violence in the state. What is true for India is truer for Himachal Pradesh because of its topographical character. An unprecedented increase in the number of vehicles has outpaced the development of adequate roads and highways. India has 1 % of the motor vehicles in the world, but bears the burden of 6% of the global vehicular accidents. In Himachal Pradesh, out of total deaths 12.75% of deaths among males and 9.67% among females are because of road accidents. It is well recognized that our health care system is not fully equipped to meet the challenge. Road-traffic accidents are increasing at the alarming annual rate of 3%. In

1997, 10.1% of all deaths in India were due to accidents and injuries. A vehicular accident is reported every three minutes and a death every ten minutes on Indian roads. During 1998, nearly 80,000 lives were lost and 330,000 people were injured. In Himachal Pradesh, males in the 15-44 age group bear the burden of road accidents because it is the number 2 reason for deaths among them while for females in the same age group; it is the sixth in number of the killers. Other unintentional injuries account for the deaths of males in the age group 45-59 age group as number 2 killer and for women in the same age group it is number three dreaded devil. It has been causing a significant impact on productivity. The majority of fatal road-traffic accident victims are passengers in the buses plying in the Pradesh. Private taxis, cars and trucks also add to such deaths. No credible data is available to ascertain the outcome of trauma victims; it is generally perceived that outcomes in patients with single system injury (e.g. musculoskeletal trauma) have improved. Unfortunately, the same cannot be said for polytrauma. There is a high mortality rate amongst those with multisystem injuries, which can be attributed to the primitive state of trauma-care systems, lack of prehospital care and inadequate critical care. It is established that the mortality in serious injuries is much worse in a hill States than compared to that in plain states.

Despite trauma being a major public health problem with high morbidity and mortality, the Department of Health and Family Welfare has been slow in opening already announced Trauma Care Centres at Mandi, Bilaspur, Hamirpur and Solan. The existing systems for trauma care are elementary in nature, predominantly restricted to cities and semi-urban areas, without integration of region or statewide systems. No such systems exist in rural and remote areas to offer prompt life-saving treatment and safe transfer to an appropriate facility. Consequently fatal accident rate is higher in the state. The workforce available for prehospital and hospital-based critical care varies enormously. Available personnel and their skills often do not match the needs of the patients. The optimal number and type of prehospital personnel for ambulances is not defined. The concept of a dedicated trauma team is not accepted at all levels. At the majority of hospitals in the public health system, the casualty medical officer is the only one to respond to a demand for major resuscitation. This paradox is striking, resulting in the most seriously injured patients frequently being dealt with by the most junior and inexperienced staff. There are no plans for dynamic and flexible responses to the optimal management of trauma patients. The lack of precise and predetermined role allocation during peak periods of activity stresses the fragile current systems and workforce. The proposal for giving training to doctors either at PGI, Chandigarh or any other institute of repute on emergency care and trauma care is buried in files and no concrete steps have been taken so far to give such training to the doctors. It is for this reason that prehospital care is virtually non-existent in most rural and semi-urban areas in India, and implementation of the 'golden hour' concept is still an unachieved goal. The concept of a coordinating agency and a designated authority is restricted mainly to cities where trauma systems are operational in some form. Although the overall picture in trauma care is not as dismal as it used to be three decades ago, 'trauma care for all' continues to remain a distant dream in the state. Despite significant overall progress in many other fields, trauma systems in the health system of the state continue to remain at a formative stage because of procrastination. The Burden of Diseases Survey would wake the authorities, so we believe. The public health institutions will also benefit from adopting WHO Essential Trauma Care guidelines for trauma care, which is aimed at low cost improvements to trauma treatment in the state.

* * * * *

ENVIRONMENTAL POLLUTION AND MANAGEMENT

Environmental Pollution¹ and Management

“Environment” includes water, air & land and the inter- relationship which exists among and between water, air and land, and human beings, other living creatures, plants, micro-organism and property; “Pollutant” means any solid, liquid or gaseous substance present in such concentration as may be, or tend to be, injurious to environment; “Environmental Pollution” means the presence of any pollutant in the environment.

8.1 Status :

8.1.1 Air Pollution²

The earth is enveloped in a layer of gaseous mixture that is called the atmosphere or more commonly air. The atmosphere performs several important functions. The water cycle in the atmosphere is responsible for earth's climate, weather and for the processes of weathering and erosion. The carbon cycle incorporates the process of photosynthesis and cell respiration that are the source of carbon dioxide and oxygen. The nitrogen cycle results in nitrogen fixation i.e. nitrogen is made available in the form that living beings can use. The atmospheric ozone layer absorbs the damaging ultraviolet radiation from the sun. The atmosphere also protects the earth's surface from lethal cosmic rays from the space. The presence of ionosphere results in reflection of the outgoing radio waves back towards the earth making communications possible. The atmosphere maintains the heat balance of the earth. The living organisms thus depend upon the atmosphere for survival but they also modify its composition. The smoke and fumes from forest fires, volcanoes and crude domestic heating and cooking arrangements have caused air pollution since long, but it is the present human activities in aggregate that have caused great changes in the air composition.

The H.P. State Pollution Control Board (HPSPCB) was constituted in 1975 to perform regulatory functions as prescribed under various environmental legislations. The State Board has eleven Regional Offices at Shimla, Parwanoo, Paonta Sahib, Nalagarh, Baddi-Barotiwala, Una, Rampur, Jassur, Chamba, Kullu and Bilaspur. There is a Central Laboratory at Parwanoo and three Regional Laboratories at Paonta Sahib, Jassur and Sunder Nagar for providing scientific support to the regulatory functions.

¹ *Pollution* is the release of environmental contaminants. Carbon monoxide, sulfur dioxide, chlorofluorocarbons (CFCs), and nitrogen oxides produced by industry and motor vehicles are common air pollutants. Sunlight converts nitrogen oxides and hydrocarbons to ozone or smog. *Water pollutants* may consist of a wide range of organic and inorganic chemicals such as heavy metals, petrochemicals, chloroform, and bacteria. *Water pollution* may also occur in the form of thermal pollution and dissolved oxygen depletion. *Land pollution* is an important aspect of environmental pollution; this phenomenon occurs when chemicals are released by spill or underground storage tank leakage. Among the most significant soil contaminants are hydrocarbons, heavy metals, herbicides, pesticides and chlorinated hydrocarbons.

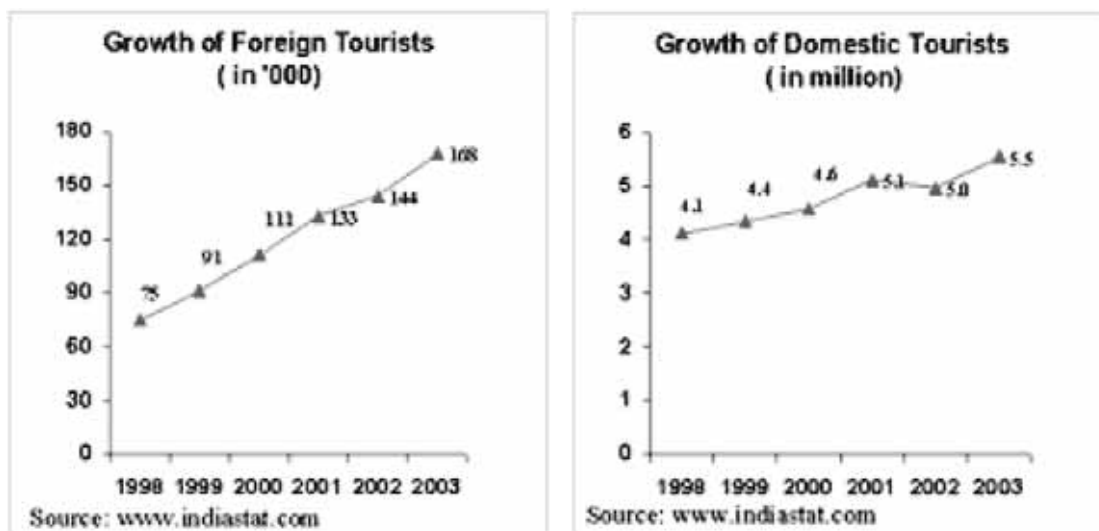
² *Air pollution* is a broad term applied to any chemical, physical (e.g. particulate matter), or biological agent that modifies the natural characteristics of the atmosphere. The atmosphere is a complex, dynamic natural system that is essential to support life on planet earth. Stratospheric ozone depletion due to air pollution has long been recognized as a threat to human health as well as to the earth's ecosystems. Air pollution is caused by gases like SO₂, CO, CO₂, NO₂, hydrocarbons Photo oxidants etc.

8.1.2 Ambient Air Quality:

Monitoring of Ambient Air Quality was started in H.P. as far as back in 1987. Over these 20 years, there have been significant change in pattern of industrialization and other activities that have an impact on air pollution. The road network in the State today is reaching far more interior; the dams are being constructed in remote areas. The air quality is thus bound to deteriorate. Air pollution in the State is thus governed from many sources such as industrial, vehicular, commercial, mineral mining, stone crushers, brick-kilns etc. However, pollution control regulatory authority such as State Pollution Control Board takes necessary measures to control/minimize pollution from time to time.

8.1.2.1 Air Pollution From Vehicles:

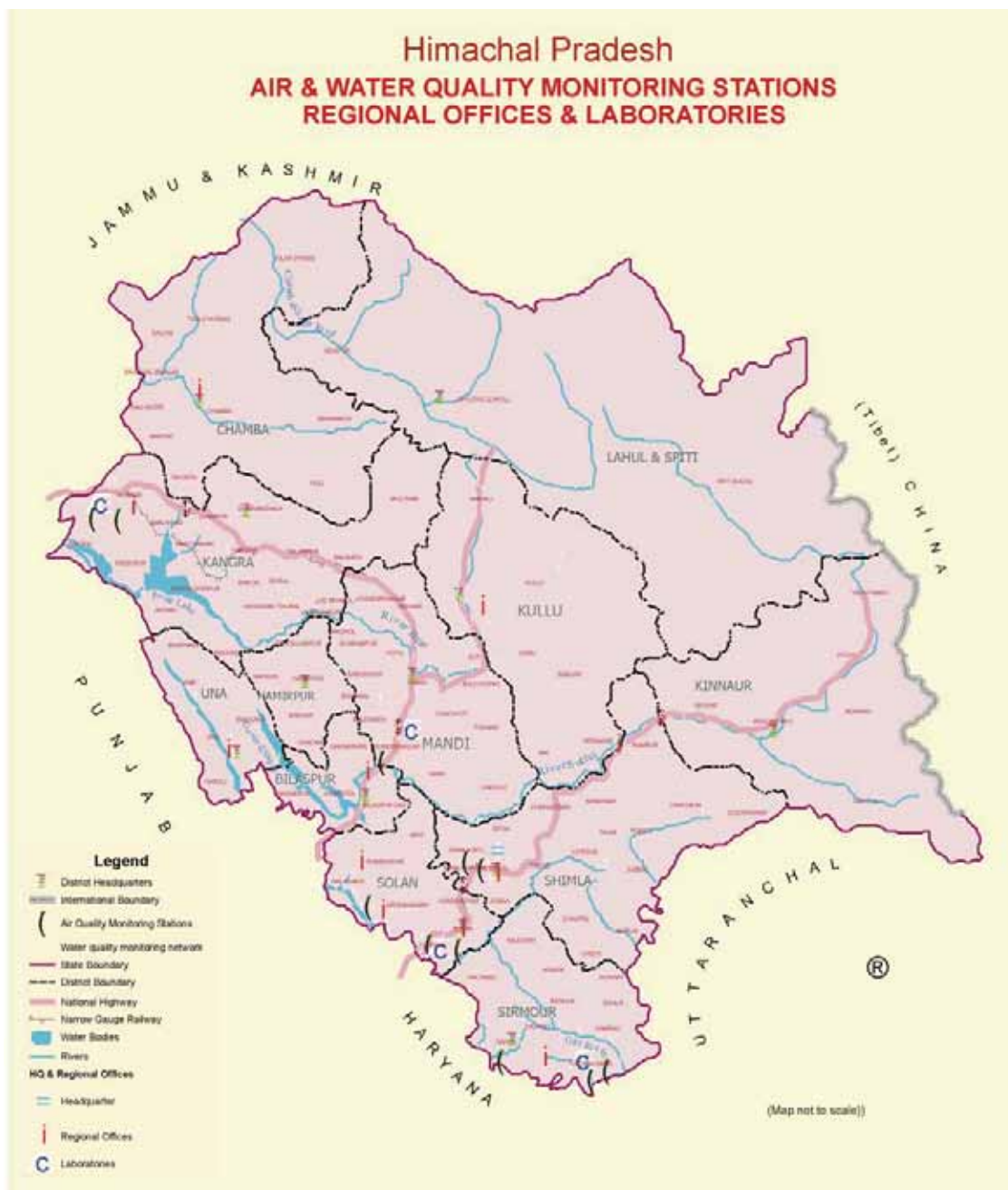
Tourism in Himachal Pradesh is one of the most important sectors for the state's economy. The major attractions in the state are tribal areas, its pilgrim centers, mountaineering and winter sports. Religious tourism is big as the State has more than two thousand temples attracting thousands of devotees from all over the country. The State ranks second in total tourism projects sanctioned between 2001-2004 in the country. Despite being small, the State ranks fifth in domestic tourist visits. The State enjoyed 14 per cent growth in the tourist visits against a national average of 6 per cent in 2001. [Source: IBEF: March 30, 2005]. During 2007-08, more than 88 lakhs of tourists visited the State, which increased from 79 lakhs during 2006-07 and 71 lakhs during 2005-06 [Department of Tourism, Govt. of HP]. **The large number of tourist's inflow leads to very high vehicular influx as the State being hilly the rail and air connections are limited.**



8.1.2.2 Air Pollution From Industries:

Mineral constitutes a fundamental component of State's economic base. The State has considerable mineral resources including rock salt, limestone, gypsum, silica-sand and baryte. Due to the high availability of quality limestone, a key raw material, the cement industry has flourished within the

State. Many domestic companies and MNCs have established their manufacturing facilities here. The three big cement plants of ACC, CCI and Ambuja Cements in the State have a total capacity of over 4 million tonnes per annum. They plan to further increase their capacity in future. Jai Prakash Associates is setting up a unit with an investment of USD 110 million in the State. Besides these, there are many other mineral-based units like stone crushing, calcium carbonate units, hydrated lime units etc within the state. Pharma units are being set up in Himachal Pradesh since there is special incentives policy pursued by the government. Ranbaxy, Torrent, Indo Pharma, Nectar Life Sciences, Indo-Swift Pharma (four units), Dr Reddy's Laboratories and Cipla are



(Source: HP State Pollution Control Board Shimla)

Map 1.14 Air & Water Quality Monitoring Network of State Pollution Control Board

some of the pharma companies that have manufacturing facilities in the state. UniChem plans to invest over USD 8.7 million on its third formulation manufacturing facility.

Indoco plans a formulation facility whereas Pulse Pharma plans its second plant for therapeutic nutrition in Baddi. Torrent plans is setting up a formulations plant at Baddi at a cost of USD 21.7 million. Zydus Cadila has also established a unit in Baddi. The **Baddi-Barotiwala-Nalagarh** region in Solan district has emerged as prominent industrial belt in the State. [Source: IBEF: March 30, 2005].

8.1.3 Impacts:

Ambient Air Quality is being monitored in the State in terms of SO₂ (Sulfur dioxide), NO_x (Nitrogen oxides), SPM (Suspended Particulate Matter) and RSPM (Respirable Suspended Particulate Matter) by the State Pollution Control Board under the Project – National Ambient Air Monitoring Programme (NAMP) as per details given in Table 8.94.

Table 8.94 Ambient Air Monitoring Stations in Himachal Pradesh

StationCode	City/town	Location	Category
34	Shimla	Takka Bench on Ridge	Sensitive
35	Shimla	Shimla Bus Stand	Residential
132	Parwanoo	Sector-IV	Residential
339	Parwanoo	Sector-1	Industrial
268	Jassur	Near PCB Office Damtal	Residential
271	Jassur	Old Road Damtal	Residential
117	Paonta Sahib	Paonta Sahib	Residential
118	Paonta Sahib	Gondhpur Industrial Area	Industrial
461	Kala Amb	Industrial Area Kala Amb	Industrial
530	Kala Amb	Trilokpur	Residential
449	Baddi	Baddi	Industrial

The **National Ambient Air Quality Standards (NAAQS)** are defined as the levels of air quality with an adequate margin of safety, to protect the public health, vegetation and property are given in Table 8.95. These standards were notified on 11th April 1994.

NAMP

The NAMP programme was launched by Central Pollution Control Board in 1984 with 7 stations at Agra and Annapara in Uttar Pradesh. The number of stations has increased steadily to 295 by 2000-01 spread over 98 cities/towns in 29 States and 3 Union Territories [Source: CPCB Annual Report 2002-03].

Table 8.95 National Ambient Air Quality Standards

Pollutants	Time Weighted Average	Concentration in Ambient Air $\mu\text{g}/\text{m}^3$		
		Category of Area		
		Sensitive Area	Industrial Area	Residential, Rural and Other Areas
Sulphur Dioxide, SO_2	Annual *	15	80	60
	24 hours **	30	120	80
Oxides of Nitrogen, NO_2	Annual	15	80	60
	24 hours	30	120	80
Suspended Particulate Matter, SPM	Annual	70	360	140
	24 hours	100	500	200
Respirable Suspended Particulate Matter, RSPM	Annual	50	120	60
	24 hours	75	150	100
Lead, Pb	Annual	0.5	1.0	0.75
	24 hours	0.75	1.5	1.0
Carbon Monoxide, CO	8 hours	1000	5000	2000
	1 hour	2000	10000	4000

* Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.

** 24-hourly/8-hourly values should be met 98% of the time in a year. However 2% of the time it may exceed but not on two consecutive days

[CPCB: NAAQMS/10/1998-99]

The Central Pollution Control Board (CPCB) has developed **AIR QUALITY CRITERIA** for the assessment of air quality. The monitored areas have been divided into three area classes as Industrial Area, Residential, Rural and other Area and Sensitive Area. The air quality is then classified on the basis of **Exceedence Factor (EF)** that is defined as observed annual mean concentration of a criterion pollutant divided by Annual standard for the respective pollutant and area class in terms of **Low** (Where EF is less than 0.5), **Moderate** (Where EF is between 1.0 and 0.5), **High** (Where EF is between 1.0 and 1.5) and **Critical** (Where EF is more than 1.5). On the above basis for the 3 Area Classes, the Air Quality of Himachal Pradesh works out to be as given in the following table:

In the whole country the three areas have been placed in the area Category-Sensitive as categorized under NAMP network. These are Agra (Station at Taj Mahal) in Uttar Pradesh, Shimla (Station at Tekka Bench Ridge) in Himachal Pradesh and Kota (Station at Barkhera) Rajasthan.

Table 8.96: Air Quality Status in Himachal Pradesh in Terms of Air Quality Category by CPCB

Location	1996				RPM	2004			
	Category	SO ₂	NO ₂	SPM		SO ₂	NO ₂	SPM	RPM
Shimla, Takka Bench on Ridge	Sensitive	L	M	H	NOT MONITORED	L	M	L	L
Shimla Bus Stand	Residential	L	L	M		L	L	L	L
Parwanoo Sector-IV	Residential	L	L	H		L	L	C	-
Parwanoo Sector-1	Industrial	L	L	L		L	L	L	M
Jassur Near PCB Office Damtal	Residential	L	L	M		L	L	M	-
Jassur Old Road Damtal	Residential	L	L	H		L	L	H	-
Paonta Sahib Industrial Area	Industrial	L	L	M		L	L	M	-
Paonta Sahib Industrial Area Gondhpur	Industrial	L	L	M		L	L	M	-

[Source: NAAQMS/10/1998-99 and Website HPSEP and PCB]

- A comparison of data of 1996 and 2006 as per Air Quality Criteria laid down by CPCB shows that air quality remains unchanged except for SPM levels in Shimla that show improvement in Air Quality Category. Another positive aspect is that HPSPCB has started monitoring RSPM at some stations. The Respirable Suspended Particulate Matter (RSPM) corresponds to particles that are less than 10-micron in size and therefore more important from health point of view as these can reach our lungs.

The Government of Himachal Pradesh under the Motor Vehicle Act, 1989 has also empowered the Regional Officers of the State Pollution Control Board with checking

<http://www.tribuneindia.com/2002/20021203/himachal.htm#1> Rakesh Lohumi, Tribune News Service Shimla, May 1

Vehicular emission is gradually emerging as a major source of air pollution in the state. The occasional checking conducted by the state Transport Department has failed to produce the desired results and a majority of vehicles in the state have not been conforming to the standards laid down under the Motor Vehicles Act. Even government vehicles and buses of the state road transport corporation have not been meeting the standards. The phenomenal increase in the number of vehicles, particularly commercial vehicles, over the past decade had also been responsible for the increasing air pollution. At present over 45,000 commercial vehicles are registered in the state.

Vehicular pollution is also a cause of concern in major towns. The pollution checking carried out by the state Pollution Control Board in the state capital three days ago revealed that over 60 per cent vehicles were not conforming to the standards. The level of emissions exceeded the permissible limits in 348 of the total 560 vehicles checked by the board. In case of petrol-driven vehicles, 56 of the 126 vehicles were found to be violating the norms. In diesel-driven vehicles, the percentage of polluting vehicles was 67 per cent. In the case of government vehicles, of the 49 vehicles checked, the level of emissions was found to be above the limit in 29. In all, 79 vehicles were challaned for not conforming to the emission standards.

of the vehicles. The State Board is regularly monitoring vehicles during mass awareness camps organized from time to time in the State. The State Board is regularly monitoring vehicles during mass awareness camps organized from time to time in the State. The State Board has monitored 1579 vehicles during the year 2006-07 and 125 vehicles were challaned for non-compliance of emission standards. [Source: Annual Report 2005-06, HPSEP and PCB].

- The State Pollution Control Board also regulates air pollution from sources such as stone crushers and brick-kilns. State Board grants consent to the stone crushers under the provisions of the Water (Prevention and Control of Pollution) Act, 1974 and Air (Prevention and Control of Pollution) Act, 1981. At present there are 320 stone crushers in the State.
- There are 102 brick kilns in the State brought under the consent mechanism of the State Board. Brick kilns mainly cause air pollution and water pollution is not a significant issue in them. All these brick kilns have provided the requisite air pollution control systems as per norms prescribed under the Environment (Protection) Act, 1986.
- In addition to above State Board also monitors hotels in the State. There are 1085 hotels identified by the State Board under the provisions of Water (Prevention and Control of Pollution) Act, 1974 and/or Air (Prevention and Control of Pollution) Act, 1981.
- Development of hydropower is one of the major thrust areas in the State. The State Government has resolved to utilize entire 21000 MW of identified potential for economic growth. The State Pollution Control Board monitors the muck disposal and minimum water discharge norms in the hydel projects for ensuring proper & adequate protection works in the designated muck dumping sites to prevent the pollution of water in streams. Brief details are as under:
 - It has been mandatory for any hydel project to first prepare the muck dumping sites with proper protection before starting work on the project.
 - All muck dumping sites to have RCC/RR masonry protection structures to prevent spillage of muck into aquatic systems.
 - Regular monitoring of muck disposal in the designated site. The State Board at present is monitoring 17 major/small and 55 micro hydel projects under construction.
 - The State Board maintains public interface with all the stakeholders including general public and local bodies, gram panchayats through conduct of Environmental Public Hearings to integrate people's concerns in the process of development.
 - A provision of minimum 15% water discharge downstream of diversion works of hydel power projects throughout the year has been made mandatory in order to maintain the aquatic natural balance.

8.1.4 Air Quality Trends in H.P.:

The recent trend of air quality revealed that higher concentration of SPM/RSPM in Residential areas such as Station No-1 in Paonta Sahib, Station No-1 in Jassur and Sector – IV in Parwanoo is mainly due to more traffic movement in these areas. Whereas, higher concentration of SPM in Paonta Sahib industrial area is contributed by industrial, construction activities & vehicle movement in the area. Station-wise details of concentration of SPM/RSPM, SO₂ and NO_x are illustrated as below.

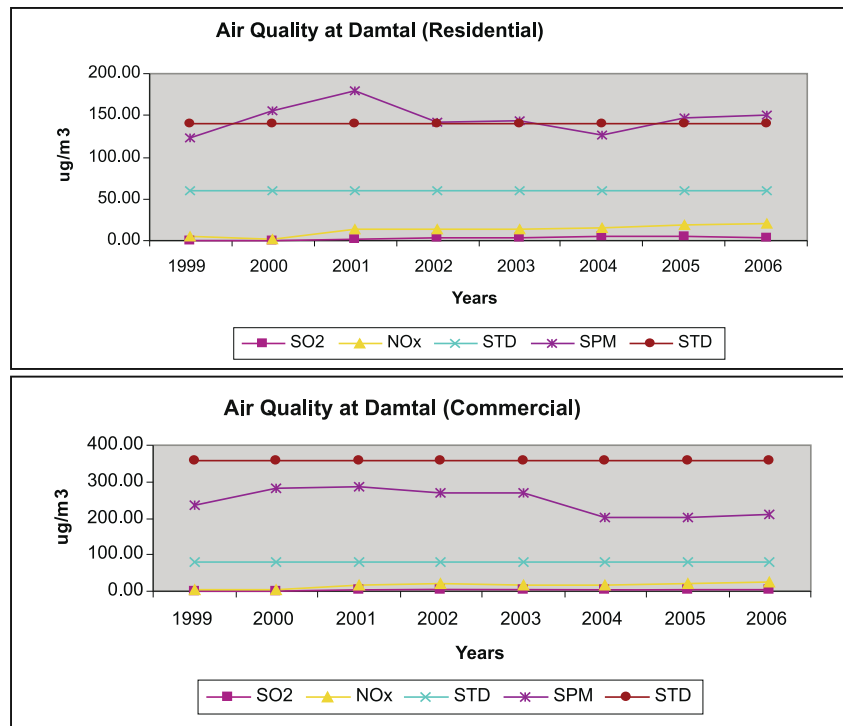
8.1.4.1 Air Quality at Shimla:

Air quality at Shimla is within the prescribed standards so far as concentration of gaseous pollutants (SO₂, NO_x) are concerned. However, there is a sharp rise in the concentration of SPM during 2006 resulting in to poor air quality of the city, which is mainly arising out of fuel combustion in automobile sector, which has increased exponentially.



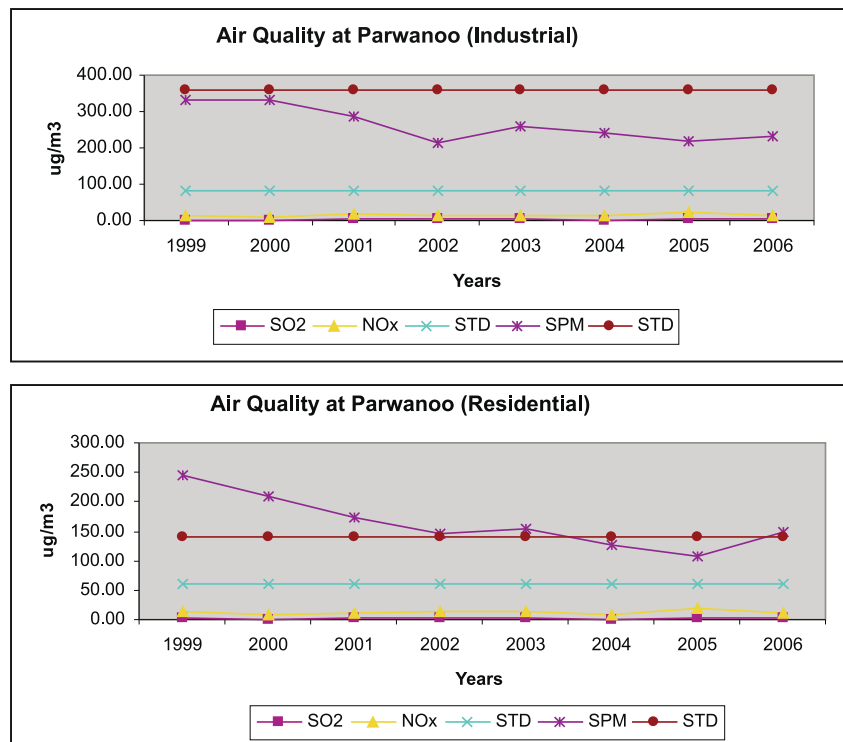
8.1.4.2 Air Quality at Damtal (Jassur, Kangra):

Air quality at Damtal has shown a marginal improvement and concentration of SPM (pollutant) is close to the standards. Whereas, concentration of gaseous pollutants is much below the standards.



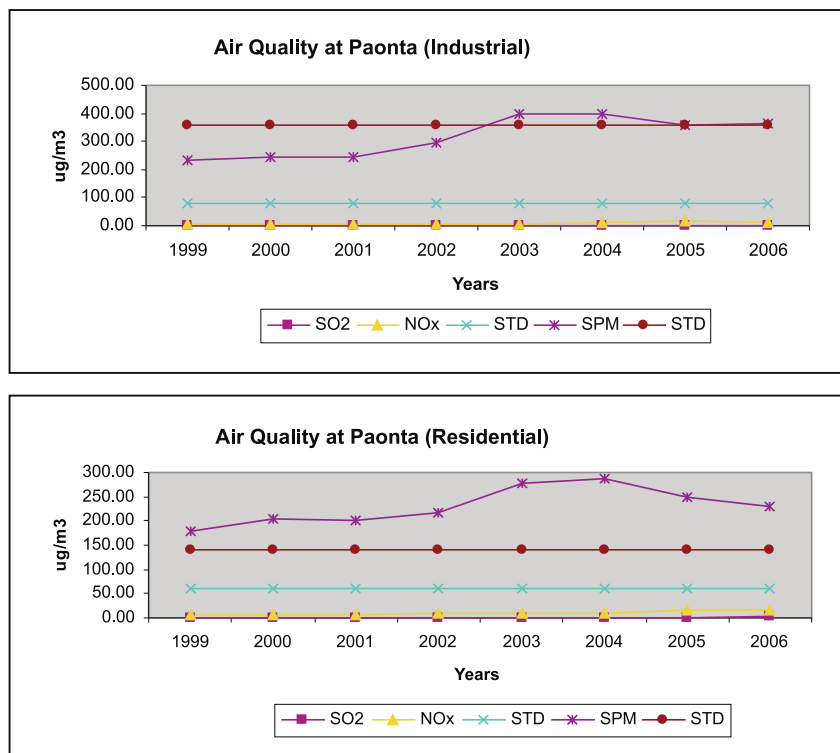
8.1.4.3 Air Quality at Parwanoo:

Although the air quality at Parwanoo is within the prescribed standards, however, SPM concentration has shown increasing trend in the residential area during 2006. Overall, there is a significant improvement in the quality of air of the town as concentration of pollutants shows decreasing trends.



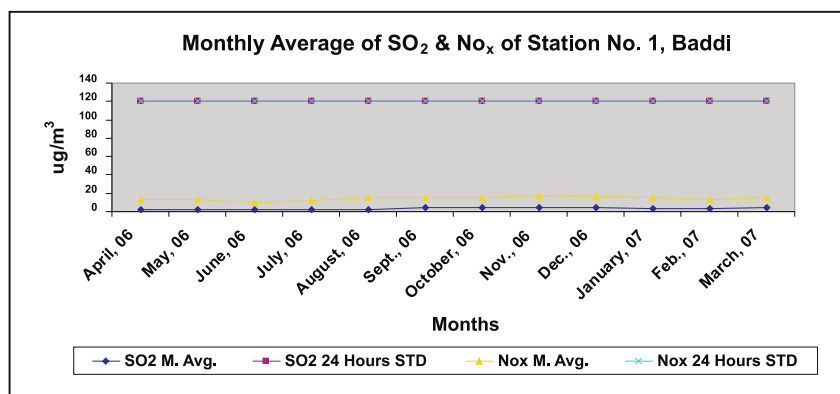
8.1.4.4 Air Quality at Paonta Sahib:

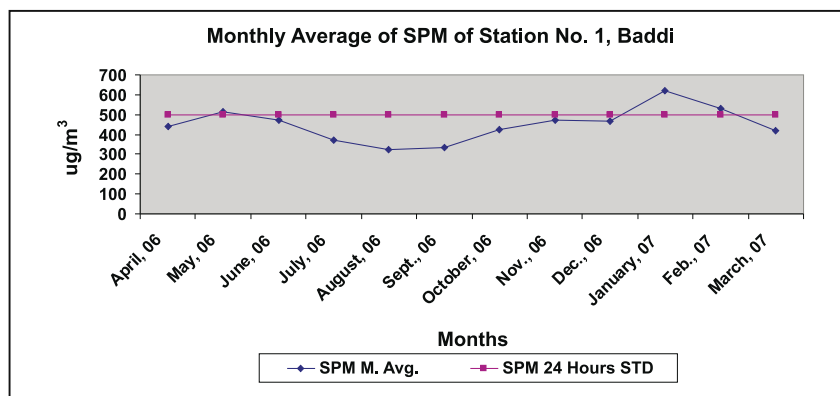
Air quality at Paonta Sahib is within the prescribed standards with regard to concentration of gaseous pollutants. However, the concentration of SPM (pollutants) earlier showing increasing trend has shown marginal improvement during the last years.



8.1.4.5 Ambient Air Quality at Baddi:

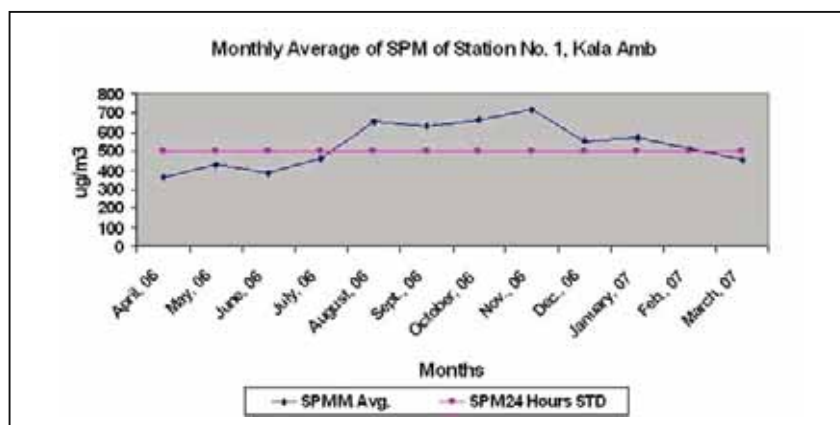
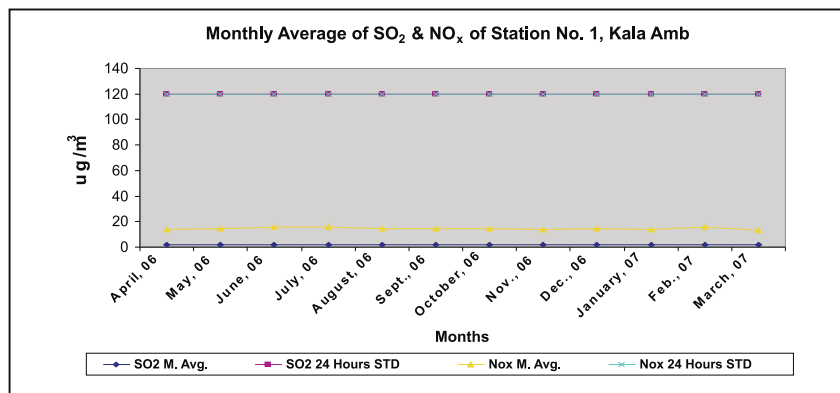
Monitoring of Ambient Air Quality at Baddi was recently started. Ambient Air quality at Baddi (Industrial Area) is very well within the prescribed standards with regard to concentration of gaseous pollutants. However, the concentration of SPM (pollutants) earlier showing increasing trend has now shown marginal improvement during the preceded months, which is mainly due to increased infrastructure construction activities in the area.



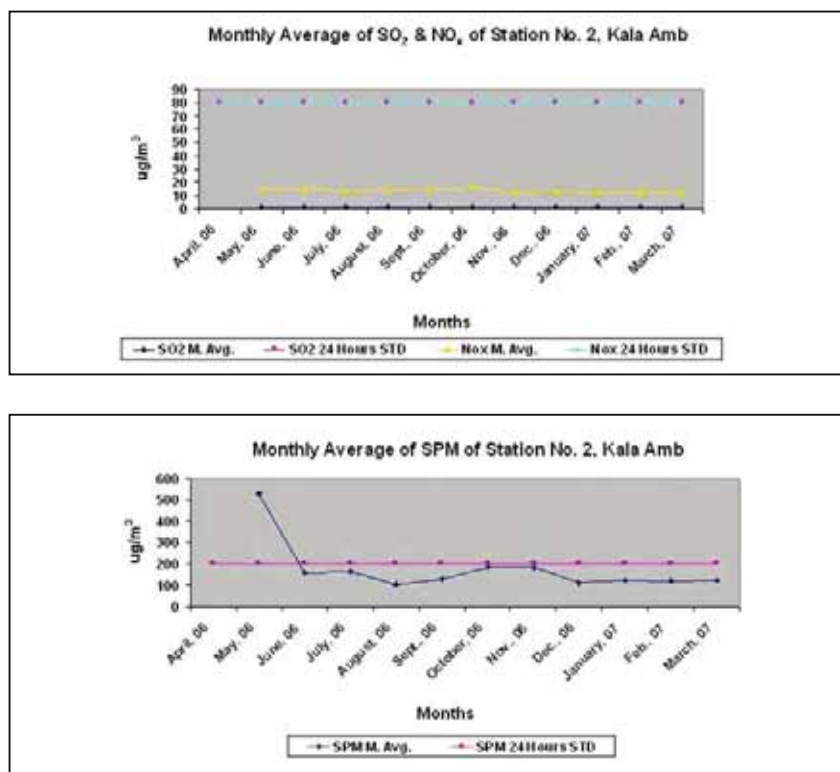


8.1.4.6 Ambient Air Quality at Kala Amb:

Monitoring of Ambient Air Quality at Kala Amb was recently started. Ambient Air quality at Kala Amb (Industrial Area) is very well within the prescribed standards with regard to concentration of gaseous pollutants. However, the concentration of SPM (pollutants) earlier showing increasing trend has now shown marginal improvement during the preceded months, which is mainly due to increased infrastructure construction activities in the area.



Ambient Air quality at Kala Amb (Residential area) is well within the prescribed standards with regard to concentration of gaseous & particulate pollutants.



8.1.5 Status of Air Pollution Control and Management:

8.1.5.1 Control and Management of Industrial Pollution: In regulating the Air Act for control & abatement of air pollution, provisions related to consent in section-21 of the said Act are most significant as the consent & its conditions are the foremost means for prevention, abatement and control of pollution. This is ensured in the following manner:

1. Consent to Establish is granted to the industry after evaluation of the potential air pollution and after the examination of the engineering design and details of the systems proposed for controlling the air pollution. The conditions consistent to air pollution control requirements are incorporated in Consent to Establish.
2. These conditions are reviewed in terms of their compliance and 'Consent to Establish' is converted to 'Consent to Operate' after ensuring that the engineering systems for control of air pollution are fully implemented.

8.1.5.2 Control of Vehicular Pollution: The Government of Himachal Pradesh under the Motor Vehicle Act, 1989 has also empowered the Regional Officers of the State Board with checking of the vehicles. The State Board through its Regional Office regularly conducts vehicular monitoring.

8.1.5.3 Control of Air Pollution in Hydroelectric Power Projects

- Dust containment and suppression systems in the stone crushing units

- Water sprinkling on haulage roads
- Cyclones/Multicyclones in the batching plants
- Ventilation systems in the tunnels & adits
- Protection & restoration of Muck Dumping sites

8.1.6 Response:

There is a need to increase the number of ambient air quality monitoring stations in the State so that the network is more representative. Recently, the CPCB has approved four new NAAQM stations for the State, which would be set up at Mandi, Dharmashala, Una and Sundernagar. It is also important to start monitoring of RSPM and CO (Carbon Monoxide) concentration.

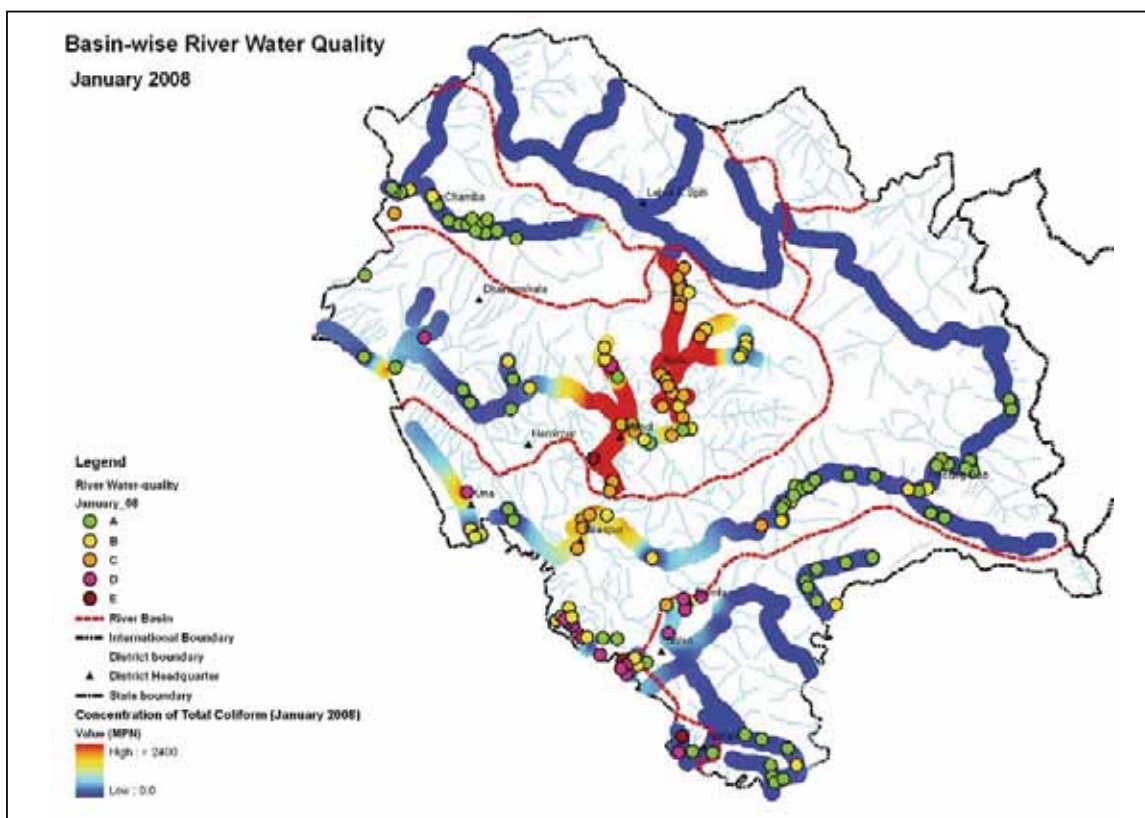
It is evident that to control the menace of vehicular pollution efforts have to go beyond organizing awareness camps or conducting surprise checks. It is important that authorities create an infrastructure for vehicular monitoring to ensure planned and intensive checking on regular basis at State's entry points. There is also a need to look at other technology options as use of Compressed Natural Gas (CNG) to run the vehicles.

The State Board, in the pursuit of discharge of its functions bestowed on it under Air (Prevention and Control of Pollution) Act, 1981 besides other Rules notified under the Environment (Protection) Act, 1986 ensures sustainable development with due regard to the environmental considerations. The State Board on one hand ensures smooth functioning of the pollution control systems installed in the existing industries and also ensures that new industries operate only after installing appropriate pollution control systems. **The cumulative number of Air Pollution Control System in the State is 1821. During the year 2006-07 the State Board under section-21 of the Air Act, issued 47 Consents to Establish, 35 Consents to Operate and renewed consent to 152 industries** [Source: Annual Report 2006-07].

8.2 Water Pollution:

8.2.1 Pressure:

With the increasing population, urbanization and industrialization it is becoming difficult to provide adequate amount of water to the users. At the same time the problem of water quality has cropped up and has become more important in the recent years rather than quantity of water. It is almost impossible to find pure water in nature as water being a universal solvent readily dissolves and collects all kinds of impurities but the crux of the problem lies in the contamination that is taking place due to human activities. The pollution by human activities emanating either from use of water for domestic or industrial purposes or as a result of ever increasing rate at which organic or inorganic chemicals, pesticides, heavy metals are being used and are being released into the atmosphere or over land whereby they are able to enter the water cycle have degraded our water resources to a large extent. The industrialization coupled with discharge of untreated sewage is responsible for deterioration in water quality.



Map 1.15 Basin wise River Water Quality

Source: HPPCB

8.2.2 Surface Water Quality

The assessment of the status of water quality of the natural water bodies and rivers is one of the most important activities of the State Pollution Control Board. Analysis of water quality data not only helps in ascertaining the nature and extent of the pollution control measures but also impact on the water quality. The Central Pollution Control Board (CPCB) under the National Program of Monitoring of Indian Natural Aquatic Resources (MINARS) is sponsoring the water quality monitoring of major rivers of the State. The samples are collected quarterly i.e. in the month of *January, April, July* and *October* each year. In all 34 points have been selected on major rivers i.e. Satluj, Beas, Ravi, Parvati and samples are being analyzed for 36 parameters which includes the Physio-chemical and bacteriological contents. Recently the Central Pollution Control Board / Ministry of Environment & Forests, Govt. of India has issued Water Quality Protocol which is being followed by the State Board.

There are four major rivers systems in the State, whose catchments cover 75% of the State's physical area, and is the home to 80% of its population. These rivers are Satluj, Beas, Ravi and Yamuna.

The existing status of water quality at various monitoring stations (as marked on the map) in upper catchment areas of Rivers have shown the water quality to be either of 'A' category or 'B' and at few locations of 'C' category due to the presence of "Total Coliforms". Details of concentration of Total Coliforms are depicted in the following graph.

1. The River Beas at D/S of the towns Manali, Kullu, Mandi and Dehra shows the contamination of water mainly due to sewage contributing to higher levels of Total Coliform.
2. The River Satluj is found slightly polluted in the down streams of the towns Rampur, Bilaspur etc.
3. The River Yamuna is also found slightly polluted in the down-streams of the towns Paonta Sahib.
4. The River Ravi is also slightly polluted in the down streams of the town Chamba mainly due to contamination of sewage.
5. In the industrial area of Baddi, Barotiwala, Nalagarh, Kala Amb & Parwanoo where the water quality of the River Sirsa, Markanda and Sukhna Nallah is 'D' because of low levels of oxygen due to organic pollution.

Summary of river basin-wise monitoring numbers and status of overall surface water quality with respect to important water quality parameters are as follow:

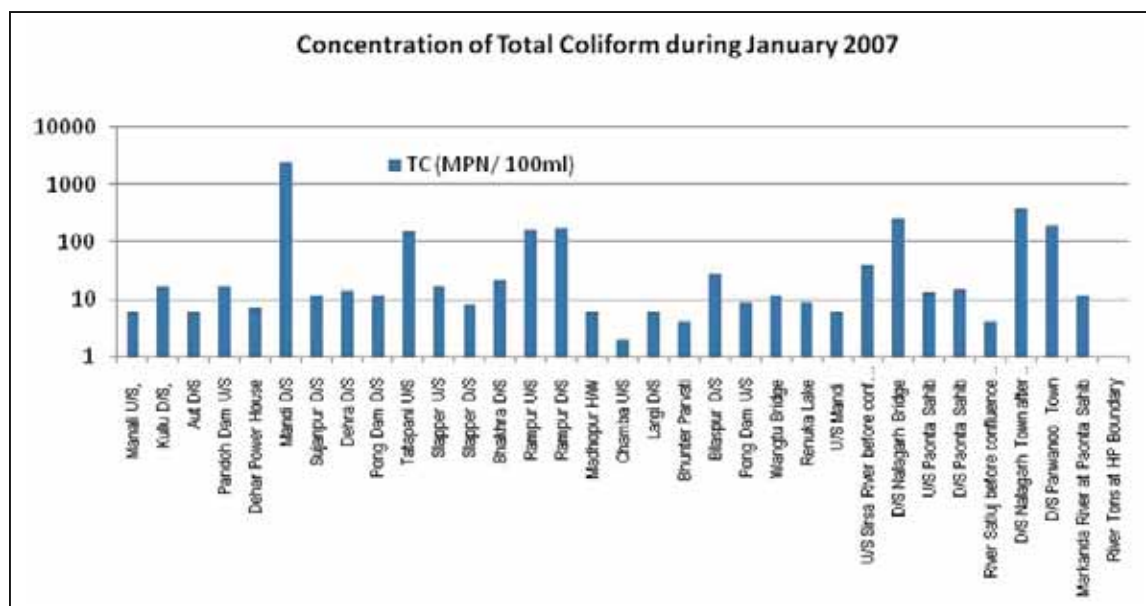
Table 8.97: River-Wise Water Quality Status (January 2007)

S. No	Rivers	Monitoring point	Status of water quality	Remarks
1	Beas	12	A to C	Untreated sewage pollutes river D/S of Kullu & Mandi town.
2	Ravi	2	A	Water quality is very good.
3	Satluj	9	A to B	Water quality is good. Though, untreated sewage from Rampur and Bilaspur pollute the river.
4	Parvati	1	A	Water quality is very good.
5	Pabber/Tons	1	A	Water quality is very good.
6	Yamuna	2	A	Water quality is very good.
7	Sirsa	3	A to D	Industrial and domestic effluent pollutes river in Baddi, Barotiwala and Nalagarh region.
8	Renuka Lake	1	A	Water quality is very good.
9	Sukhana	1	D	Industrial and domestic effluent pollutes river in D/S Parwanoo town.
10	Lift Nala MSW site	1	D	Effluents from hotels and domestic sources pollute river in D/S Shimla town.
11	Swan	2	A to B	Water quality is good.
12	Markanda	1	A	Water quality is very good.

[Source: HPSPCB Shimla]

The reason for above quality however may be attributed primarily to the following reasons:

- Illegal dumping of Municipal Solid Waste: Resultantly the waste is being disposed off along hill slopes and in our river system. Now, the Municipal Authorities has started setting up proper waste disposal facility in the State.
- Disposal of untreated waste water/Sewerage water etc.



[Source: HPSPCB Shimla]

8.2.3 Impacts:

The quality of surface water in the country are monitored via a network that functions in a 3-tier system; **Tier-I:** Global Environmental Monitoring System (GEMS); **Tier-II:** Monitoring of Indian National Aquatic Resources Systems (MINARS); **Tier-III:** Water Quality Monitoring by State Pollution Control Boards in addition to GEMS and MINARS. At present it comprises of 784 stations spread over the country. [Source CPCB Annual Report 2002-03]. In Himachal Pradesh water quality is being monitored at 54 Locations (18 wells) under MINARS, 63 locations under State Monitoring Programme and 15 locations under MSW & 2 location for TSDF well, 55 under Hydroelectric monitoring activity at the end of year 2007. The Use-Classification and Primary Water Quality Criteria developed by CPCB for assessing the water quality for fresh water are given in Table 8.98.

The Surface Water Quality of Rivers in Himachal Pradesh in terms of few parameters such as pH, DO (Dissolve Oxygen), BOD (Biochemical Oxygen Demand) and TC (Total Coliform) as reported by the State Board is given in Table 8.99. A total of 22 Parameters are monitored, however, only key parameters are reported in the Table 8.99.

Table 8.98: Primary Water Quality Criteria and Designated Best Use of Fresh Waters

Characteristics	A*	B*	C*	D*	E*
Dissolved Oxygen (DO) mg/l, Minimum	6	5	4	4	-
Biochemical Oxygen Demand (BOD) mg/l, Maximum	2	3	3	-	-
Total Coliform (TC) Organism MPN/100 ml, Maximum **	50	500	5000	-	-
pH value	6.5 - 8.5	6.5 - 8.5	6 - 9	6.5 - 8.5	6.5 - 8.5
Free ammonia (as N), mg/l, Maximum	-	-	-	1.2	-
Electrical conductivity, micro-mhos per centimetre	-	-	-	-	2250
Sodium Absorption Ratio (SAR), Maximum	-	-	-	-	26
Boron, mg/l Maximum	-	-	-	-	2
*Class-A	Drinking water source without conventional treatment but after disinfection.				
Class-B	Outdoor bathing organized.				
Class-C	Drinking water source with conventional treatment followed by disinfection.				
Class-D	Propagation of wildlife, fisheries.				
Class-E	Irrigation, industrial cooling, controlled waste disposal.				

[Source: CPCB Parivesh, Vol.-I, 1995, No.4]

Table 8.99: Surface Water Quality of Rivers in Himachal Pradesh (January 2007)

Location/ Station Code	pH	DO (mg/l)	BOD (mg/l)	TC (MPN/ SPC/100ml)
Manali U/S, 1001-R-BEA-A	7.55	11.0	0.2	6
Kullu D/S, 1002-R-BEA-A	7.51	11.2	0.6	17
Aut D/S, 1003-R-BEA-A	7.86	11.0	0.2	6
Pandoh Dam U/S, 1004-R-BEA-A	7.83	11.1	0.3	17
Dehar Power House, 1005-R-BEA-A	7.96	12.8	0.1	7
Mandi D/S, 1006-R-BEA-A	7.58	9.5	13.0	>2400
Sujanpur D/S, 1007-R-BEA-A	8.68	8.3	0.8	12
Dehra D/S, 1008-R-BEA-A	8.60	8.1	0.9	14
Pong Dam D/S, 1009-R-BEA-A	8.48	8.0	0.8	12
Tatapani U/S, 1013-R-SAT-A	8.17	11.7	0.3	160
Slapper U/S, 1014-R-SAT-A	8.03	11.2	0.3	17
Slapper D/S, 1015-R-SAT-A	8.00	12.0	0.1	8
Bhakhra D/S, 1016-R-SAT-A	8.24	9.1	0.2	22
Rampur U/S, 1086-R-SAT-A	8.24	11.9	0.2	162
Rampur D/S, 1087-R-SAT-A	8.14	11.5	0.4	180
Madhopur H/W, 1088-R-RAV-A	8.49	9.3	0.7	6

Location/ Station Code	pH	DO (mg/l)	BOD (mg/l)	TC (MPN/ SPC/100ml)
Chamba U/S, 1089-R-RAV-A	8.26	10.0	0.7	2
Largi D/S, 1090-R-LAR-A	7.94	11.3	0.3	6
Bhunter Parvati, 1290-R-PAR-A	7.28	11.0	0.2	4
Bilaspur D/S, 1291-L-GOL-A	8.08	10.0	0.8	27
Pong Dam U/S, 1292-L-PDL-A	8.07	8.2	0.7	9
Wangtu Bridge, 1389-R-SAT-A	8.21	11.6	0.3	12
Renuka Lake, 1429-L-REL-B	8.19	6.2	0.6	9
U/S Mandi 1550-R-BEA-A	7.93	11.0	0.3	6
U/S Sirsa River before conf. of Sitomajri Nallah, 1551-R-SIRSA-A	7.29	8.9	2.0	40
D/S Nalagarh Bridge, 1552-R SIRSA-A	8.26	8.4	3.0	260
U/S Paonta Sahib, 1553-R-Yamuna-A	6.71	9.0	0.6	13
D/S Paonta Sahib, 1554-R-Yamuna-A	7.14	8.9	0.6	15
River Satluj before confluence of River Spiti at Khab, 1867-R- Satluj	8.28	11.5	0.1	4
D/S Nalagarh Town after meeting with Khad, 1868-R-Sirsa	8.10	8.0	4.8	380
D/S Parwanoo Town, 1870- R- Sukhna	7.97	6.0	120	200
Markanda River at Paonta Sahib, 1871-R-Markanda	7.54	8.3	0.2	12
River Tons at HP Boundary, 1510-R-Tons	-	-	-	-

[Source: HPSPCB Shimla]

8.2.4 Responses:

In case of major rivers on the basis of Primary Water Quality Criteria developed by CPCB, it can be concluded that quality of river falls under 'A' category of water with respect to pH, DO and BOD but has to be categorized in 'C' category due to higher levels of Total Coliform. Discharge of untreated sewage from the towns on the river banks is the main reason behind this and installation of Sewage Treatment Plants by municipal authorities needs to be taken on priority. The State Board, in the pursuit of discharge of its functions bestowed on it under Water (Prevention and Control of Pollution) Act, 1974 besides other Rules notified under the Environment (Protection) Act, 1986 ensures sustainable development with due regard to the environmental considerations. **The cumulative number of Water Pollution Control System in the State is 1955. During the year 2006-07 the State Board under section-25/26 of the Water Act, issued 115 Consents to Establish, 133 Consents to Operate and renewed consent to 598 industries.** [Source: Annual Report 2006-07, HPSEP and PCB].

With a pro-active policy of the government, Himachal has managed to woo significant investment in the recent past and industrialization in the state is increasing rapidly. It thus becomes imperative for the State Board to be more vigilant. The State Board has undergone a radical transformation in the recent years from merely being a regulatory agency to an interactive, participative and scientific organization. Some of the noteworthy steps taken in this directions by the Board focus on Concept of Joint Industrial Planning and Management so as to associate the industries, local bodies, NGOs, and public in the endeavours for prevention and control of pollution and Self Regulatory Order that lays down the self-assessment and self regulation as an essential ingredient of environmental monitoring by forming a peer group among the industries themselves to exert pressure on the defaulters.

In addition to monitoring carried out under MINARS, the State Board also monitors water quality of Khads, Nallahs and Lakes such as Giri River, Markanda River, Sirsa River, Kaushalya River, Swan Khad, Banner Khad, Jattawal Nallah, Sukhana Nala, Khajjiar Lake, Riwalser Lake.

8.2.5 Sanitation:

Management of Sewage: As per the findings of the monitoring of different waterbodies carried out by the State Board, untreated sewage emerged as a single largest polluter as trends w.r.t. Faecal Coliform and BOD is on rise. To check pollution due to sewage the State Board by intervention and constant persuasion of concerned authorities got commissioned 23 numbers of STPs and 32 numbers of STPs are under construction by I&PH Department as detailed below:

Table 8.100: Number of STPs Commissioned and Under Construction

No. of STPs commissioned	No. of STPs proposed/under construction (up to 31/12/2007)	No. of STPs required to cover major Urban Local Bodies
23	32	32 26

(Source: HP State Pollution Control Board Shimla)

In remaning left out areas, sewage system is characterized by septic tanks. In most of the cases, these septic tanks are also not designed or maintained properly. Moreover, rocky mountains also cause run over rather than infiltration, thus soak pits do not work in the desired manner which leads to unhygienic conditions & the untreated sewage takes its course into various rivers/khads/nallah. As far as coverage of various urban/large rural settlements is concerned, the following are the details of sewage management systems in the State :

Table 8.101: Details of Sewerage Schemes in HP

District	No. and Location of STPs in operation	No. and Location of STPs proposed/ under construction	No. and Location of STPs required for Left out areas falling within the Municipal limits in H.P.
Bilaspur	2 [Ghumarwin, Naina Devi ji]	1 [Bilaspur]	1 [Talai]
Chamba	2 [Bhagot, Barga]	—	3 [Dalhausie, Chowari, Bakloh]
Hamirpur	1 [NIT Hamirpur]	6 Zone-I, Zone-II, Zone-III [Hamirpur], Zone-I, Zone-II [Sujanpur], Nadaun	1 [Bhota]
Kullu	2 [Manali, Kullu (Bhootnath)]	6 [Lanka Banker, Badah (Kullu), Mela Ground, Jard, Sharabai, Hati-Than (Bhunter)]	1 [Banjar]
Kangra	4 [Palampur, Jawalamukhi, Challian at Dharamsala, MC Tanda]	4 Zone –I, Zone-II, Zone-III (Kangra) Nagrota	3 [Nurpur, Dehra, Yol]
Kinnaur	1 [Reckongpeo]	—	—
Lahaul & Spiti	—	3 Zone-I, Zone-II, Zone-III [Keylong]	—
Mandi	3 [Khaliar, Raghunath Ka Padhar, Sundernagar]	2 [Sarkaghat, Neri Khadd (Joginder Nagar)]	1 [Rewalsar]
Shimla	7 [Sanjauli, Lalpani North Disposal, Dhalli Summer Hill, Snowdown, Rohroo]	2 [Rampur, Jubbal]	6 [Theog, Chopal, Kotkhai Narkanda, Suni, Jatog]
Solan	1 [Arki]	2 [Solan]	6 [Baddi, Nalagarh, Parwanoo Kasauli, Subathu, Dagshai]
Sirmour	—	1 [Paonta]	2 [Nahan, Rajgarh]
Una	—	6 Zone-A, Zone-B, Zone-C, Zone-D (Una), [Mehatpur, Santokhgarh]	2 [Gagret, Daulatpur]
Total	23	32	26

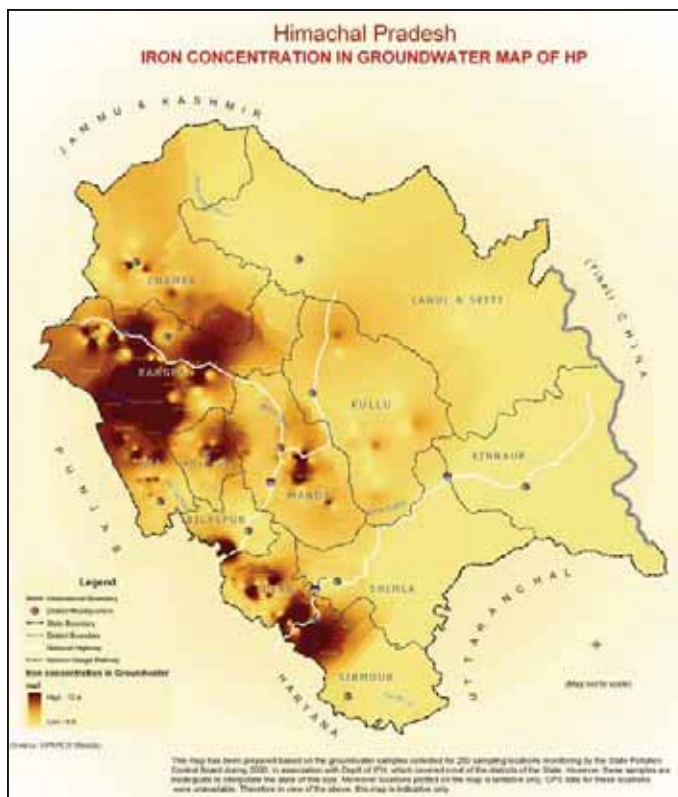
(Source: HPSPCB Shimla)

8.3 Ground Water Pollution :

The State Board also monitors the ground water quality of major industrial areas of the State. The monitoring is carried out on quarterly basis at 17 different locations. The ground water quality in the State is observed to be absolutely safe. In addition to above, the State Pollution Control Board monitored 250 samples collected from different parts of the State and water quality was assessed in terms of microbiological and chemical water quality and the results were compared with WHO Guidelines. Based on the above data, a map was prepared on the iron concentration depicting spatial distribution of iron through interpolation method of GIS.

As per WHO guidelines “Anaerobic ground water may contain ferrous, iron at concentrations of up to several milligrams per litre without discoloration or turbidity in the water when directly

pumped from a well. On exposure to the atmosphere, however, the ferrous iron oxidizes to ferric iron, giving an objectionable reddish-brown colour to the water.” Iron also promotes the growth of “iron bacteria,” which derive their energy from the oxidation of ferrous iron to ferric iron and in the process deposit a slimy coating on the piping. At levels above 0.3 mg/litre, iron stains laundry and plumbing fixtures. There is usually no noticeable taste at iron concentrations below 0.3 mg/litre, although turbidity and colour may develop. Iron concentrations of 1-3 mg/litre can be acceptable for people drinking anaerobic well water. There is no health-based guideline value is prescribed by WHO. Sampled data interpolated through are shown in Map 1.16.



Map 1.16 Interpolated Iron Concentration
(Source: HPSPCB Shimla)

8.4 Land Pollution

The pollution from Solid wastes:

Municipal wastes, hazardous wastes and biomedical wastes are attaining alarming proportions all over the country. This has led to enactment of individual legislations as Municipal Solid Wastes (Management and Handling) Rules, 2000; Bio-medical Waste (Management and Handling) Rules, 1998; Hazardous Waste (Management and Handling) Rules, 1989 and Amendment Rules, 2003.

In tourist centers in particular, solid waste management and the plastic bag problem has become a plague. Carelessly dumped polythene bags on the slopes, mar the scenic beauty of the hills. These are an eyesore and, being non-biodegradable, are ultimately washed into drains and nullahs and choke them. The medical institutions are generating bio-medical waste and the disposal is undertaken without complying with the statutory provisions. The industries so far are storing hazardous wastes with in their premises. This is, however, not a long term solution.

8.4.1 Municipal Solid Waste Management:

Municipal Solid Wastes (Management & Handling) Rules, 2000 provide procedure, provisions for handling and management of municipal solid wastes in an environmentally sound and safe manner.

Municipal solid waste consists of household waste, construction and demolition debris, sanitation residue, and waste from streets. This garbage is generated mainly from residential and commercial

complexes. With rising urbanization and change in lifestyle and food habits, the amount of municipal solid waste has been increasing rapidly and its composition is also changing.

There has been a significant increase in the quantities of municipal solid wastes and hazardous waste generated in Himachal Pradesh. The approximate quantity of municipal waste generated in the State is 300-350 Tonnes/day. The rate of generation of solid waste in urban centres has outpaced population growth in recent years with the wastes normally being disposed off in low-lying areas of the town's outskirts. The municipal waste generated in cities and towns is managed under the provisions of Municipal Solid Waste (Management and Handling) Rules, 2000.

i) Responsibilities / Functions:

- a) Responsibility of Municipal Authority: Every municipal authority shall within the territorial area of the municipality, be responsible for the implementation of the provisions of these Rules and for any infrastructure development for collection, storage, segregation, transportation, processing and disposal of municipal solid waste.
- b) Responsibility of the State Government:
 - The Secretary-in charge of the Department of Urban Development of the State has the overall responsibility for enforcement of the provisions of these Rules.
 - The District Magistrate or the Deputy Commissioner of the concerned district has the overall responsibility for the enforcement of the provisions of these Rules within the territorial limits of their jurisdiction.
- c) Responsibility of the State Board:
 - Monitor the compliance of the standards.
 - Grant of Authorization for setting up of Waste Processing and Disposal Facility.
 - Prepare and submit Annual Report to CPCB Delhi with regard to the implementation of the Rules by of 15th September every year.

ii) Implementation Status:

There are 56 Municipal Authorities covered under the MSW Rules 2000, of which one is Municipal Corporation, 20 Municipal Councils, 28 Nagar Panchayats and 7 Cantonment Boards.

a) Implementation w.r.t. Collection/Segregation/Storage/Transportation

In almost all the Municipal Authorities, the compliance w.r.t. collection / segregation / storage / transportation is partial.

- Waste Collection is much lesser than the waste generation.
- Waste segregation is not being practiced.
- Storage facilities provided in the residential areas is insufficient.
- Waste is not being cleared as per the need.

- Transportation is not in covered vehicles.

(b) Implementation w.r.t. Waste Processing/Disposal Facility :

- Only Eight numbers of Waste Processing Facilities have been installed by Municipal Authorities at Shimla, Solan, Nahan, Kullu/ Bhunter, Manali, Una, Kangra/ Nagrota & Hamirpur in the State.
- Moreover, the performance of the existing treatment facilities is not satisfactory.
- None of the Municipal Authorities has set up proper waste disposal facility for disposal of non-biodegradable waste in the State. These engineered landfill sites need to be identified and developed on priority basis.

8.4.2 Plastic Waste Management:

- a) *Regulatory Rules:*** Recycled Plastics Manufacturer and Usage Rules – 1999/2003:- Rule 3(a) designates State Pollution Control Board (SPCB) as prescribed authority for enforcement of the provisions of these rules related to manufacture and recycling whereas enforcement of the provisions of these rules related to the use, collection, segregation, transportation and disposal are vested with the District Collector/Deputy Commissioner of the concerned district.

The State Government has also imposed ban on use of plastic carry bags of specified size and thickness under H.P. Non-Biodegradable Garbage (Control) Act, 1995.

b) *Management:*

Table-8.102 Number of Units Manufacturing Plastic Bags

Total number of units manufacturing carry bags/ plastic containers in the State.	88
Number of units consented/registered with the State Board.	64/34
Number of closed units.	29

c) *Actions initiated:*

For implementation of laws related to Polythene bags following initiatives have been taken by the State Board:

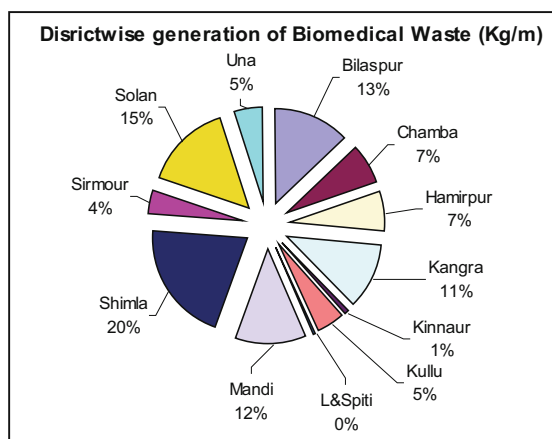
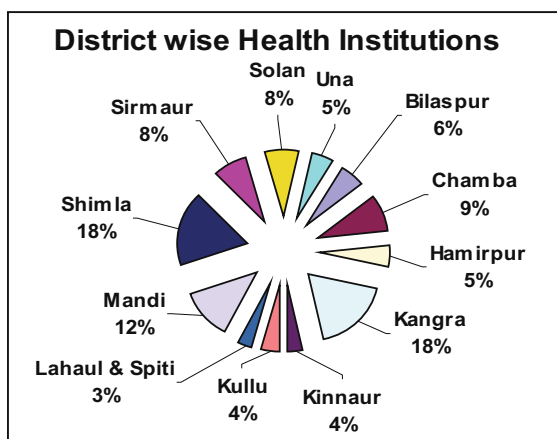
1. Strict Regulation of production of polythene carry bags and plastics in about 88 Plastic bags units in the State according to the legislative framework as amended by Govt. of India in June, 2003.
2. Awareness and checks are being conducted to regulate use of polythene carry bags in association with the District Administration.

8.5 Bio-Medical Waste Management:

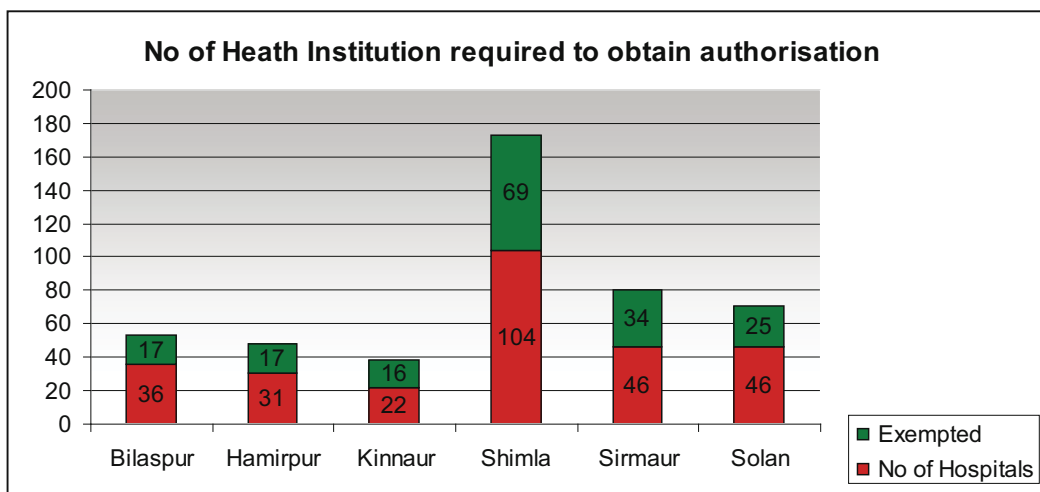
Bio-medical waste in the State is being managed under Bio-medical Waste (Management and Handling) Rules, 1998. Bio-medical waste as per these Rules is being got disposed off by

- Incineration
- Deep burial
- Auto cleaving
- Shredding
- Disinfecting

District-wise health institutions and generation of bio-medical wastes (kg/m) are as follows:



Number of District-wise Health Institutions Required to obtain Authorization is as follows:



The status with respect to the management of bio-medical waste (BMW) in the State is as listed below:

Table 8.103: Status on HCFs Complying Bio-medical Rules as on 30-11-2007

Category of HCF	Total Number of HCF identified	No. of HCFs exempted as per BMW Rules	Total Number of HCF falling under the preview of Rules	No. of HCFs Applied for Authori-zation	Authori-zation Granted	Waste Generated Kg/Month	Method of Disposal (Kg/Month)	
							Incine-ration	Deep Burial
Govt.	580	355	225	224	217	21025	8644	12381
Private	397	104	293	290	283	7079	4729	2350
Total	977	459	518	514	500	28104	13373	14731

(Source: HPSPCB Shimla)

Out of the total waste (28,104 kg/month) generated, 13,373 kg (42%) is being incinerated and remaining 14,731 kg (52%) is being put to deep burial.

The State Board through persuasion has got installed twelve incinerators which includes 1 each by MC Shimla and MC Kullu which are being used as a Common Bio-medical Waste Treatment Facility. District wise details of incinerators and their coverage area are as below:

Table 8.104: District wise Details of Incinerators

S. No.	District/Name of Authority	Coverage area	Quantity of waste incinerated /Capacity
1	Shimla/Municipal Corporation, Shimla.	IGMC, DDU & KNH Shimla. Indus Hospital, Shimla. Shimla Sanatorium and Tara Hospital.	170 Kg./DC
2	Kangra/Dr. RPGMC, Dharamshala.	Dr. RPGMC & Hospital, Dharamshala.	40 Kg./ DC
3	Mandi/NJSCB Hospital, Mandi.	NJSCB Hospital, Mandi.	35 Kg./ DC
4	Kullu/Municipal Committee, Kullu.	Govt. & Private Hospitals of Manali, Kullu and Bhunter	70 Kg./DC
5	Kinnaur/Chief Medical officer, Reckong-Peo,	District Hospital, Reckong-Peo.	10Kg./DC
6	Sirmour/Civil Hospital, Paonta Sahib	Civil Hospital, Paonta Sahib, Sirmour.	5Kg./SC
7	Solan/Govt., T.B. Sanatorium, Dharampur	Govt., T.B. Sanatorium, Dharampur, Solan.	Old Incinerator
8	Solan/Sub-Divisional Hospital, Rajgarh.	Sub-Divisional Hospital, Rajgarh, Sirmour.	5Kg./SC
9	Hamirpur/Bhota Charitable Hospital, Bhota	Bhota Charitable Hospital, Bhota	30Kg./DC
10	Chamba/Project Hospital, CPS-I, Khairi, Chamba.	Project Hospital, CPS-I, Khairi, Chamba.	5Kg./SC
11	Sirmour/Zonal Hospital Nahan	Zonal Hospital Nahan	25Kg./DC
12	Akal Charitable Hospital, Baru Sahib	Akal Charitable Hospital, Baru Sahib	25Kg./DC

(Source: HPSPCB Shimla)

8.6 Hazardous Waste Management :

The State Pollution Control Board has identified 1241 industrial units responsible for generation of hazardous wastes as on 31.10.2007, under the Hazardous Waste (Management & Handling) Rules, 2003. Management/mode of disposal of sludge from Effluent Treatment Plant of 18505.8 T/Year and other residual wastes are secured onsite storage, while waste oil of 644.588 KL / Year and process residue amounting 669.4 T/Year are recycled. Contaminated containers of 50268 No./Year is also recycled/reused after cleaning. For effective management of hazardous waste, the Govt. of Himachal Pradesh has notified a TSDF Site near village Majra, Tehsil Nalagarh, Distt-Solan (HP) vide letter No-Ind-A(F) 15-4/2003-11 dated 07.03.2007.

Status of category-wise hazardous waste types, quantity generated and mode of disposal is listed below:

Table 8.105: Hazardous Waste Management Status

S. No	Type of Hazardous Wastes	Quantity/Annum	Management/Mode of Disposal
1	Sludge from Effluent Treatment Plant	18505.574 T/ Year	Secured onsite storage and final disposal in the TSDF site
2	Waste Oil	644.588 KL/ Year.	Recycled
3	Contaminated Containers	50268 No. / Year.	Recycled (Reused after cleaning)
4	Others (Residual wastes)	18849.939 T/ Year.	Secured onsite storage and final disposal in the TSDF site
5	Process Residue	669.488 T/Year	Recycling

[Source: HPSPCB Shimla]

8.7 Response:

The initial campaign against plastic began in the hill station of Shimla, in the state of Himachal Pradesh. In July 1996, the **State Government of Himachal Pradesh passed India's first Non-Biodegradable Waste Act**. A complete ban was not possible as it involved inter-state trade and commerce, which was a Central subject. Moreover, it was also impracticable as a host of items like milk and potato chips were marketed in non-biodegradable packaging. The Center not only appreciated the effort of the state in this regard but also took the initiative of notifying Recycled Plastics Manufacture and Usage Rules 1999, Amendment Rules, 2003 banning plastic carry bags of thickness less than 20 microns and measuring less than 8"x12". However, given the magnitude of the problem, these measures proved insufficient to rid the hills of the nuisance. The experiment to enforce the Act in the State has not yielded much in absence of an effective mechanism to implement it. Under the latest decision, carry-bags made of non-biodegradable materials and of size smaller than 12"x18" and thickness less than 70 microns

³ Such wastes are usually a by-product of industrial operations which involve heavy metals such as arsenic, cadmium, chromium, lead, mercury, etc; processes which utilize different categories of oil and petrochemicals; products such as PVC and plastics; waste products from photocopiers; chemicals such as PCBs; and finally, by-products such as dioxins and furans which are now recognized as extremely toxic substances, affecting all forms of life.

have been banned under Section 7(h) of the State Non-Biodegradable Garbage (Control) Rules. Distributors, stockists, retailers, etc, could be fined up to Rs 25,000 for violating the ban. The minimum fine is Rs 500.

The matter regarding violation of Municipal Solid Wastes (Management and Handling) Rules, 2000, was taken up with the Local Self Govt. Department of the State followed by notices being issued to all the municipal authorities under Municipal Solid Waste (Management and Handling) Rules, 2000/ Environment (Protection) Act, 1986 for compliance.

Notices preparatory to prosecution for non-compliance of the provisions of the aforesaid rules were issued on 24.10.02 to the local bodies viz Manali, Kullu, Dalhousie, Shimla, Hamirpur, Dharamsala, Chamba, Bilaspur, Una, Solan, Nahan and Mandi. The matter was also taken up in the 48th Board meeting held on 8th Nov.2002 for ratification of the above said notices. Consequent upon the decision of the 48th Board meeting and on the basis of the replies filed by concerned municipal authorities, criminal proceedings have been launched against MC Mandi and Bilaspur and operating agency of MSW facility at Shimla which is pending in the court since 2002.

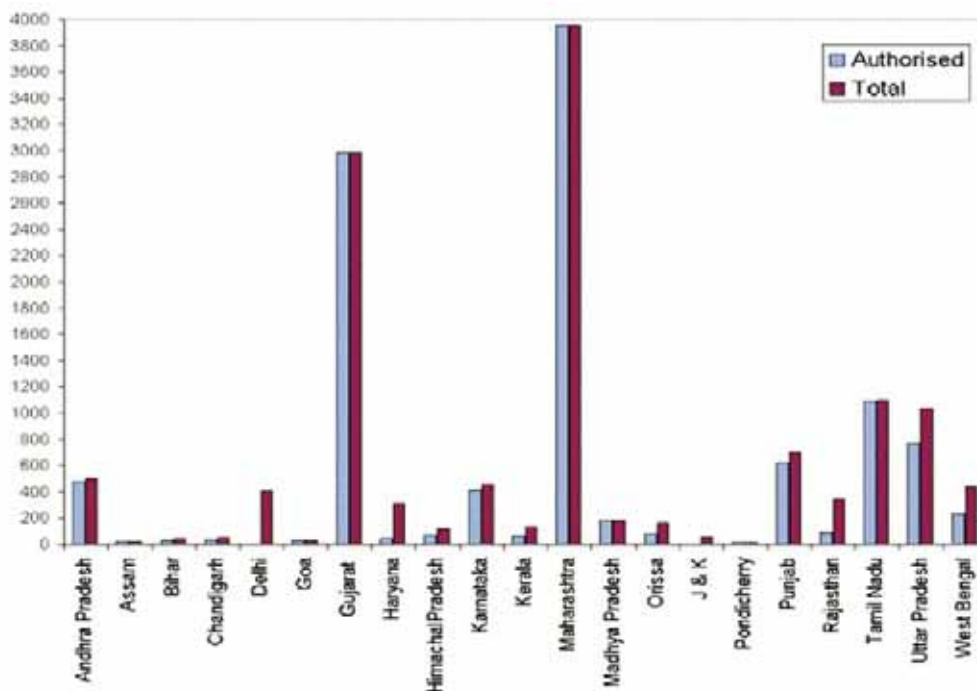


Fig. 1.20 Statewise Status of Hazardous Waste Generation in India

8.8 Noise Pollution:

8.8.1 Himachal Pradesh:

Noise pollution is often misinterpreted by most of the people as sound pollution. As a matter of fact, sound is a pure tune, harmonically related, having fixed frequencies and amplitudes, occurring at regular intervals and produces meaningful communication and pleasure in hearing. On the other hand, 'unwanted sound' is termed as noise, having a complex mixture of a number of pure tones of various frequencies and amplitudes. These sound waves fluctuate and repeat themselves in highly haphazard manner.

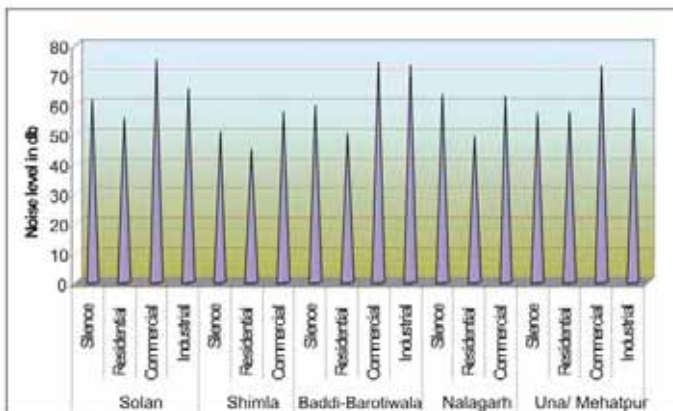


Table 8.106: Noise Level Standards

Area Code	Category of Area	Limit in dbA	
		Day	Night
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

Noise pollution has become a part of industrial and urban life in modern times. Urban people are at constant exposure to such pollution contributed by movement of vehicles and blowing of horns. Urban & rural population is increasingly being exposed to noise pollution by 'loudspeakers'/ public address system, an amplifier of music especially during social functions. The State Board had monitored five places namely Shimla, Solan, Baddi-Barotiwala, Nalagarh and Una/Mehatpur areas. Solan and Baddi-Barotiwala recorded high noise pollution than Shimla.

8.8.2 Status of Noise Level in Shimla Town:

The noise level monitoring was conducted at various locations on a normal day & on the Deepawali day showed the high noise level due to movement of traffic & festival activities. During Diwali, the State Board conducted noise pollution monitoring at various places to monitor noise pollution level at various places of the city and the results are as follows:

Table 8.107: Noise Level monitored at various locations at Shimla on Diwali during 2007 Conducted between 7 PM – 10 PM

Location	Leq(dB)				Zone
	Dipawali day On 9.11.07		Normal day on day time		
	Day	Night	8/11/07	10/11/07	
Brock Hurst	59.7	-	54.3	47.8	Residential zone
Sanjauli	70.3	-	47.8	62.8	
High Court	58.2	-	49.2	46.1	Silence zone
IGMC 60.3	-	49.9	57.1		
H.P. University	65.2	-	54.2	56.5	
Khalini Chowk	62.8	-	71.7	54.2	Commercial zone
Ridge 70.3	-	65.3	66.1		
Lower Bazar	72.7	-	69.2	70.9	
HP Secretariat	72.7	-	59.2	59.4	
Bus Stand	68.7	-	62.9	65.4	Traffic Intersection

(Source: HP State Pollution Control Board Shimla)

8.9 Initiatives Through Spatial Environmental Planning:

8.9.1 Zoning Atlas & Associated Activities:

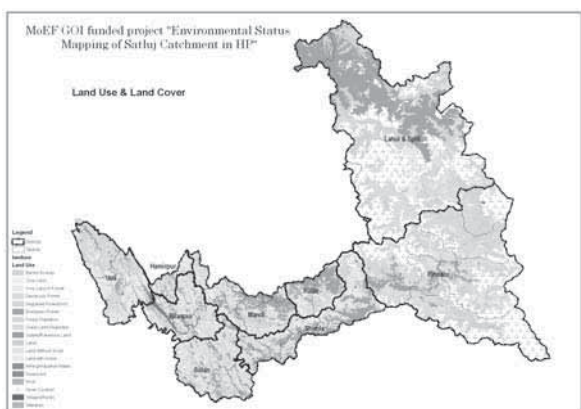
Apart from its regulatory role, the State Board is also undertaking a pro-active visionary approach by making use of scientific tools such as GIS application for environment management etc. To undertake the Spatial Environmental Planning Program, the State Board has a state of the art facility in terms of infrastructure and technical manpower. It has so far covered all the districts under Zoning Atlas for Siting of Industries. In addition, the State Board has also taken lead towards revising all these zoning atlases as per the modified criteria devised by the Central Pollution Control Board and the Ministry of Environment and Forests, Govt. of India and consequently more sites are available now for sustainable industrialization. The summary of the activities undertaken/being undertaken by the State Board in order to achieve the objectives of sustainable industrialization are as follows:

1. Prepared Zoning Atlas for Siting of Industries for all districts of the State.
2. Prepared Industrial Estate Planning for Baddi, Barotiwala-Nalagarh in Solan and Paonta Sahib in Sirmour.
3. Sustainable Tourism Development of Dharamshala, McLeodganj and Bhagsunath areas of district Kangra.
4. Prepared State Environmental Atlas of Himachal Pradesh.
5. Prepared District-wise Environmental Atlases for Solan, Sirmour, Kangra, Mandi & Hamirpur and remaining districts are also being covered.

The outcomes of these studies are submitted to the planning and development agencies of the State, which need to be integrated into the process of development planning so as to achieve the objective of sustainable development.

8.9.2 MoEF, GOI funded Environmental Status Mapping of Satluj Catchment in HP:

In addition to above, the H.P. State Pollution Control Board in collaboration with the Ministry of Environment and Forests, Govt. of India is also carrying out “Environmental Status Mapping” of the Satluj Catchment in Himachal Pradesh. The main objective of this study is to prepare an environmental status report of the Satluj catchment and to identify the environmental issues and conservation measures required for resolving these problems. Besides, the outcome of this environmental resource inventory/spatial environmental information database would be helpful to the development agencies and user institutions of the State in their decision-making wherein, all aspects related to environment are considered in relation to the entire catchment system and to achieve the development targets which are compatible with the environmental setting of the catchment. This composite view of environmental status mapping and conservation priorities of the region/catchment would also be useful to the environmental regulators to have a neutral opinion in decision making while granting environmental clearances to the development projects at the State and MOEF level. Some useful GIS analysis/maps of the study are as listed below:



8.10 Conclusion:

The challenge of creating and maintaining a sustainable environment is a pressing issue that confronts us today. One should neither sugarcoat the problems nor give gloomy predictions of disaster. Instead different stakeholders should take positive roles using the practical and conceptual tools to meet the environment challenges of today and tomorrow. The environment is an interdisciplinary field and environmental matters are diverse requiring a larger intervention and an integrated approach. “But if to succeed, the efforts to improve the environmental need the support of far more people than it now has saving the planet is not a spectator sport” Lester Brown: Founder Worldwatch Institute.

* * * * *

ENERGY AND ENVIRONMENT

Energy and Environment

GENERAL:

Energy is the most vital infrastructure input for economic, agriculture and industrial development of any country. It is indeed, the fulcrum on which vests the future pace of growth and development. Hence, there has been an increasing demand of energy in its various forms. The most significant of these forms is the electrical energy, availability of which has been recognised as an index of a country's overall economic growth and level of development. Therefore our country needs to accelerate the development of electrical energy sector to meet its aspirations especially in the field of Industry, Agriculture and also for Commercial and Domestic activities.

9.1 State:

9.1.1 Energy Sources:

India is rich in coal and abundantly endowed with renewable energy in the form of solar, wind, hydel and bio-energy. India like many other developing countries meets its energy needs through mainly in the form of crude oil and natural gas. The rising import bill, causing pressure on scarce foreign exchange resources, is largely responsible for energy supply shortages.

Energy can mainly be developed from hydro, thermal and nuclear sources. Out of these sources, hydro electric energy is most attractive and therefore preferred being renewable, economically cheap, non-polluting, inexhaustible and environmentally benign source of energy for the country. Hydro-electric plants have long useful life, requires less maintenance and help in conserving scarce fossil fuels, besides opening of avenues for development of remote and backward areas. These hydro plants are the best alternative to meet up the peaking requirements due to their inbuilt operational versatility. Moreover per unit cost of generation reduces with passage of time.

9.1.2 Overall Energy Scenario in India:

India ranks sixth in the world in total energy consumption and therefore, demand for electric energy has been growing at a rapid pace in the country. Per capita consumption of electricity has increased from 15 kwh in the year 1950 to 360 kwh in the year 2002 and is projected to increase to 750 kwh by 2012.

Presently, there is a shortfall in energy by 8.8% and peak demand by 13%. Long term energy requirement for the country as a whole is projected in Table 9.108.

Table 9.108: Energy Requirement for the Country

Year	Energy Requirement (mkwh)	Peak Demand (mkwh)
2001-02	5,29,013	85132
2006-07	7,19,097	1,15,705
2011-12	9,75,222	1,57,107
2016-17	13,18,644	2,12,725

Source: 16th Electrical Power Survey Report, CEA.

Hydro Potential in Himachal Pradesh :

Himachal Pradesh has a vast hydel potential and through preliminary hydrological, topographical and geological investigation, total power potential so far identified is approximately 21000 MW, which is nearly 14% of the total hydro power potential of the entire country. Basin-wise availability is indicated in Table-9.109.

Table 9.109: Basin-wise Availability of Hydel-potential

Sr. No.	River Basin	Total Hydro-potential (MW)
1.	Satluj	9450.25
2.	Beas	4604.00
3.	Ravi	2359.00
4.	Chenab	3032.30
5.	Yamuna	591.52
6.	Mini-Micro Projects	750.00
	Total	20787.07
	Say	21000.00

Source: Status Note By HPSEB

A large number of unidentified areas have still been left in the river basins, which can contribute substantially to Himachal Pradesh by way of mini/micro, medium and even larger projects. Thus a conservative estimate in Himachal Pradesh could well be put up at 25,000 MW or even more.

9.1.3 Hydro Power Development in Himachal Pradesh

In Himachal Pradesh, the hydro-power development was started even before it became full fledged State. A small project was commissioned during 1908 by erstwhile Raja of Chamba, another at Chaba near Shimla in 1912, followed by commissioning of Shanan hydro-electric project (110 MW) in Distt. Mandi during mid twenties by the British. Giri Hydel Project (60MW) and Bassi

**Fig 1.21****Fig 1.22**

H.E.P. (60 MW) were added later on by the then Department of Multi-purpose and Power, H.P. Govt.

Himachal Pradesh Electricity Board (HPSEB) was subsequently created in September 1971, for investigations and execution of various hydro-electric projects, and transmission and distribution of power in the State.

The status of hydro-power in the State is slightly better as 6060 MW under various agencies including State Sector (through HPSEB) has been developed. Projects aggregating 8500 MW installed capacity are at various stages of executing under State (through HPSEB), Private, and Central/Joint Sectors for commissioning during 10th and 11th Five Year Plans. Rest of the power potential nearing 10,000 MW would remain to be harnessed.

The details of Hydro-electric Projects already under operation are in Table 9.110.

Table 9.110: Hydro-electric Projects under Operation

Sr. No.	Name of Project	Basin	No. of Units and Rating (MW)	Installed Capacity (MW)
I	STATE SECTOR			
1.	Andhra Project	Yamuna	3x5.65	16.95
2.	Giri Project	-do-	2x30	60.00
3.	Gumma Project	-do-	2x1.15	3.00
4.	Rukti Project	Satluj		1.50
5.	Chaba Project	-do-		1.75
6.	Rongtong Project	-do-		2.00
7.	Nogli Project	-do-		2.50
8.	SVP-Bhaba Project	-do-	2x60	120.00
9.	Ghanvi Project	-do-	2x11.25	22.50
10.	Binwa Project	Beas	2x3	6.00
11.	Gaj Project	-do-	2x3.5	10.50
12.	Baner Project	-do-	2x6	12.00
13.	Uhl-II Project (Bassi Project)	-do-	4x15	60.00
14.	Sal-II Project	Ravi	2x1	2.00
15.	Gharola Project	-do-		0.05
16.	Bhuri-Singh P.H.	-do-		0.45
17.	Holi Project	-do-		3.00
18.	Sissu Project	Chenab		0.10
19.	Billing Project	-do-		0.20
20.	Shamsha Project	-do-		0.20
21.	Killar Project	-do-	3x100 KW	0.30
22.	Thirot	-do-	3x1.5	4.50
	Total			329.50

Sr. No.	Name of Project	Basin	No. of Units and Rating (MW)	Installed Capacity (MW)
II	JOINT SECTOR			
1.	Bhakra Dam	Satluj		
		- Right Bank	5x132	660
		- Left Bank	5x108	540
2.	Nathpa-Jhakri	-do-	6x250	1500
3.	B.B.M.B.(Dehar PH)	Beas	6x165	990
4.	Pong Dam	-do-	6x60	360
	Total			4050
III	CENTRAL SECTOR			
1.	Baira-Suil	Ravi	3x60+uprating	198
2.	Chamera-I	-do-	3x180	540
3.	Chamera-II	-do-	3x100	300
	Total			1038
IV	PRIVATE SECTOR			
1.	Malana	Beas	2x43	86
2.	Solang	-do-		01.00
3.	Titang	-do-		0.90
4.	Raskat	-do-		0.80
5.	Manjhi	-do-		4.50
6.	Baspa-II	Satluj	3x100	300
7.	Dehar	-do-		5.00
8.	Bara-gaon	-do-		3.00
	Total			401.20
V	OTHERS			
1.	Shanan Project	Beas	1x50	110.00
			4x15	
2.	Yamuna Share	-do-		131.57
	Total			241.57
	Grand Total			6060.27

Source: Status note of HPSEB and earlier Report of Environment H.P.

Table 9.111: H.E.P. Planned for Commissioning During 10th Plan (2002-07)

Sr. No.	Name of Project	Basin	Capacity (MW)
I	STATE SECTOR		
1.	<i>Larji Project</i>	Beas	126
2.	Keshang-I	Satluj	66
3.	Khauli Project	Beas	12
4.	Holi Project	Ravi	3

Sr. No.	Name of Project	Basin	Capacity (MW)
5.	Uhl-III Project	Beas	100
6.	Ghanvi-II	Satluj	8
7.	Bhaba Aug. P.H.	Satluj	4.5
	Total		319.50
II	PRIVATE SECTOR		
1.	Baspa-II	Satluj	300
2.	Fozal Project	Beas	9
3.	Neogal Project	Beas	15
4.	Dhambari-Sunda	Yamuna	70
5.	Patikari	Beas	16
	Total		410
III	JOINT/CENTRAL SECTOR		
1.	Nathpa-Jhakri	Satluj	1500
2.	Chamera-II	Ravi	300
	Total		1800
IV	MINI-MICRO HYDEL SCHEMES		
1.	Mini-Micro Projects		151
	Grand Total		2680.50

Source: Information Collected from HPSEB

Out of above Nathpa-Jhakri (1500 MW), Baspa-II (300MW) and Holi (3MW) hydel schemes have already been completed, whereas Larji project (126 MW) and Khauli project (12 MW) are scheduled to be commissioned during 2005-06.

Hydro Power generation in the State has been accorded top priority and has adopted multi pronged strategy so as to meet the increasing power demand within the State, also to bridge the gap in the demand and supply in the northern region as a whole. In view of this, a phased programme to take up various major, medium, small and mini/micro schemes in the State, to harness the balance identified potential has been prepared. It is planned to harness 2680.50 under 10th Plan, 8087.50 MW during 11th Plan and 5621 MW during 12th and 13th Plan (up to year 2020). The commissioning of these hydel schemes can play a major role in power development programmes in the northern region, which will provide an economic base for overall development of Himachal Pradesh.

The State Government has opened up power sector to private sector. NTPC and NHPC have also been given large projects like Chamera-II (300 MW), Kol Dam (800 MW) and Parbati (2051 MW) schemes for execution. The State govt. is also encouraging co-operative sector by reserving sites in the small and micro-hydel sectors, which will involve local community and increase the employment opportunities to local people. Our State would get 12% free power on all new installations which will increase the resources of the State to a significant extent.

The details of the hydel schemes proposed to be commissioned up to the year 2020 are given below in Table 9.112 and 9.113.

Table 9.112 : Projects Planned for Commissioning During 11th Five Year Plan (2007-12)

Sr. No.	Name of Project	Name of Basin	Installed Capacity in (MW)
I	STATE SECTOR		
1.	Renuka	Yamuna	40.00
2.	Kashang-I	Satluj	66.00
3.	Kashang-II	-do-	60.00
4.	Kashang-III	-do-	132.00
5.	Kut	-do-	15.00
6.	Jangi Thopan	-do-	480.00
7.	Shong Karcham	-do-	402.00
8.	Thopan Powari	-do-	400.00
9.	Kilhi Bahl	Beas	7.50
10.	Sainj	-do-	100.00
11.	Kuther	Ravi	260.00
12.	Bajoli-Holi	-do-	180.00
13.	Chamba	-do-	125.00
	Total		2267.50
II	CENTRAL/JOINT SECTOR		
1.	Chamera-III	Ravi	231.00
2.	Kol-Dam	Satluj	800.00
3.	Rampur	-do-	400.00
4.	Parbati-I	Beas	750.00
5.	Parbati-II	-do-	800.00
6.	Parbati-III	-do-	501.00
7.	Gyspa Dam	Chenab	240.00
8.	Sawra Kuddu	Yamuna	110.00
	Total		3832.00
III	PRIVATE SECTOR		
1.	Sai Kothi	Ravi	17.00
2.	Budhil	-do-	70.00
3.	Harsar	-do-	60.00
4.	Bharmour	-do-	45.00
5.	Siul	-do-	13.00
6.	Lambadug	Beas	25.00
7.	Baragaon	-do-	11.00
8.	Fozal	-do-	6.00
9.	Malana-II	-do-	100.00
10.	Dhaura Sidh	-do-	80.00
11.	Allain Duhangan	-do-	192.00
12.	Tirthan	-do-	18.00
13.	Chirgaon-Majhgaon	Yamuna	46.00
14.	Paudital Lassa	-do-	24.00
15.	Tangnu-Romai	-do-	44.00
16.	Dhamwari Sunda	-do-	70.00

Sr. No.	Name of Project	Name of Basin	Installed Capacity in (MW)
17.	Shalvi	-do-	7.00
18.	Sorang	Satluj	60.00
19.	Tidong-I	-do-	100.00
20.	Karcham-Wangtoo	-do-	1000.00
	Total		1988.00
	Total I+II+III		8087.50

Source: Status note to HPSEB.

Table 9.113 : Projects Identified and Proposed for Commissioning During 12th and 13th Plans (Up to year 2020)

Sr. No.	Name of Project	Name of Basin	Capacity in (MW)
1.	Rupin	Yamuna	39.00
2.	Bahairari	Satluj	5.50
3.	Tidong-II	-do-	90.00
4.	Baspa-I	-do-	210.00
5.	Luri	-do-	425.00
6.	Kuling Lara	-do-	40.00
7.	Lara	-do-	60.00
8.	Ropa	-do-	60.00
9.	Mani Nadang	-do-	70.00
10.	Lara Sumta	-do-	104.00
11.	Sumta Kathang	-do-	130.00
12.	Chango-Yangthang	-do-	140.00
13.	Khab-I	-do-	450.00
14.	Khab-II	-do-	186.00
15.	Yangthang Khab	-do-	400.00
16.	Gharopa	Beas	85.00
17.	Gara-Gosain	-do-	25.00
18.	Sal-I	Ravi	6.50
19.	Kugti	-do-	45.00
20.	Chanju-I	-do-	40.00
21.	Chanju-II	-do-	23.00
22.	Bara-Bangahal	-do-	200.00
23.	Chattru	Chenab	140.00
24.	Khoksar/Tunsha	-do-	150.00
25.	Seli	-do-	150.00
26.	Bardang/Tingar	-do-	180.00
27.	Sach Khas/Sagpari	-do-	210.00
28.	Patam	-do-	60.00
29.	Teling	-do-	81.00

Sr. No.	Name of Project	Name of Basin	Capacity in (MW)
30.	Tinget	-do-	81.00
31.	Miyar	-do-	90.00
32.	Tandi	-do-	150.00
33.	Rashil	-do-	150.00
34.	Dugar	-do-	360.00
35.	Gondhala/Chandra Bhaga	-do-	270.00
36.	Reoli/Dugli	Chenab	715.00
	Total		5621.00

Source : Status Note of HPSEB.

9.1.4 Private Sector Participation:

The policy of privatisation of power projects in India was mooted by the Government of India in October, 1991. However, Himachal Pradesh had already taken the lead with involvement of private companies in the implementation of hydroelectric projects in the state with a view to exploiting its vast hydro power potential even earlier, in October, 1990.

The State Government has recently modified the power policy to ensure expeditious exploitation of the remaining hydroelectric potential likely to be offered to private sector and has incorporated in its global invitation for bids for implementation of hydro-electric projects excluding SHPs up to 5MW. Among others, the main points incorporated are as follows:-

- Projects having installed capacity 5 MW to 100 MW will be awarded through memorandum of understanding (MOU) route, whereas the projects exceeding 100 MW will be assigned to the Private Sector on International Competitive Bids route.
- The projects for implementation in the Private Sector will be in Build, Own, Operate and Transfer (BOOT) basis.
- Govt. of Himachal Pradesh reserves the right of equity participation up to 49% on selective basis for the projects above 100 MW installed capacity.
- Land, whether private or Govt, shall be taken on lease basis at the rates approved by the Govt. for agreement period.
- The Government will constitute a Local Area Development Authority (LADA) for project(s) being implemented in each river valley. The Deputy Commissioners will be Chairman of LADA and representatives of the developers, HPSEB/State Utility, PWD, IPH, Forest, Pradhan of the affected Panchayat, Chairman Panchayat Samiti, Block Development Officer, Land Acquisition Officer and any other concerned department will be the other members of the LADA. Concerned SDM will be the Member Secretary, The LADA will be entrusted with, but not limited to, the following activities:-

- a) Oversee the restoration of facilities adversely affected due to implementation of the project.
- b) Oversee the implementation of Rehabilitation and Relief Plan.
- c) Oversee the implementation of Catchment's Area Treatment (CAT) Plan and Compensatory Afforestation.
- d) Local development activities related to development of Agriculture, Horticulture, Animal Husbandry, IPH, Health and Forest Departments and other Social Activities. The activities of LADA during execution will be financed by the project itself and for this purpose the Developer will make a provision of 1.5% of total cost in the Detailed Project Report other than the funds required for R&R scheme and CAT plan. The LADA activities should be financed from the 1.5% provision proposed in the DPR and not from the power royalty. The State Government will use the free power royalty.

It has been observed that after the setting up of various hydroelectric projects in Satluj basin, numbers of technical and socio-economic problems have arisen due to post-effects of hydroelectric projects in the State. To mitigate any eventuality with regard to the execution of Hydroelectric Projects in the Satluj Valley, a forum of Hydro-Power Producers of Satluj basin has come into existence on 05.11.2005. The main function of the forum relates to (i) Environment (ii) Operation of Power Stations and Sharing of Technical Expertise and Experience (iii) Data sharing (iv) Disaster Management and Planning and (v) Common issues with State Govt. and Govt. of India. The guidelines of the forum wherever applicable, the attempt will be made to abide by the recommendations of forum and applicable to all the Power Producers/Developers in the State of H.P. If however, any such more forums are constituted for other river basins, the guidelines of the same will also be applicable on Developers/Power Producers, executing projects in that area.

State Government signed 28 memorandum of understanding (MOUs) with Independent Power Producers (IPPs) for various hydroelectric projects totalling 2868 MW between 1991 and 2004 and subsequently signed Implementation Agreements (IAs) in respect of 9 hydroelectric projects with the concerned companies. Out of above, 13 MOUs/IAs have been cancelled due to non fulfilling of stipulated terms and conditions so as to resort to re-invitation of bids.

The status of 13 hydro-electric projects, which are at various stages of implementation, is detailed in Table-9.114. However, two projects : Baspa-II (300 MW) in District Kinnaur and Malana (86 MW) in District Kullu have already been commissioned during 2001-02 and 2003-04, in the Private Sector. In addition, six mini / micro projects aggregating to 15 MW have also been commissioned during the last four years.

Table 9.114: Status of Private Sector Hydro Electric Projects in Himachal Pradesh

Sr. No.	Name of Project/ installed Capacity (MW)	Dependable Year Energy MUs (90%)	Executing Agency	Date of Signing of MOU/IA	Status of Project
DISTRICT KINNAUR					
1.	Karcham-Wangtu (1000 MW)	4428	M/S Jaippee Karcham Hydro Corporation Ltd.	22.8.1993/ 18.11.1999	Estimated Cost = Rs. 7720 Crores TEC 31.3.2003 E&F 14.9.2001 Acquisition of land and remaining clearances in process. Project works have been started and likely to be commissioned during 2009-10
2.	Titong-I (100 MW)		M/S Nuziveedu Seeds Ltd. Secundrabad	23.9.2004	The company is in process of preparation of DPR.
3.	Sorang (60 MW)		M/S SSSJV Projects Pvt. Ltd. Bangalore (Himachal Consortium)	23.9.2004	The company is in process of preparation of DPR.
DISTRICT SHIMLA					
4.	Sainj (3 MW)		M/S East India Petroleum Ltd.	26.6.2000/ 24.7.2004	TEC 23.4.2002 The project being less than 5 MW stands transferred to Him Urja. Remaining clearances are in progress.
5.	Paudital Lassa (24 MW)		M/S Shree Jai Lakshmi	6.6.2002	DPR under examination in HPSEB and slated for commissioning in 2009-10.
6.	Tangu Romai (44 MW)	163	M/S PCP International Ltd.	5.7.2002	DPR is under scrutiny in HPSEB and is slated for commissioning during 2009-10.
DISTRICT MANDI					
7.	Patikari (16 MW)	78	M/S East India Petroleum Pvt. Ltd.	21.6.2000/ 9.11.2001	TEC 27.9.2001 Forest 1.11.2004 Company has commenced project works w.e.f. 2005.
8.	Lambadug (25 MW)		M/S Himachal Consortium	13.6.2002	DPR under scrutiny in HPSEB. Company is in process of obtaining clearances. Detailed S&T works in progress. Project is scheduled for commissioning during 2008-09.

Sr. No.	Name of Project/ installed Capacity (MW)	Dependable Year Energy MUs (90%)	Executing Agency	Date of Signing of MOU/IA	Status of Project
DISTRICT KULLU					
9.	Allain Duhanagan (192 MW)	673	AD Hydro Power Ltd.	28.8.1993/ 22.2.2001	Estt. cost Rs. 922.36 Cr. TEC 20.8.2002 E&F 12.12.2000 MoEF 18.10.2002 The project works have been recently commenced and likely to be commissioned during 2009-10.
10.	Malana-II (100 MW)	428	M/S Everest Power Pvt. Ltd.	7.5.2002/ 14.1.2003	Estt. Cost Rs. 581 Cr. TEC 15.10.2004 In process of obtaining various statutory/Non statutory clearances and has initiated process for land acquisition. Project is scheduled to be completed during 2008-09.
11.	Baragaon (11MW)	54	M/S Padmini Traders	6.6.2002	DPR under examination. Scheduled for commissioning in 2008-09.
DISTRICT CHAMBA					
12.	Budhil (70 MW)	286	M/S Lanco Green Power Pvt. Ltd. Hyderabad	23.9.2004	Estt., cost 290 Cr. DPR under scrutiny in HPSEB
DISTRICT HAMIRPUR					
13.	Dhaura-Sidh (40 MW)	-	M/S GVK Industries Ltd.	20.6.2002	DPR under scrutiny in HPSEB for TEC. Project slated for commissioning during 2009-10.

In addition, global bids for implementation of more medium and large hydroelectric projects having total installed capacity of about 5500 MW on BOOT basis have been invited recently. These can also be offered to Central Agencies in case any responded to the above global tenders.

Central Sector Projects

i) Parbati HEP (2051 MW)

An agreement was signed with M/S NHPC by Govt. of H.P. on 20.11.1998 for execution of the Parbati HEP (2051 MW).

Stage-II (800 MW)

TEC for the revised DPR for stage II was accorded by CEA on 3.1.2001 at a completed cost of Rs. 4478 crores.

Forest and Environment Clearances were accorded by MoEF on 4.9.2001 and 4.6.2001 respectively.

Land acquisition and the infrastructure works i.e. residential and non residential buildings, approach roads and bridges are in progress. The contracts for four main packages of the Project components have been awarded and work at different locations/project components has been taken up by different companies. The project is slated for commissioning in 2007-08.

Stage-III (501 MW)

The project has been Techno-economically cleared by CEA on 12.11.2003 for an estimated cost of Rs. 2228.41 crores.

Stage-I (750 MW)

Survey and Investigation works are in Progress.

ii) **Koldam HEP (800 MW)**

An agreement was signed with M/S NTPC by Govt. of Himachal Pradesh on 26.2.2000 for the execution of Koldam HEP. The techno-economic clearance for the project on the revised DPR has been accorded by CEA on 30.6.2002 at an estimated cost of Rs. 5300 crores. The work on the project has been commenced and the project is slated for commissioning in 2008-09.

iii) **Chamera-II HEP (300 MW)**

The agreement between Govt. of H.P. and NHPC was signed on 20.12.2000. Project was commissioned on 2.11.2003.

iv) **Chamera-III (Hibra) HEP (231 MW)**

An agreement was signed with M/S NHPC by Govt. of H.P. for the execution of the Project on 5.7.2001. The Techno-economic clearance for the project has been accorded by CEA on 10.10.2003. Land acquisition and site development works are in progress.

9.1.5 Consumption Trends of LPG

LPG is mainly used in the domestic Sector in Himachal Pradesh and its scope for commercial use is limited. Baddi, in Solan district is the only area where LPG has significant commercial use. To ensure the availability of LPG to every village, there are 78 distribution counters and 256 extension counters throughout the State.

Table 9.115 : District-wise Per Capita Consumption of Electricity (1999-2000)

Districts	Population 1999	Domestic		Industrial agriculture		Total	
		kWb	Kilo calorie per person	kWb	kWb	kWb	Kilo watt per person
Bilaspur	3,48,865	417.90	11,70,120	629.05	1.15	872.58	24,43,224
Chamba	4,70,472	422.18	11,82,104	85.24	8.29	300.62	8,41,736
Hamirpur	4,21,552	401.61	11,24,508	12.50	0.44	191.51	5,36,228
Kangra	13,67,902	470.30	13,16,840	10.80	0.16	113.90	3,18,920
Lahaul & Spiti	82,242	369.28	10,33,984	8.67	4.11	216.58	6,06,424
Kullu	3,62,366	458.29	12,83,212	10.59	1.30	166.11	4,65,108
Kinnaur	35,340	369.28	10,33,984	14.80	1.44	216.18	6,05,304
Mandi	9,14,733	417.57	11,69,196	9.03	0.38	80.64	2,25,792
Shimla	7,19,908	1133.55	31,73,940	4.47	0.01	259.65	7,27,020
Sirmour	4,52,400	570.73	15,98,044	423.21	3.48	556.76	15,58,928
Solan	4,62,442	607.60	17,01,280	1289.68	14.20	1525.50	42,71,400
Una	4,38,257	532.73	14,91,644	62.59	5.66	260.63	7,29,764
Himachal Pradesh	60,76,479	484.40	13,56,320	182.91	2.72	360.87	10,10,436

9.1.6 Consumption trends of Kerosene Oil:

Kerosene is used mainly for domestic purposes as its consumption in the commercial sector is not very large. Between 1991 and 2000, the consumption of kerosene doubled in all the districts of Himachal Pradesh Table 9.116. In 1991-92 the total consumption of kerosene in the State was 44,618 kilolitres, and this increased to 79,857 kilolitres in the year 1999-2000. Details of the consumption pattern through the districts is displayed in the Table.

Table 9.116 : Number of Consumers and Consumption of Kerosene Oil

District	Consumption (kilolitres)			Year 2000		Per capita consumption	
	1991-92	1996-97	1999-2000	Ration card holders	Population	Kltr/person	Kilo calorie per person
Bilaspur	2118	3036	3871	77,214	3,54,355	10.92	2,27,136
Chamba	3842	4448	5413	68,535	4,24,734	12.74	2,64,992
Hamirpur	3212	4765	5604	99,236	4,73,736	11.83	2,46,064
Kangra	10,304	16,503	19,132	2,88,167	14,92,557	12.82	2,66,656
Kinnaur	3025	4226	5524	18,074	83,495	66.16	13,76,128
Kullu	805	1100	1249	75,204	3,76,373	3.32	69,056
Lahaul & Spiti	686	989	714	8273	38,254	18.66	3,88,128
Mandi	5025	9316	10,757	1,96,751	9,93,635	10.83	2,25,264
Shimla	6271	8645	10,633	1,29,825	7,15,268	14.87	3,09,296

District	1991-92	1996-97	1999-2000	Ration card holders	Population	Kltr/person	Kilo calorie per person
Sirmour	2228	3762	4623	74,288	4,23,627	10.91	2,26,928
Solan	3950	5586	6537	73,632	3,99,994	16.34	3,39,872
Una	3152	4463	5800	96,932	4,75,205	12.21	2,53,968
Himachal Pradesh	44,618	66,839	79,857	12,06,131	62,51,233	12.77	2,65,616

9.1.7 Consumption trends of Coke & Coal:

Both coke and coal are consumed mainly in the cold areas of the state – the districts of Chamba, Kinnaur, Lahaul & Spiti and Shimla. The consumption pattern of the state is displayed in Table 9.117. The consumption of coal has actually decreased from 74,283 quintals in 1996, to 69,528 quintals in 2000. This decrease in consumption can be partially attributed to an increase in awareness amongst the people about the potential harmful effects of burning coal to the environment and mainly due to the government's decision to ban the use of coal in all government offices.

Table 9.117 : Number of Consumers and Consumption of Coal/Coke

District	Consumption (in quintal)		Population 1999	Per capita consumption	
	1996-97	1999-00		(per kg of coal)	Kilo calorie per person
Bilaspur	n.a.	n.a.	3,48,865	0.00	n.a.
Chamba	4124	4815	4,70,472	1.02	4080
Hamirpur	n.a.	n.a.	4,21,552	0.00	n.a.
Kangra	n.a.	n.a.	13,67,902	0.00	n.a.
Kinnaur	18,633	17,992	82,242	21.88	87,520
Kullu	n.a.	n.a.	3,62,366	0.00	n.a.
Lahaul & Spiti	24,286	25,076	35,340	70.96	2,83,840
Mandi	n.a.	n.a.	9,14,733	0.00	N.a.
Shimla	27,240	21,645	7,19,908	3.01	12,040
Sirmour	n.a.	n.a.	452400	0.00	n.a.
Solan	n.a.	n.a.	462442	0.00	n.a.
Una	n.a.	Na.a	438257	0.00	n.a.
Himachal Pradesh	74283	69528	6076479	1.14	4560

9.1.8 Consumption trends of Fuel Wood:

Traditionally, fuel wood has been the main source of energy in the entire state because of its ready availability. About 6-8 kg of fuel wood is consumed per day per household in the state and its annual per capita consumption has been estimated at 785 kg. The level of fuel wood consumption is mainly related to the natural resource base and the climatic conditions of an area.

Table 9.118 : Biome-wise Per Capita Consumption of Fuel Wood

Biome zone	District	Per capita consumption of fuel wood
A	1) Kinnaur	1000 kg/annum
	2) Lahaul & Spiti	
B	3) Kullu	800 kg/annum
	4) Chamba	
C	5) Shimla	600 kg/annum
	6) Kangra	
D	7) Sirmour	500 kg/annum
	8) Solan	
	9) Bilaspur	
	10) Una	
	11) Hamirpur	
	12) Mandi	

Table 9.119 : District-wise Number of Consumers and Consumption of LPG

District	Number of consumers			Consumption (number of cylinders)		Per capita consumption of LPG Domestic		
	Single Cylinder	Double Cylinder	Total	Domestic	Commercial	(Kg per person)	Kilo Calorie per person	Commercial
Bilaspur	15,573	13,373	28,946	1,44,224	565	29.08	11,92,280	0.04
Chamba	11,940	8835	20,775	1,10,5096	1264	53.14	21,78,740	0.06
Hamirpur	47,242	26,868	74,110	2,87,378	172	18.24	7,47,840	0.01
Kangra	1,04,610	77,202	1,81,812	6,85,931	1736	24.31	9,96,710	0.03
Kinnaur	13,312	5667	18,979	58,250	0	17.37	7,12,170	0.00
Kullu	8386	15,514	23,900	1,27,329	5537	33.73	13,82,930	0.35
Lahaul & Spiti	3080	3006	6086	28,157	0	15.78	6,46,980	0.00
Mandi	53,574	27,526	81,100	3,74,996	573	29.40	12,05,400	0.01
Shimla	82,418	71,198	1,53,616	5,56,164	13,036	15.76	6,46,160	0.40
Sirmour	17,552	15,490	33,042	2,17,371	2205	24.80	10,16,800	0.11
Solan	35,252	36,299	71,551	3,14,688	3182	17.25	7,07,250	0.16
Una	35,547	26,262	61,809	2,77,616	1231	19.35	7,93,350	0.06
Himachal Pradesh	42,84,86	3,27,240	4,28,486	34,36,200	29,501	21.37	8,76,170	0.11

Table 9.120 : District-wise Bio-mass Dependency

District	Population 1991	Percent population using biomass	Percent rural population using biomass	Percent urban population using biomass
Bilaspur	2,95,357	90.770	94.85	24.57
Chamba	3,93,286	85.221	80.60	14.56
Hamirpur	3,69,128	91.682	96.51	30.11
Kangra	11,74,072	88.307	91.02	28.78
Kinnaur	71,270	73.517	71.52	0.00
Kullu	3,02,432	85.279	92.62	16.52
Lahaul & Spiti	31,294	84.364	84.30	0.00
Mandi	7,76,372	88.815	95.94	18.92
Shimla	6,17,404	66.187	89.29	6.23
Sirmour	3,79,695	84.271	92.51	19.45
Solan	3,82,268	73.173	85.00	7.88
Una	3,78,269	91.073	94.86	49.12
Himachal Pradesh	51,70,847	83.967	90.96	16.78

Table 9.121 : District-wise Requirement of Different Sources of Energy in Year 2001

District	Electricity (million kWb)	LPG (million kg)	Kerosene (million kltr)	Coal (tones)	Fuel wood (thousand tones)
Bilaspur	31.73	0.25	0.40	0.00	181.84
Chamba	14.79	0.19	0.63	501.87	393.62
Hamirpur	8.35	0.48	0.52	0.00	217.89
Kangra	16.19	1.18	1.82	0.00	852.70
Kinnaur	1.85	0.10	0.56	1865.05	85.24
Kullu	6.30	0.23	0.13	0.00	303.30
Lahaul & Spiti	0.79	0.47	0.07	2585.14	36.43
Mandi	7.69	0.65	1.03	0.00	476.51
Shimla	19.42	0.96	1.11	2251.75	448.85
Sirmour	26.32	0.38	0.52	0.00	236.33
Solan	73.98	0.57	0.79	0.00	242.49
Una	11.85	0.47	0.56	0.00	227.31
Himachal Pradesh	219.26	5.93	8.14	7203.81	3702.51

9.1.9 Institutional Framework For Power Projects (Under HPSEB):

H.P. State Electricity Board while contributing its share on surveys, investigations, preparation of DPR's generation, transmission and distribution, it has constituted two Special Purpose Vehicles (SPVs) Himachal Pradesh Jal Vidyut Nigam Ltd. (HPJVNL) during June 2003 and Pabbar Valley Corporation (PVPC) during 2004 for execution of hydro-electric schemes on fast track basis

with dedicated funds, in the state. These Corporations have been registered with the Registrar of Companies and have been made functional with the appointment of Managing Director, Company Secretary and other associated staff.

Presently Uhl Stage-III (100 MW), Kerang integrated projects in Sutlej valley and Ghanvi (8 MW) have been entrusted to HPJVNL and all hydel schemes existing in Pabbar Valley to PVPC. Both these corporations are expected to function on commercial lines and would provide 12% free power to the State like other project under Central and Private Sectors.

Benefits to H.P. Govt. from Hydel Schemes:

Himachal Pradesh has hydroelectric power as one of its main sources. The State Government will be benefited in the following manner from the hydel schemes, executed/being executed by Central Public Sector Undertakings (CPSUs) and Independent Power Producers (IPPs).

Power and Financial Benefits:

Initially, the schemes executed in the Central Sector, the state was given only a token share of the energy generated from the power schemes located in Himachal Pradesh, as the hydel schemes under Bhakra Beas Management Board (BBMB) having an installed capacity of about 2675 MW, only 2.12% adhoc share has been given to Himachal Pradesh.

The power projects presently executed or being executed by CPSUs, 12% free power is given to the state throughout the agreement period. In addition, H.P. will also get 15% of the power generated, which is at the disposal of Central Government at Bus Bar rate.

From the schemes allotted to IPPs, at present 12% free power is given to the state for the first twelve years and 18% for the next twenty eight years. After 40 years, the project is to be transferred to the state free of cost.

For future hydel schemes, 12% of free power is extended up to 12 years and @ 18% for a period of next 18 years and thereafter @ 30% for the balance agreement period beyond 30 years as royalty to be provided by the Project Developers. The operation period of these schemes will again be forty years and at the end of which, these schemes will stand transferred to H.P. Govt. free of cost.

9.2 Impacts:

The development of hydropower projects brings both positive and negative impacts, on one hand these power projects helps in development of infrastructure as well as generating employment opportunities to the local communities, whereas on the other hand it may degrade the natural environment as well and local people may be required to be displaced from the areas. A brief of positive and negative impact has been described below:

9.2.1 Employment Opportunities:

The private/central sectors will ensure provision of employment to bonafide Himachalis whose names are registered on live register of any employment exchange located in the State of Himachal Pradesh, in respect of all the unskilled/skilled staff and other non-executives as may be required for execution, operation and maintenance of the project, through the local Employment Exchanges, failing which through the Central Employment Cell at Shimla. However, the first preference will be given to oustees. In the event of non-availability of the requisite skilled manpower of various levels with requisite qualification and experience, non-availability certificate will be obtained from the Labour Commissioner/Director Employment, H.P. and only thereafter will these sectors be free to recruit such persons from outside the State of H.P.

These sectors will also satisfy the Government, that the contractors/sub-contractors engaged by them for the project will give employment to local people/Himachalis for appointment as supervisors, workmen and labourers/workers in the project.

In regard to direct recruitment of Engineers and other Executives, other things being equal in terms of eligibility criteria, qualification, experience these sectors will give preference to the candidates well conversant with customs, culture, language and dialect of Himachal Pradesh.

These sectors will maintain 70% of the total employees/officers/executives from bonafide Himachali persons.

These sectors will also provide employment to the members of each of the displaced families or adversely affected as result of the acquisition of land for the project, during construction of the project. During the operation and maintenance of the project, these sectors will give preference to members of displaced families for employment in the project.

These sectors will associate a representative of the Power Department of H.P. Govt. in the process of recruitment for all categories of employees to be recruited for the project.

The petty contractors of the road work, retaining walls, buildings construction, carriage of construction material like sand, aggregate, cement, steel engagement of all categories of other service providers taxis for the staff deployed to the sites, engagement of other light and heavy vehicles, running of canteens/mess, engagement of security personnel through ex-servicemen will normally be awarded to local/Himachalis.

These sectors will also provide programmes to the locals affected by the project so that they are in a position to get employment as various technical/administrative jobs in the project.

9.2.2 Infrastructure Development:

Subject to security and operational factors, these sectors will permit free use by the government and the general public of all service roads, constructed and maintained by it for the project. Other facilities like hospital, post offices, schools.

The fishing, recreational and navigation rights in the river, water channels, reservoir, lake will be vested in the government, subject only to such restrictions as may be necessary for the operational requirements and safety of the project.

Fishing rights will be vested with Government of Himachal Pradesh.

and will also be made available to the general public.

Displacement of the local community.

Unscientific & illegal dumping of the muck along the river banks deteriorates the water quality and is responsible for floods in the downstream areas.

The dumping of the debris in the forest areas not only debeautifies the hill slopes but also destroys the bio- diversity of the areas.

Social & cultural fabric of the local areas is affected.

9.3 Challenges in Hydro Power Sector in H.P.

Like life, development of hydel schemes right from the initial stages of survey, investigation up to the point of generation of power is full of challenges which have resulted in huge time and cost to overrun, especially in the public sector. Even the running and maintenance of these hydel projects have been confronted with various challenges before the authorities. Some of notable and significant as experienced in Himachal Pradesh are indicated below need particular/conscious attention and studies ultimately for effective control on the time and cost overrun on hydel schemes.

- i) Inaccessible and remote project location in the state.
- ii) Non-realistic Master Plan for development of hydro power in an individual river basin.
- iii) Paucity of funds both at investigation and DPR stage and also during construction period.
- iv) Obtaining techno-economic clearance, E&F clearances at Govt. of India level.
- v) Repetition of notification of the scheme under section 29 of Electricity Act.
- vi) Rehabilitation and Resettlement of displaced persons from the project areas.
- vii) Land acquisition (Forest and Non-forest).
- viii) Uncertainties imposed by nature such as earthquakes, unpredictable Himalayan geology geological faults, shear planes intra thrust zones, high stress zones, ground water, high temperature zones.
- ix) Climatic changes viz. global warming causing depletion of snow and glaciers.
- x) Poor management at the project level and induction of inefficient and non-trained staff, political interference.
- xi) Similarly poor contract management.
- xii) Faulty contract provisions.
- xiii) Environmental and ecological problems causing cloud bursting unprecedented flash floods with high percentage of silt, landslides.

- xiv) Formation of artificial lakes, one recently experienced in the catchment of river Satluj, known as Parchhu lake in Tibetan territory; resulting loss of generation and property worth crores of rupees.
- xv) Law and order problems like militancy, labour problems, strikes.
- xvi) Non-coordination among the various units of the project and also outside agencies like Forest, Pollution Control, Revenue Department.

In order to handle excessive silt challenge in Satluj river causing forced repeated shutdown and loss of crores of rupees in the generation of Nathpa Jhakri Project (1500 MW) during peak generation season, Khab hydroelectric project (1020 MW), having 275m high dam, second highest in Asia, with a storage capacity of 95 million cu.m. has been proposed to be taken up for execution by SJVNL. On its completion, it will enable smooth power generation throughout the year and a relief of fear of floods to the people residing downstream. Also all other hydel schemes likely to come up in the valley will be greatly benefited besides increase of life to Bhakra Dam by thirteen years and that to Kol Dam by nine years. Khab storage Dam can accommodate all the waters in case of sudden bursting of Parchu lake in Tibet and any other lake up-stream.

Few more such storage hydel schemes can also be considered for execution upstream of Nathpa-Jhakri Project for further control of silt content.

9.4 Small Hydro Projects in Himachal Pradesh (Including Mini-Micro Schemes):

India has an estimated potential of more than 15000 MW in the form of Small Hydro Projects (SHP), having capacity up to 25 MW, mostly available in Himalayan and hill regions. These SHPs, besides being environment friendly with low gestation period, require little input for operation and maintenance. Such schemes having estimated cost up to Rs. 100 crores are exempted from environmental clearance. The responsibility for development of SHPs lies with Ministry of Non-conventional Energy Sources (MNES), Government of India.

Government of Himachal Pradesh has been laying a great thrust for encouraging generation of power through renewable energy sources with special emphasis of SHPs, including and up to a capacity of 5 MW in the state. Out of the total potential of 750 MW, 469 sites with capacities ranging from 100 KW to 5 MW, has so far, been identified. The State Government has entrusted the implementation of Micro (less than 100 KW), Mini (100 KW-2000 KW) and SHPs (2000 KW-25000 KW) through private investment to HIMURJA (H.P. Govt. Energy Development Agency). For hydel schemes above 5MW capacity, administrative control is with HPSEB, but for liaison work with MNES, HIMURJA will remain the Nodal Agency. The administrative charge of HIMURJA has also been transferred to MPP and Power, during 2000, for better co-ordination of policies at Govt. level.

The following table shows the status of SHPs under HIMURJA :

Table 9.122: Abstract of Status of SHPs

Sr. No.	Description	Total
1.	Total No. of projects for which MOUs signed	235
2.	Total MOUs in operation	186
3.	Total estimated capacity of projects	419.39 MW
4.	Total No. of DPRs received	148
5.	Total No. of DPRs yet to be submitted	25
6.	Total No. of DPRs for which TEC accorded by HPSEB	84
7.	Total No. of projects for which IAs signed	64
8.	Total No. of companies with whom IA signed	43
9.	Total estimated capacity	186.75 MW
10.	Total estimated cost in crores	1120.42
11.	Total No. of PPAs signed	28

Source: A Note From HIMURJA

Out of 64 projects for which IAs have been signed since March 2002, two projects namely Manjhi (4.50 MW) in District Kangra and Baragaon (3.00 MW) in District Kullu have been commissioned in June and July 2004 respectively and works on seven projects is in progress. These schemes are Jiwa (1.00 MW), Aleo (3 MW) and Suman-Sarwari (2.50 MW) in District Kullu, Manjhal (1.00 MW) and Dehar (5.00 MW) in District Chamba, Ching (1.00 MW) in District Shimla and Manal (3.00 MW) in District Sirmour. Forest clearance cases for 36 projects have been submitted, out of which 18 have been approved. The estimated investment is expected to be approx. Rs. 2186.70 crore.

Further, Govt. of Himachal Pradesh has recently approved revised policy guidelines for SHPs (up to 5MW) which envisage mainly the following points:-

- Micro-hydel projects up to 2MW capacity will be exclusively reserved for bonafide Himachalis and Co-operative societies.
- Royalty in the form of power to H.P. Govt. will be free up to twelve years, @ 12% for the next 13 years and thereafter it would be @ 18%.
- The Independent Power Producers (IPP) would sell power to HPSEB @ Rs. 2.50 per unit.
- The upfront premium up to 2MW has been prescribed at Rs. 25000.00 per MW with a slab of Rs. 40,000.00. For SHPs above 2MW, up to 5 MW, the rate of upfront premium shall be Rs. 45000.00 per MW with a ceiling of Rs. 75,000.00.
- The private or government land shall be on lease basis except for permanent structures, at the rates approved by the Govt. for the agreement period.
- The registration of employment-related information to the Labour Department and local police station on monthly basis too has been made mandatory for the IPP.

- IPP can be permitted to transfer the project further to any IPP/turn-key contractor subject to the payment of Rs. 75 lakh per MW as one-time offer.

On the environment aspect, the policy specifically states that the entrepreneurs will have to get a letter from the Wildlife Department stating that the project area is outside the wildlife park, sanctuaries and zoos. The consent of gram panchayats, too, has been made mandatory in addition to a certificate from the IPH and the Revenue Department that the project does not infringe on the drinking and irrigation rights of inhabitants and ownership of the traditional water mills.

9.5 Development of Non-Conventional Energy Sources:

HIMURJA (H.P. Govt. Energy Development Agency) has been constituted to promote and popularise renewable and provide appropriate energy systems at affordable prices among the larger public and also encourage R&D efforts in the renewable energy sector.

HIMURJA has made concerted efforts to popularise renewable energy through the integrated Rural Energy Planning Programme (IREP), and has taken up as full-fledged programme in the State with the financial support of MNES, Govt. of India. Initially, the programme was started on a pilot basis in two blocks, Theog and Spiti of the state, and later on extended to 45 blocks in a phased manner.

Efforts are also being made to propagate fuel efficient devices and non-conventional energy devices like solar cookers, solar water heating systems, improved chullahs, improved water mills and photovoltaic lights. The achievements made under different programmes are as under:-

Solar Thermal Extension Programme:

- 29,573 Solar Cookers have been provided in the state up to December 2004 to potential beneficiaries.
- 3265 Solar Water Heating Systems of different capacities with a total capacity of 5, 91,400 LPD (litre per day) have been installed/ booked in different parts of the state.

The State Government has taken a decision to make the installation of Solar Water Heating Systems mandatory in all Government buildings/institutions.

Solar Photo Voltaic Programme:

Though hundred percent electrification has been achieved in the state, yet there are a number of hamlets and small pockets of houses, which are still un-electrified. Some of these houses are so remotely located that the people living there cannot hope for electrification by conventional means since it is not possible to lay the transmission/distribution lines for covering these areas as it is very costly proposition. The only alternative for such a multitude of hamlets/pockets of houses is electrification by providing solar photovoltaic systems for decentralization application.

- 2426 Solar P.V. Street Lights, 14744 Domestic P.V. Lights have been provided at subsidized rates in the Pradesh up to December, 2004.
- Efforts were also made to electrify rural/remote villages.

Two villages Chasak Bhatori and Murch in Pangi have been electrified by Solar Photovoltaic Systems. Similarly Bara Bhargal has also been electrified. Domestic Solar Lights have been provided to the villages @ Rs. 500/- per beneficiary household.

9.6 Energy Conservation Programme Under HIMURJA:

In order to conserve energy, HIMURJA has provided energy efficient devices like Pressure Cookers, Nutan Stoves and Nutan Jyoti to identified IRDP families in the selected IREP blocks. So far 105823 Pressure Cookers, 11,196 CFL Systems, 26881 Nutan Jyoti and 41,579 Nutan Stoves have been provided to identified families at a subsidized rate:-

- 1247 improved wheels (gharats) with improved efficiency have also been installed/booked in different parts of the state up to December, 2004.

9.6.1 Wind Energy:

There is little scope for exploitation of wind energy in the state for power generation and other mechanical uses like lifting groundwater. Efforts are being made to strengthen the wind data base through wind monitoring stations.

India, however, after emerging as fourth largest wind power producer in the world with 4200 MW installed capacity, is likely to add 1200 MW during 2006-07, mainly the private sector like Reliance, ONGC and HPCL. The new projects may be set up in states like Rajasthan, Tamil Nadu, Maharashtra, Gujarat and the North-East.

Portable Micro Hydel Generator Sets:

The electric energy can also be generated on a small scale by utilising natural falls available in the nallahs and rivulets with the help of micro hydel generator sets.

Fifteen portable hydel generator sets have been supplied free of cost to HIMURJA by MNES, Govt. of India, out of which 12 Nos. have been commissioned in remote Pangi Sub-Division of Chamba District and 2 Nos. in Dodra-Kawar. HIMURJA is also rehabilitating 15 KW demonstration Unit at Sarahan, District Shimla damaged in flash floods during July 2003, by upgrading it to a 30KW project.

9.6.2 Hydrams Popularisation:

Hydro power at the micro level can also be utilized in a cost effective manner in the form of mechanical power through Hydraulic-Ram (Hydrams). A Hydraulic-Ram (Hydram) is an impulse

pump working on the principle of water hammer. Major feature of a hydraulic ram is non-requirement of an external source of energy, low maintenance and operation costs and the requirement of some minimum head at water source. The Hydrams assume special importance in hill areas.

HIMURJA has installed 392 Hydrams in different locations of the state under Swarnjayanti Gram Swarojgar Yojna (SGSY) and Development of Marginal and Waste Land through application of appropriate technology (200 under pilot project) of Ministry of Rural Development, Govt. of India.

9.7 Power Sector and Environment Aspects in Himachal Pradesh:

9.7.1 Environment Issues in Hydel Sector:

The development of large and medium size hydro-electric schemes like Bhakra (1200 MW), Pong Dam (360 MW), Beas Satluj Link (Dehar Power House) 990 MW, have already caused deforestation, submergence of the area, rehabilitation of the population and adverse impacts on flora and fauna in the state. It mainly disturbs the catchment area, watercourse itself, nature conservation, wildlife, water supply, quality of water, agriculture, forestry, water transport, cause floods, silting, erosion and cloud bursting. These are termed as environmental issues.

The threat looms large and deserves to be tackled through Herculean and gigantic efforts both at state and national levels. It requires efficient deep thinking adequate protection measures and co-coordinated plan among the concerned departments.

People Concern

It was highlighted by the local NGOs that during the desiltation operations huge quantity of silt is released by the BSL authorities and due to deposition of this silt in the agriculture fields between Mandi and Sundernagar about 100 villages have been affected and the production in the agriculture fields have also been affected. The Ghats of the river Saketi has been destroyed by the deposition of the silt. The aquatic life has also been disrupted. It was informed that NEERI has also brought out a report in this regard and requested that a detailed survey by the some State agency is required to be undertaken to understand the issues related with the deposition of the silt.

Each hydel scheme in the state has its own specific environmental issues. Before taking up the project works, visual documentation of water sources, hill slopes and other environmental sensitive features, require to be carried out to enable actual assessment to quantify overall environmental impact. Boring of the tunnels under hills and other underground works resulting in land slides, cracks in the houses, drying of natural springs and other water sources falling along the alignment of head race tunnel, have already been noticed on a number of hydel schemes in the past, causing numerous hardships to the local people residing in the vicinity.

It is suggested to have further detailed studies from some expert institution to quantify the actual environmental impacts on the concerned river including environmental impacts on flora and fauna in the downstream areas in case of diversion of river for power generation. The recommendations

of such organization may be faithfully taken into consideration by Union Ministry of Environment and Forests, Govt. of India and the State Government before granting environment and forest clearance to the concerned hydel scheme; to ensure environmental protection and pollution free projects.

9.8 Environmental Safeguards:

Most of the hydel schemes under execution and also those likely to be taken up for construction in the state are run-of-the-river type development (except a few schemes with storage), as these are non-consumptive, non-radioactive, non-polluting and more friendly to environments. By and large, the major components comprise underground structures, which further reduce environmental impact.

In order to maintain the environmental benign and ecological balance in Himachal Pradesh, DPRs of the hydel schemes prepared under State, Central or Private Sectors, are approved only after detailed examination of adequate provision for R&R Plan, afforestation, Catchment Area Treatment (CAT) plan and other environmental issues identified including especially adequate provision for dumping sites for disposal of debris, augmentation and restoration of water supply schemes, warning system in case of sudden release of water. Some of the major environmental aspects and their safeguards are briefly described as under:-

- During the construction period of the hydel scheme, the muck generated from excavation is being properly disposed of at the earmarked dumping sites.
- Effective ventilation system in underground structures, wetting of un-metalled roads frequently to prevent generation of dust are being provided.
- Engineering measures like gully control, bench terracing land-slide control, hill slope stabilisation and cut are being stabilized by proper shortcreting and rock-bolting.
- Whenever possible, fish passage is being provided, especially on the hydel schemes located on the main rivers. Also aquaculture facilities are being provided on the hydel schemes having reservoirs.
- Himachal Government has already notified suitable instructions to all the existing and upcoming hydel projects in the state to release and maintain minimum water flow of fifteen percent of lowest inflow downstream into the river body throughout the year, for separate drinking water, irrigation arrangements, environmental and ecology.
- It is further made mandatory on the part of all hydel project authorities to install appropriate instruments or devices to keep the record of water flow on a day-to-day basis.
- Social impacts including loss of homes and agriculture areas are compensated based on resettlement and rehabilitation policy of Himachal Pradesh Government.
- Anti-poaching laws are enforced to attract wildlife under the help and guidance of State Wild Life Department.

- Loss of forests and habitats for wild life are compensated by carrying out compensatory afforestation in and around the project area and also in the catchment area as per plan and provision in Catchment Area Treatment Plan (CAT) for concerned river basin, biological measures such as nursery development, horticulture plantation and silvipastoral plantation in catchment areas of the project and also the creation of greenbelts around the reservoir, are being taken under Environment Management Plan of the Project.
- Adequate funds are being provided for habitat improvement, conservation of endangered species and enrichment of flora and fauna.
- About 1.5 percent of the estimated cost of the project will be spent on socio-economic development of the area.

9.9 Responses:

9.9.1 Constitution of State Level Environment Monitoring Committee:

The Govt. of Himachal Pradesh Vide notification dated 9th September 2002 has constituted a State level Environment Impact Assessment and Monitoring Committee for examining / recommending the cases for clearance and Monitoring Environmental safe gaurds.

9.9.2 H.P. Power Policy:

The State Government has notified Power Policy during 2006. In the Power Policy 1.5% of the project cost is made mandatory to be utilized for Socio-economic development of the local area through Local Area Development Agency (LADA).

9.9.3 Maintainance of Minimum Discharge:

State Govt. has made it mandatory to release 15% of minimum observed threshold discharge into the River /streams downstream of the diversion.

9.9.4 Renovation, Modernization and Upgradation (R M& U) of Existing Old Power Houses (Under HPSEB):

The performance/efficiency of old power plants can be further improved economically by the technique of RM & U and thereby, usefulness of the plants can also be enhanced. Keeping in view the demand and supply position of power and overall resource constraints, RM & U of the old hydro plants is a preferable alternative to increase in power generation capacity both from point of view of costs and time frame work. The cost of RM&U of the power plants is even less than 50 percent compared to the cost required for new plants.

H.P.S.E.B. has already taken up the following schemes for RM&U and indicated as below:-

Table 9.123 : Schemes for R.M &U under HPSEB

Sr. No.	Name of Existing Scheme	Capacity	Estimated cost (Rs. in lakhs)
1.	Nogli HEP	2.5 MW	544
2.	Chaba HEP	1750 KW	361.67
3.	Thirot HEP	4500 KW	1248.77
4.	Binwa HEP	6 MW	Under process
5.	Giri HEP (Up-rating)	60 MW	Under process

Source: Information collected from HPSEB.

9.9.5 Transmission and Distribution:

To match the increasing activities on the construction of hydel schemes there is an immediate need to lay emphasize on adequate transmission system to facilitate unhindered transmission of power to the load centres located within or outside the state.

Himachal Pradesh, through HPSEB, has currently 329.50 MW and is also considering its entitlement in the various Central Sector Projects, shared generation and projects constructed by IPPs selling power to HPSEB, the availability of power as 1200 MW. This power is handled by a transmission network, comprising of 2100 km of lines of 66 KV and above with 75 power transformers aggregating to around 1650 MVA capacity.

For the future, a proper Transmission Plan for the State will be prepared by the Government of H.P. for the evacuation of power to the order of 5500 MW expected to be harnessed in the State/Central/Joint and Private Sector by end of the XI plan, and power generated in addition by small hydel projects (SHPs).

On distribution side, the state has 14576 Nos. distribution transformers, 24,362.215 km 22KV and 11 KV lines, 47875.62 km LT (Low Tension) lines. The present HT to LT ratio is 1:1.96. Himachal Pradesh is one of the few states in the country where energy delivered to the consumer is 100 percent metered. The electricity is being provided to 15,75356 consumers in the state.

Under the Accelerated Power Development and Reform Programme (APDRP), H.P. Govt. (through the HPSEB) has framed the schemes for the improvement of the sub-transmission and distribution system, amounting to Rs. 327 crore and Ministry of Power, Govt. of India has released an amount of Rs. 163 crore. So far Rs. 168 crore has been spent and in all 1, 80,000 new electric meters have been installed. As many as 1026 km. of low tension line and 500 km of high tension line have been spread and 33,000 new electric poles are being erected in place of the old ones.

Transmission and Distribution (T&D) Losses:

All India average T&D losses are around 22-23 percent for the last few years and these losses in some states varies from 16 percent to 45%.

As per CEA, recommendations, T&D losses should be aimed at 8% and maximum could be around 15%.

In Himachal Pradesh, this loss varies from 19.20% to 21.17%. Consistent efforts are being made for its further improvement as to bring it within limits.

Recently, HPSEB, on a trial basis has installed 750 special electricity meters in Shimla, Mandi and Dharamsala facilitating a re-charge of the electrical supply by purchasing a pre-paid power card and activating it by simply sending a SMS to HPSEB outlets. If it is successful, more areas can be covered. It would avoid loss of power due to pilferage, problems like excess or under billing, standing in queues to pay the bills and help HPSEB to save considerable revenue.

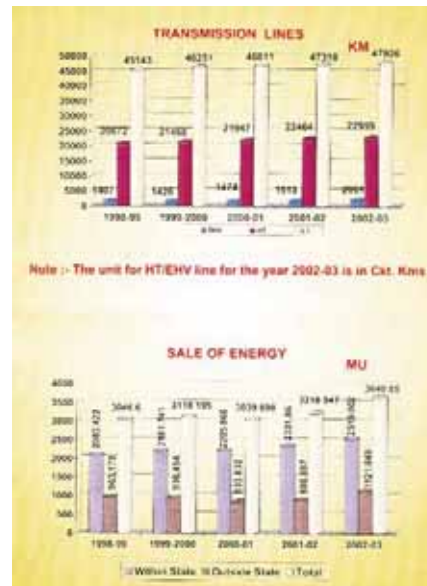


Fig. 1.23

9.9.6 Rural Electrification - The Challenge:

Rural electrification in India has suffered badly over the last decade mainly because of the poor operational and financial health of SEBs. so far 86 percent of all villages have been electrified over the years, nearly 80,000 villages are yet to be electrified. Uninterrupted power supply to rural areas is a major challenge for today.

In Himachal Pradesh, out of a population of 52 lakhs, 91 percent of the population is residing in villages, similarly out of 9,59,453 households in the state 8,53,130 Nos. (89%) are in villages. Considering it a social compulsion, Himachal Pradesh, through HPSEB, completed 100 percent electrification of its villages way back in the year 1988.

With the passage of time, the number of villages has increased and as per 1991 census, 16,997 villages are further identified out of which 16,891 (99.37%) have been electrified up to 31.03.2004. Also out of 4182 up to identified hamlets 4009 (95.86%) stand electrified as on 31.03.2004.

The State Government is committed to providing quality and reliable power supply to 100 percent to rural people residing in villages and hamlets.

Rajiv Gandhi Grameen Vidyutikaran Yojna - Scheme of Rural Electricity Infrastructure and Household Electrification:

This new scheme has been launched by the Ministry of Power, Govt. of India, to provide access

to electricity for all rural households in five years for reaching the goals of the National Common Minimum Programme (NCMP). The approval of the Govt. of India has already been accorded in March, 2005.

The Highlights of the Programme are as follows:-

- The scheme will be implemented through the Rural Electrification Corporation (REC) and act as a nodal agency.
- Ninety percent capital subsidy would be provided by the Central Government for overall cost of the project.
- Below Poverty Line (BPL) households to get electricity connection free of charge.
- Revenue sustainability of electricity supply to be ensured through franchises, which might be NGOs, users associations, co-operatives or individual entrepreneurs with association of panchayati institutions.
- No discrimination in the hours of supply between rural and urban households.
- Services of Central Public Sector Undertakings (CPSUs) made available to states willing to utilize their services for implementing of the programme.
- The scheme will create the necessary information through:-

a) Rural Electricity Distribution Backbone (REDB):-

Provision of 33/11 KV (or 66/11 KV) sub-stations of adequate capacity and lines in blocks where these do not exist.

b) Creation of Village Electrification Infrastructure (VEI)

- Electrification of un-electrified villages.
- Electrification of un-electrified habitations.
- Provision of distribution transformers with the appropriate capacity in electrified villages/habitations.

c) Decentralised Distributed Generation (DDG) and Supply:-

System for villages where grid connectivity is either not possible or not cost effective.

Under the above scheme, H.P. Government through HPSEB will provide one transformer for each village in the state for maintaining a reliable and efficient power supply. Also a 33 KV sub-stations would be installed in every block in the State. District-wise schemes are already under preparation in HPSEB, to be submitted to Ministry of Power, Govt. of India to take and use maximum funds shortly.

So far schemes for seven districts have been submitted to the Centre and for the remaining five districts are being formulated.

9.9.7 Power Sector Reforms:

Govt. of Himachal Pradesh is committed to reforming its Power Sector with a view to achieve commercial viability and providing reliable and quality power at competitive prices to all consumers in the state.

As a first step, an MOU was signed by the H.P. Govt. with the Ministry of Power, Govt. of India on 31.3.2001 to reform the power sector in the state and to set out reform measures to be implemented by the Govt. of Himachal Pradesh with the support that the Govt. of India will provide.

Under the reform programme as detailed in the MOU, the major milestones are:-

- i) to create independent centres under the overall aegis of H.P. State Electricity Board for its major wings Generation, Transmission and Distribution.
- ii) to endeavour to reduce progressively the surplus manpower.
- iii) to scrutinize outstanding dues of CPSUs as per the scheme approved by the Govt. of India.
- iv) to bring current operations on distribution to break even by 31st March 2005 and achieve positive returns thereafter.
- v) to develop an effective distribution management information system.
- vi) to undertake energy audit at all levels.
- vii) to implement a programme in the field of demand side management through energy efficient bulbs, tube lights, time of day metering.
- viii) to maintain grid discipline, comply with Indian Electricity Grid Code and carry out the directions of the Regional Load Dispatch Centre.
- ix) to undertake computerized billing of all urban consumers by 31st March 2003 and in the entire state complete the computerized billing, accounting and audit system by March, 2005.
- x) to ensure filing of tariff petition before Himachal Pradesh Electricity Regulatory Commission (HPERC) by 30th April, 2001.

The Govt. of Himachal Pradesh has already taken strides in this direction so that the aforementioned milestones are achieved on time. HPERC has been established which is functioning with independence and appropriate support from the Govt. of India. The progress on Accelerated Power Development and Reform Programme (APDRP) front has been made effective from 1st April, 2004.

The above strategic measures supplemented with central assistance in the priority areas through APDRP and other channels will enable us to drive the synergies of HPSEB and will result in following integrated benefits in percentage points by the end of the MOU period, 2005-2006.

i)	Increase in generation capacity	50%
ii)	Additional availability of power	25%
iii)	Reduction in T&D losses	5%
iv)	Less purchase of costly power	25%
v)	Increase in Tariff	20%
vi)	Improvement in Billing, Collection and other efficiencies productivity Levels	15%

This will make H.P. State Electricity Board self-sustainable as Govt. of Himachal Pradesh is committed to continue the Board as a single entity in the best interest of people of the Pradesh; as unbundling of State Electricity Board is not the goal. The goal is efficiency, economy, enhancement of power generation and overall ensuring that a competitive environment prevails.

9.9.8 Schedule of Tariff:

The schedule of tariff for the supply of electricity to various categories of consumers in Himachal Pradesh as notified by HPSEB from the week ending 05.07.2004 is as under:-

Sr. No.	Category	Tariff week ending 5.7.2004
1.	Domestic Supply (D.S.)	
	Energy Charges	
	Consumer Service Charge (Part-I)	Nil
	i) Antodya Anna Yojna beneficiaries (up to 45 units per month)	
	ii) Other Consumers	Rs.11/Month/ Consumer
	Energy Charge (Part-2)	
	First 45 kwh/month	
	i) For Antodya Anna Yojna	70 paise /Unit
	ii) For General Public	85 paise /Unit
	From 46-150 kwh/month	130paise/Unit
	All above 150 kwh/month	240paise/Unit

A rebate of 7.5% on the energy charges will be allowed if the supply, at the discretion of the supplier, is given 11 kv or above.

2.	Non-domestic Non-commercial (NDNC)	
	Consumer Service Charge (Part-I)	
	From 0 to 20 KW	Rs. 50/month/consumer
	From 20 KW and above	Rs.100/month/consumer
	Energy Charge (Part-II)	
	All consumption	Rs. 3.50/KWH

Equivalent Two Part Tariff (applicable from
1st October, 2004 for consumers with connected
load above 20 KW

Consumer Service Charge (Part-I)

Above 20 KW Rs.100/month/consumer

Energy Charge (Part-II)

All consumption Rs. 2.30/KVAh

Demand Charge (Part-III)

Above 20 KW Rs. 50/KVA/month

A rebate of 7.5% on the energy charges will be allowed if the supply, at the discretion of the supplier, is given at 11 KV or above.

3. Commercial Supply (C.S.)

Consumer Service Charge (Part-I)

From 0-20 KW Rs. 50/month/consumer

From 20-100 KW Rs.100/month/consumer

Above 100 KW Rs.200/month/consumer

Energy Charge (Part-II)

All Consumption Rs. 3.50/KWH

Equivalent two part tariff (applicable from October 1, 2004 for consumers with connected load above 20 KW.

Consumer Service Charge (Part-I)

From 20 - 100 KW Rs.100/month/consumer

Above 100 KW Rs.200/month/consumer

Energy Charge (Part-II)

From 20 - 100 KW Rs.2.40/KVAH

Above 100 KW Rs.2.10/KVAH

Demand Charge (Part-III)

From 20 - 100 KW Rs.50/KVA/month

Above 100 KW Rs.100/KVA/month

A rebate of 7.5% energy charges will be allowed if the supply, at the discretion of the supplier, is given at 11 KV or above.

4. Small and Medium Industrial Power Supply (SMS)

Consumer Service Charge (Part-I)

From 0-20 KW Rs. 50/month/consumer

From 20-100 KW Rs.100/month/consumer

ENERGY CHARGE (PART-II)

From 0-20 KW	Rs. 3.10/KWh
From 20-100 KW	Rs. 100/month/consumer

Rebate of 10 paise per KWH on the energy charges for consumers drawing energy at 11 KV.

Peak Load Exemption Charges (PLEC)

Above 20 KW and up to 100 KW load	Rs. 6.20/KWH

PLEC is applicable for consumption during peak load hours only.

A rebate of 20 paise per KWH on the PLEC for consumers drawing energy at 11 KV.

Peak Load Violation Charges

Above 20 KW and up to 100 KW load	Rs. 9.30/KWH

Equivalent two part tariff for consumers with connected load above 20 KW.

20-100 KW	- Energy Charge Rs. 2.40/KVAH - Consumer Service Rs.100/ consumer/month Charge. - Demand Charge Rs.50/KVA/ month

A rebate of 10 paise per KVAH will be given to consumers drawing energy at 11 KV, PLEC for Peak Time Consumption.

20-100 KW	Rs. 4.80/KVAH

A rebate of 20 paise per KVAH on PLEC will be given to consumers drawing energy at 11KV.

Peak Load Violation Charges:- (PLVC)

From 20-100 KW	Rs. 7.20/KVAH

A rebate of 30 paise per KVAH on PLVC will be given to consumers drawing energy at 11KV.

Night-Time Concession

A night time concession of 20 paise/KWH till 1.10.2004 and 20 paise/KVAH after 1.10.2004, on energy consumption between 00.00 hours to 06.00 hours will be given to consumers whose connection is provided with an electronic tri-vector meter.

Surcharge for L.T. supply to STEEL Rolling Mills

Steel Rolling and Re-rolling Mills given supply at L.T. under this tariff will be charged a surcharge @ 10% on the amount of energy charges.

**5. Large Industrial Supply
Including Mini Steel Plants (Ls)
Consumer Service Charge (Part-I)**

- EHT	Rs.300/month/consumer
- HT	Rs.200/month/consumer

Energy Charge (Part-II)

- EHT	Rs.2.15/KVAH
- HT	Rs.2.22/KVAH

Dem and Charge (Part-III)

- EHT	Rs.150/KVA/month
- HT	Rs.150/KVA/month

Peak Load Exemption Charges (Plec)

- EHT	Rs.4.30/KVAH
- HT	Rs.4.45/KVAH

Peak Load Violation Charges (Plvc)

- EHT	Rs.6.45/KVAH
- HT	Rs.6.70/KVAH

Penalty For Over Drawl

A penalty of Rs. 300.00 per KVA per month will be levied on the part of the demand in excess of the contract demand.

Night Time Concession

A night time concession of 20 paise/KVAH on the consumption of energy between 00.00 hours to 06.00 hours will be given. The concession will be available only where electronic tri-vector meters have been installed.

Rebate for supply at higher voltage

-33KV	1.5%

**6. Water Pumping Supply (WPS)
Consumer Service Charge (Part-I)**

All Consumers	Rs.100/month/consumer

Energy Charge (Part-II)

-Supply at less than 11 KV	Rs. 3.10/KWH
-Supply at 11 KV and above	Rs. 2.70/KWH

Peak Load Exemption Charges (Plec)

-Supply at less than 11 KV	Rs. 6.20/KWH
-Supply at 11 KV and above	Rs. 5.40/KWH

Peak Load Violation Charges

-Supply at less than 11 KV	Rs. 9.30/KWH
-Supply at 11 KV and above	Rs. 8.10/KWH

KVAH based equivalent approved tariff for WPS**-Energy Charge**

i) Supply at less than 11 KV	Rs. 2.20/KWH
ii) Supply at 11 KV and above	Rs. 1.85/KWH

-Demand Charge

i) Supply at less than 11 KV	Rs. 125/KVA/month
ii) Supply at 11 KV and above	Rs. 125/KVA/month

-Consumer Service Charge

i) Supply at less than 11 KV	Rs. 100/month/consumer
ii) Supply at 11 KV and above	Rs. 100/month/consumer

PLEC for Peak Time Consumption

-Supply at less than 11 KV	Rs. 4.40/KVAH
-Supply at 11 KV and above	Rs. 3.70/KVAH

PLVC is regard to the KVAH tariff

-Supply at less than 11 KV	Rs. 6.60/KVAH
-Supply at 11 KV and above	Rs. 5.50/KVAH

Night Time Concession

A night time concession of 20 paise/KVAH on consumption of energy between 00.00 hours to 06.00 hours will be given. The concession will be available only where electronic tri-vector meters have been installed.

Rebate for Higher Voltage

The consumers who take supply under this schedule at voltage higher than 11/22 KV will get a rebate at the following percentages on the amount of energy charges.

-33 KV	1.5% (Rebate)
-66 KV	2% "
-132 KV	2.5% "
-220 KV	3% "

7. Agriculture Pumping Supply (APS)**Consumer Service Charge (Part-I)**

All consumers	Rs. 20/month/consumer

Energy Charge (Part-II)

All consumption	Rs. 0.50/KWH

Peak Load Exemption Charges (Plec)

AP Supply	Rs. 1.00/KWH

Peak Load Violation Charge (Plvc)

AP Supply	Rs. 1.50/KWH

8. Bulk Supply (BS)**Consumer Service Charge (Part-I)**

All Consumers	Rs. 100/month/consumer

Energy Charge (Part-II)

-Supply at less than 11 KV	Rs. 3.50/KWH

-Supply at 11 KV and above	Rs. 3.15/KWH

Equivalent KVAH based Tariff

-Energy Charge

(Bulk Supply above 20 KW)

i) LT	Rs. 2.50/KVAH

ii) HT	Rs. 2.10/KVAH

-Consumer Service Charge

i) LT	Rs.100/- per consumer/month

ii) HT	Rs. 100.00/consumer/month

Demand Charge

i) LT	Rs. 40.00/KVA/month

ii) HT	Rs. 50.00/KVA/month

Rebate For The Higher Voltage

The consumers who take a supply at voltage higher than 11 KV shall get the rebate at the following percentages on the amount of energy charges.

-33 KV	1.5% (Rebate)

-66 KV	2% "

-132 KV	2.5% "

-220 KV	3% "

Street Lighting Supply (SLS)**Consumer Service Charge (Part-I)**

All Consumers	Rs. 50.00/month/consumer

Energy Charge (Part-II)

All Consumption	Rs. 2.85/KWH

Temporary Metered Supply (TM)**Consumer Service Charge (Part-I)**

All Consumers	Rs.100.00/month/consumer

Energy Charge (Part-II)

All Consumption	Rs. 6.00/KWH

9.9.9 Energy Conservation:

Energy conservation is synonymous with energy generation. Conservation means a more rational and scientific use of energy and is cheaper than incremental cost of energy production. It is, therefore, the cheapest solution for bridging the gap between demand and supply.

In our country, there is substantial scope for energy conservation, mainly from the same sectors, where it is used. The major areas, besides conservation measures on the generation side, transmission and distribution are:-

- Industrial Sector
- Agriculture Sector
- Domestic and Commercial Sector

In Himachal Pradesh, the State Electricity Board has already taken various steps to make people aware and give information on all aspect of energy conservation on a wide scale. Slogans like “Energy Saved is Energy Generated”, “Energy Saved is Money Saved”, and “Cut Your Energy Bills” have become very popular.

H.P. State Electricity Board, as one of the measures through its Energy Bills to domestic, commercial, industrial and agriculture consumers circulates “Energy Saving Tips” as follows:-

Domestic and Commercial Consumers

- i) Switch off all electrical appliances and lights when not in use.
- ii) Keep lamps and fixtures clean and dirt free.
- iii) Use light colours for walls and ceilings.
- iv) Tube lights give more light than bulbs, consume less electricity and have a longer life.

- v) Use standard electrical fittings/fixtures and wires with ISI marking.
- vi) Make greater use of daylight.
- vii) Thermostat setting of geyser should be as per requirement.

Industrial and Agricultural Consumers:

Lubricate motors and motor drives regularly.

Place motor as close to the load as possible.

Do not use oversized motors which waste energy and increase demand charges.

Use shunt capacitors across motor terminals to reduce demand charges and also to avoid damage to motors.

Tighten belt and pulley at regular intervals to reduce loss of energy due to “Slip”.

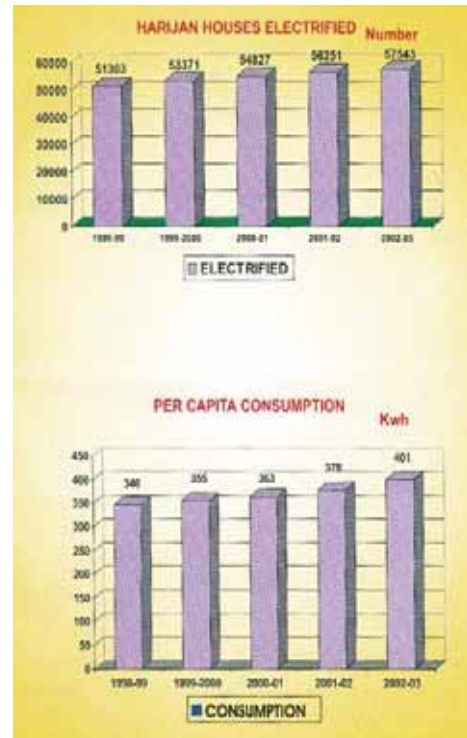


Fig. 1.24

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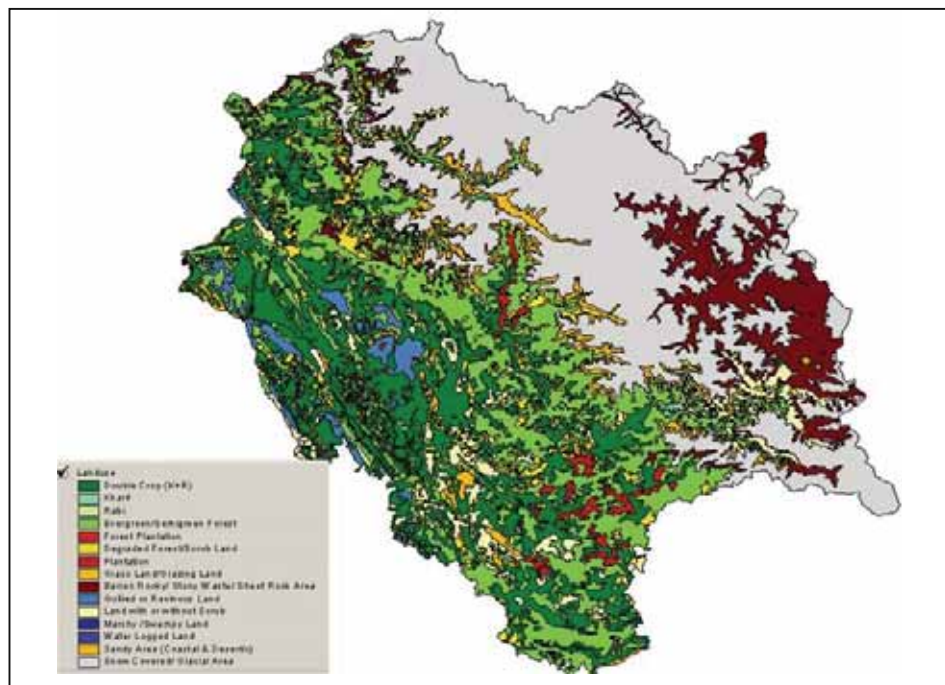
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LAND USE AND ENVIRONMENT

Land Use and Environment

Introduction:

For a society land is a primary but prime resource which is non renewable and limited; almost every activity is associated with it in one way or the other. The human as well as livestock populations determine the land use to a great extent, apart from other factors like the stage and pattern of development, depending also upon the climatic conditions, type of the land and physical features and also the texture of the land. The per capita availability of land is comfortable in the state. However, unless sensible use, preservation, regeneration and upgradation are not ensured, a sustainable development in food production, animal husbandry, forestry and horticulture cannot be achieved. The laying down of an integrated land use policy with correct legislation cover is therefore of utmost importance.



Map 1.17. Land use classification

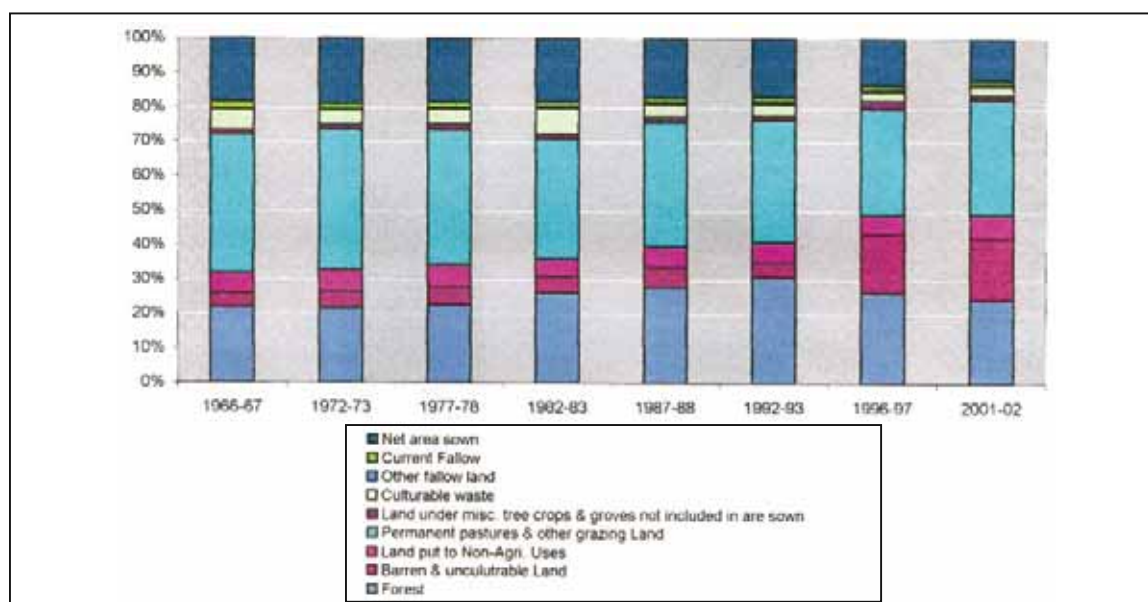
Land use profile was published in the March, 2000 edition of SoER. Land use patterns were studied and elaborated in that publication with 1994-95 as the terminal year and a comparative study was made from 1966-67 to 1994-95. The present report, therefore, aims at updating the same for the block's period 1999-2000 and also taking the terminal year as 2001-02. The object of this paper is, therefore, to study the land use patterns with reference to the 2000 report and update up to the year 2001-02.

The scope of this study is, therefore, not to repeat the detailed definitions or concepts discussed in detail in the original report of March 2000, but to restrict it to the progress made since then and to discuss the changes and shifts thereafter and also to study further, degraded lands, waste lands, common property and resources, conserving land degradation and desertification, drought-prone and flood-affected areas, changing cropping patterns and trends, cropping intensity and legislation policies and programmes for land development.

The population of the state is 60 lakh as per the 2001 census with a density of 109 people per km² and the livestock population was 55.48 lakhs up to 1994-95 but has gone down to 45.78 lakhs up to 1997. Due to ever increasing pressures on land, the problems relating to land use have gained importance if we are to ensure a clean environment and sustainable development without harming the ecological balances. Land use pattern, shifts and issues related thereto need to be identified and addressed on priority.

Table 10.124: Himachal Pradesh Shift in Land Use Pattern for the Block Year 1966-67 Onwards
(Area in Hectares)

	1966-67	1972-73	1977-78	1982-83	1987-88	1992-93	1996-97	2001-02
Forest	636096	637598	677187	808616	931552	1038003	1084633	1098661
Barren & uncultrable Land	109383	129733	154178	143606	191702	146075	715578	806574
Land out to Non-Agri Uses	177483	160156	197707	163480	202706	201311	226446	317469
Land under misc tree crops & groves not included in are sown	39716	44000	53050	41426	43936	42800	97751	60230
Culturable waste	176760	127035	135231	238971	125573	120360	106150	122114
Other fallow land	2630	3176	3403	13940	17047	22834	21663	13093
Current fallow	65759	49606	51070	43065	45355	48517	50781	56287
Net area sown	535107	558626	560103	571408	575870	572563	567534	549643
Total area	2906336	2930936	3010278	3113429	3349546	3395434	4161263	4542759



(in %)

	1966-67	1972-73	1977-78	1982-83	1987-88	1992-93	1996-97	2001-02
Forest	22	22	22	26	28	31	25	24
Barren & uncultrableLand	4	4	5	5	6	4	18	18
Land out to Non-Agri Uses	6	6	7	5	6	6	5	7
Permanent pastures & other grazing Land	40	41	40	35	36	35	31	33
Land under misc tree crops & groves not included in area sown	1	1	1	1	1	1	2	1
Cultivable waste	6	5	5	8	4	4	3	3
Other fallow land	1	1	1	0	1	1	1	1
Current Fallow	2	2	1	1	1	1	1	1
Net area sown	18	18	18	19	17	17	14	12

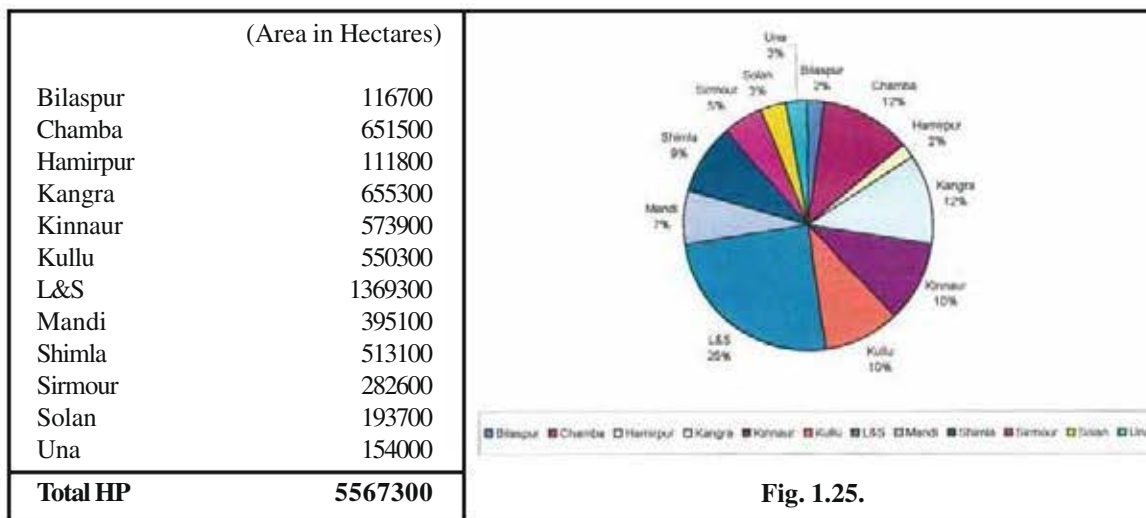
10.1 Issues:

- 1) Changed land use profile since 1966-67, 1972-73, 1994-95 to 2001-02;
- 2) Land use trends;
- 3) Analysis of the shifts in land use patterns after 1994-95 :
 - i) A cross-section study of the land use for the latest available year 2001-02 compared with the corresponding data from 1966-67 and 1994-95.
 - ii) A time series study of data 1966-67, 1972-73, 1994-95, 1999-2000 and also up to the year 2001-02, to appraise the latest trends in major components of land use.
 - iii) A comparative study of district-wise land use data for the year 1966-67, 1972-73, 1994-95 to 2001-02.
 - iv) Exhibiting the land use data with the help of pie diagrams, layer charts, graphs and tables to enable a quick glance to be taken at comparative positions in terms of the total geographical area, surveyed and un-surveyed areas and the progress made since 1966-67, 1994-95 and up to 2001-02 and also the manifold land classification of the total cadastrally surveyed areas. Apart from this some new concepts such as degraded lands, wastelands, drought-prone areas, natural calamity affected areas, encroachments in forests and government lands, watershed development, drought affected area development and desert development programmes and other afforestation and regeneration programmes, and updating programmes will also be discussed.

10.2 Status:

10.2.1 Ninefold Classification:

The following ninefold classification out of the total geographical area, (the concepts of which have been discussed in detail in the March 2000 study) will be used:-

Distribution of Geographical Area of the Districts in HP & their percentage

1. Forests
2. Barren and culturable lands
3. Areas under non-agricultural uses
4. Permanent pastures and other grazing lands
5. Land under miscellaneous tree crops and groves not included in net area sown
6. Culturable waste
7. Fallow lands other than current fallows
8. Current fallow and
9. Net area sown

10.2.2 Geographical Area and Reported Area:

- i) Geographical area - 55673 km²
- ii) Reported area - 45318 km²

The analysis of the above table shows that the reported area up to the year 1994-95 was 34024 km² and it had increased to 45318 km² by 1999-2000 and to 45418 km² by 2001-02. There has been an increase of 11294 km² in the reported area which is mainly due to the completion of settlement operations in the districts of Kinnaur, Shimla and parts of Lahaul and Spiti. In Kinnaur there has been an increase of 3766 km². This district has 11.8 percent of the total geographical area and the reported area has increased from 7.3 percent in 1994-95 to 13.8 percent in the year 1999-2000 and 13.7 percent by the year 2001-02. In Lahaul and Spiti district the increase in the reported area has been 7055 km² from the reported area of 2156 km² to 9111 km² in the year 1999-2000 and 2001-02. It has therefore increased from 6.5 percent in 1994-95 to 20.4 percent in the year 1999-2000 and 20 percent in the year 2001-02. Settlement work has been completed in Kinnaur district and the reported area is now 6237 km² which is 316 km² less than the total geographical area. There seems to be some mistake somewhere which needs to

be looked into and reconciled by the settlement office at Shimla in consultation with the Survey of India. In Lahaul and Spiti district, settlement has been completed in Spiti sub-division and the Lahaul sub-division is yet to be settled. An area of 4582 km² is yet to be surveyed in Lahaul sub-division.

Table 10.125: District wise Geographical & Reported Area:

(Area in Sq. km.)

S. No.	Name of District	Geographical Area		Reported Area						Variation from geographical area
			%	1994-95	%	1999-2000	%	2001-2002	%	
1.	Bilaspur	1167	2.1	1154	3.4	1154	2.5	1118	2.5	-49 sqm of Govindsagar not ensured
2.	Chamba	6515	11.7	6924	20.4	6924	15.3	6924	15.2	+40.9
3.	Hamirpur	1118	2	1099	3.2	1101	2.4	1101	2.4	-7
4.	Kangra	5739	10.3	5776	1.7	5779	12.8	5780	12.7	+41
5.	Kinnaur	6553	11.8	2471	7.3	6237	13.8	6237	13.7	-316
6.	Kullu	5503	9.9	500	1	501	1.1	501	1.1	-5002
7.	Lahul & Spiti	13693	24.6	2156	6.03	9111	20.4	9111	20	-4582
8.	Mandi	3951	7.1	3971	11.7	3976	8.8	3978	8.8	+27
9.	Shimla	5131	9.2	4377	12.9	4926	10.9	5070	11.2	-61
10.	Sirmour	2826	5.1	2248	7.2	2247	5.1	2248	5	-578
11.	Solan	1937	3.5	1806	5.3	1809	4	1809	4	-128
12.	Una	1540	2.8	1542	4.5	1549	3.4	1549	3.4	+9
	Average	55673		34024		45318		45418		

In Shimla district the reported area has increased from 4477 km² in 1994-95 to 4926 km² in 1999-2000 and 5070 km² in 2001-02. Thus only 61 km² area remains to be surveyed in this district for which the works is going on.

In Bilaspur district, the reported areas has come down to 1118 km² from 1154 km² which is incorrect reporting. The reason given is, that, in the present settlement the area of Gobind Sagar lake has not been surveyed which is not correct as the area was previously measured and it cannot be taken out of the reported area the it should be included in the area put into non-agricultural uses as it falls under this definition. This needs to be sorted out by the Director of Land Records and the Deputy Commissioner concerned

In Kullu district the settlement work has started but the reported area is 501 km² out of a total geographical area of 5503 km². In the districts of Sirmour and Solan there are certain areas which have not been surveyed or the records are not available. In Chamba district where the

settlement was completed long ago the reported area is 6924 km² against a geographical area of 6515 km² which needs to be reconciled by the Director Land Records, the Deputy Commissioner and the Survey of India.

Thus, the thrust of settlement work should be in the districts of Kullu, Lahaul sub-division of Lahaul and Spiti district and parts of Sirmour and Solan districts instead of Hamirpur, Una and Bilaspur districts where all the areas have been previously settled. The areas yet to be surveyed in Kullu is 5002 km², in Lahaul & Spiti it is 4582 km², in Sirmour 578 km² and 128 km² in Solan district making a total area yet to be surveyed of 10351 km² which is 18.59 percent of the geographical area.

10.2.3 Barren and Unculturable Land:

The area under this category includes barren and uncultivable lands like mountains and deserts which cannot be brought under cultivation without incurring very high costs. In the year 1966-67 the area under this classification was 1093 km² which increased to 1493 km² by 1994-95 and 8569 km² by 1999-2000. In 2001-2002 it has again come down to 8066 km². From those figures two factors emerge, firstly that the major increases have been recorded in the districts of Lahaul & Spiti, Kinnaur and Shimla districts due to completion of settlement operations in Shimla and Kinnaur districts and Spiti sub-division of Lahaul & Spiti district, and secondly that there is no consistency in the recording of the village papers. They were recorded as 8569 km² in 1999-2000 and 8072 in 2000-01 and 8066 in 2001-02. This area was 4 percent of the recorded area in 1966-67 and 19 percent in 1999-2000 and 18 percent in 2001-02. Land Records Agency should take appropriate steps to ensure correct recording of areas.

10.2.4 Land Put to Non-agricultural Use:

This classification of land includes lands under buildings, roads, railways and water : rivers, canals, water reservoirs, and lands put to uses other than agriculture. Area under this category was 1775 km² in 1966-67 and 1986 km² in 1994-95, 3021 km² in 1999-2000 and 3175 km² in 2001-02. The percentage of this type of area to the total reported area fluctuated between 5 percent and 7 percent. The analysis of these figures will show that there has been a constant increase except for the year 1982-83 and 1994-95 when it came down; this could be due to wrong recording. The quantum jump has been recorded in 1999-2000 is due to completion of settlement

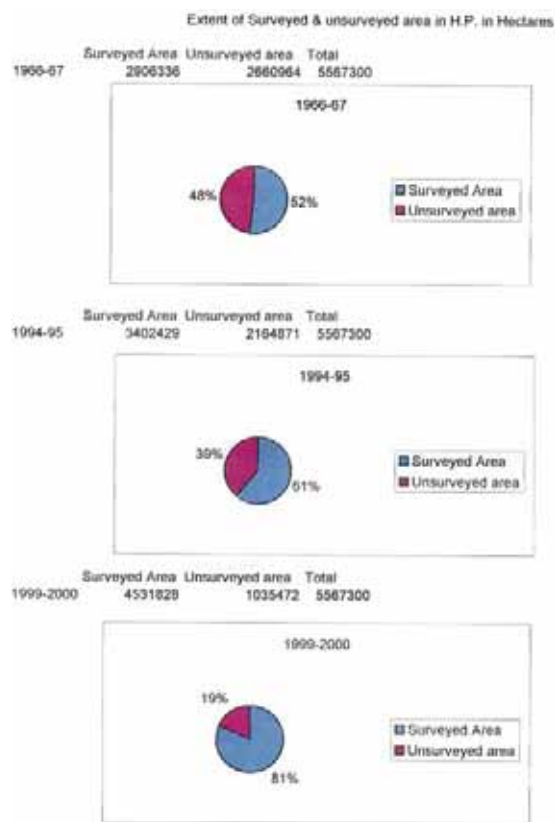


Fig. 1.26

operation in Shimla and Kinnaur districts and Spiti sub-division of Lahaul & Spiti district. It also shows that the areas of other categories have been used for development activities including power projects, which is a welcome and progressive shift.

10.2.5 Permanent Pastures and Other Grazing Lands:

The areas under this classification include grazing lands whether they are permanent pastures or meadows. Village common and grazing lands are also included in this category. The area under this category had increased by 302 km² between 1966-67 and 1994-95 i.e. from 11634 km² to 11936 km². It has increased to 14715 km² in 1999-2000 and to 15190 km² by 2001-02 thus registering an increase of 3254 km² which is due to the completion of settlement work in Shimla, Una, Hamirpur and Kinnaur districts and Spiti sub-division of Lahaul & Spiti district. The increase in this category has been recorded in the four districts where settlement operations have been fully or partially completed, otherwise the shift shows a decrease in all the other districts. The following table shows the increase due to settlement completion:-

Table 10.126: Increase in Area under Pastures (Hectares):

Sr. No.	Name of the District	Area in the year 1994-95	Area in the year 1999-2000	Area in the year 2001-02
1.	Kinnaur	1,60619	318352	3,18131
2.	Lahaul & Spiti	95453	220045	220112
3.	Shimla	200803	203047	248660
4.	Una	6877	12935	13427
5.	Hamirpur	309	969	9718

The position in the remaining districts shows a decrease as under:-

Table 10.127: Decrease in Pastures and Grazing Lands (Hectares):

Sr. No.	Name of the District	Area in the year 1994-95	Area in the year 1999-2000	Area in the year 2001-02
1.	Bilaspur	42649	44858	40949
2.	Chamba	353252	352594	352594
3.	Kangra	97107	87585	89453
4.	Mandi	97151	96624	96383
5.	Sirmour	60671	57031	57689
6.	Solan	78711	77496	78572

The analysis will show that the area under this category is decreasing as this type of land is being brought under miscellaneous trees, orchards and other cultivation. The pressure of the increasing population is causing the conversion of this category into area under trees and crops. The marginal increase in Solan district seems to be due incorrect reporting. Now the area under this category is 33 percent of the total reporting area which was 41 percent in 1972-73.

Table 10.128: District-wise Classification of Area 1994-95

Distt.	Total geographical area		Classification								Cultivated Area		
	By professional survey	By village papers	Forests	Barren and uncultivable lands	Land put to non-agricultural uses	Permanent pastures and others grazing lands	Land under misc. tree crop and groves not included in area sown	Cultural waste	Other fallow land	Current fallows	Net area sown	Area sown more than once	Total cropped area
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bilaspur	1,16,700	1,15,445	11,358	6,223	15,471	42,649	75	4,701	902	1,625	32,441	28,168	60,609
Chamba	6,51,500	6,92,419	2,71,611	5,246	11,535	3,53,252	24	5,961	920	2,217	42,353	21,785	64,138
Hamirpur	1,11,800	1,09,940	20,037	17,688	17,721	309	3,077	4,888	264	9,098	36,858	35,209	72,067
Kanga	5,73,900	5,77,598	2,24,418	-	81,643	97,107	2,130	39,957	4,567	8,878	1,18,898	95,582	2,14,480
Kinnaur	6,55,300	2,47,098	27,206	34,033	9,370	1,60,619	83	6,333	318	1,529	7,607	1,678	9,285
Kullu	5,50,300	50,021	-	4,702	2,643	-	274	3,711	-	2,570	36,121	22,616	58,737
L& Spiti	13,69,300	2,15,636	1,10,056	4,116	1,599	95,453	96	682	2	185	3,147	138	3,285
Mandi	3,95,100	3,97,053	1,73,185	11,963	10,407	97,151	17	6,074	301	3,142	94,813	69,521	1,64,334
Shimla	5,13,100	4,37,715	1,13,831	16,526	7,934	2,00,803	3,808	9,880	1,693	9,882	73,288	31,741	1,05,029
Sirmaur	2,82,600	2,24,752	48,482	7,792	9,913	60,671	37,137	12,982	1,026	5,331	41,418	36,802	78,220
Solan	1,93,700	1,80,553	20,205	11,056	10,551	78,711	1,765	12,639	953	5,425	39,248	26,748	65,996
Una	1,54,100	1,54,199	28,650	29,673	19,882	6,877	148	10,318	10,449	6,056	42,146	29,664	71,810
Total	55,67,300	34,02,429	10,49,039	1,49,388	1,98,669	11,93,602	48,634	1,18,126	20,695	55,938	5,68,338	3,99,652	9,67,990

Source: Annual Season Crop Report DLR Shimla-9

Table 10.129 : District-wise Classification of Area 2001-02

Distt.	Total geographical area		Classification								Cultivated Area		
	By professional survey	By village papers	Forests	Barren and uncultivable lands	Land put to non-agricultural uses	Permanent pastures and others grazing lands	Land under misc. tree crop and groves not included in area sown	Cultural waste	Other fallow land	Current follows	Net area sown	Area sown more than once	Total cropped area
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bilaspur	1,16,700	1,11,775	12,866	6,818	11,949	40,949	132	6,261	1,113	1,321	30,366	27,417	57,783
Chamba	6,51,500	6,92,419	272,008	5,504	11,722	3,52,594	15	5,985	240	1,816	42,535	25,774	68,309
Hamirpur	1,11,800	1,10,169	18,565	13,602	18,345	2,718	2,789	10,847	1,285	6,636	35,382	34,680	70,062
Kanga	5,73,900	5,77,961	2,32,108	18,487	77,102	89,453	7649	25,312	416	10,839	1,16,595	1,05,559	2,22,154
Kinnaur	6,55,300	6,23,742	36,904	1,30,887	1,24,635	2,18,131	76	3,670	108	1,751	7,580	1,508	9,088
Kullu	5,50,300	50,122	-	1,129	6,000	-	355	2,978	170	2,398	37,092	24,315	61,407
L & Spiti	13,69,300	9,11,163	1,35,369	5,46,695	4,865	2,20,112	114	588	18	106	3,296	81	3,377
Mandi	3,95,100	3,97,823	1,75,375	24,990	-	96,383	341	4,479	154	8,794	87,307	69,155	1,56,462
Shimla	5,13,100	5,06,987	1,28,509	13,293	13,777	2,48,660	3,221	14,827	5,574	9,853	69,273	28,126	97,399
Sirmaur	2,82,600	2,24,752	48,502	8,468	10,478	57,689	37,579	14,822	1,629	4,138	41,447	35,121	76,568
Solan	1,93,700	1,80,923	20,290	14,405	9,602	78,572	855	12,186	1,172	5,574	38,267	25,787	64,054
Una	1,54,100	1,54,923	18,165	22,296	28,994	13,427	7,104	20,159	1,214	3,064	40,503	28,374	68,877
Total	55,67,300	45,42,759	10,98,661	8,06,574	3,17,469	1918,688	60,230	1,22,114	13,093	56,287	5,49,643	4,05,897	9,55,540

Source: Annual Season Crop Report DLR Shimla-9

10.2.6 Land under Miscellaneous Tree Crops and Groves not Included Under Area Sown:

This category includes areas that are not included in “Net Area Sown” but put to some other agricultural uses such as thatching grasses, bamboo, bushes and other tree groves which have been raised for fuel. In the year 1966-67 the area under this classification was 397 Km² and it increased to 486 Km² up to 1994-95, to 642 Km² by 1999-2000 and 602 Km² in 2001-02. The total reported area has increased from 29063 Km² to 34024 Km² in 1994-95 to 45318 Km² in 1999-2000 and to 45418 Km² by 2001-02. The analysis of the above tables shows that the percentage of this category area has almost remained the same in relation to the total reported area. There has been substantial increase in areas under this category in the districts of Bilaspur from 75 hectares in 1994-95 to 132 hectares in 2001-02, in Kangra district from 2130 hectares in 1994-95 to 7640 hectares in 2001-02 and in Una district from 148 hectares in 1994-95 to 7104 hectares and in Mandi district from 17 hectares in 1994-95 to 341 hectares in 2001-02 and it has recorded a decrease in Hamirpur from 3077 hectares in 1994-95 to 2789 hectares in 2001-02, in Shimla district from 3808 hectares in 1994-95 to 3221 hectares in 2000-01, and in Solan district from 1765 hectares in 1994-95 to 855 hectares in 2001-02. The districts which registered an increase show a shift for planting trees like poplar and eucalyptus and in the districts where the areas decreased the shift was towards vegetables and orchards.

10.2.7 Culturable Waste Land:

The area under this category includes lands available for cultivation but not cultivated during the last five years or more in succession for various reasons. From the analysis of the data given in the above tables it transpires that the area under this category was 1181 Km² in 1994-95 out of the total reported area of 34024 Km² in that year but it has increased to 1221 Km² in the year 2001-02 which is marginal keeping in view the fact that the reported area has increased to 45417 Km². There was no proportionate increase under this category which is a good trend as if the waste land available for cultivation is utilized for growing crops, vegetable or trees it is being put to profitable uses. The area under this category should decrease if the conditions are favourable but an increase in area under this category is not a good sign for improvement in cultivation. Hence this is a good shift that more and more culturable waste is being put to other uses.

The study of district-wise figures in the table shows that the area of this category has increased in the districts of Bilaspur from 4701 hectares in 1994-95 to 6261 hectares, in the district of Hamirpur from 4888 hectares in 1994-95 to 10847 hectares in the year 2001-02, in the district of Shimla from 9880 hectares in 1994-95 to 14827 hectares in the 2001-02, in district Sirmour from 12982 hectares in 1994-95 to 14822 hectares in the year 2001-02 and in district Una from 10318 hectares in 1994-95 to 20159 hectares in the year 2001-02. This shift, therefore, reflects either the bad climatic conditions or bad financial conditions of the farmers or both in these districts. The government should plan providing more irrigation facilities in these districts. The percentage of this category to the total reported area was 6 percent in the year 1966-67

and it came down to 3.5 percent by 1994-95 and further to 3 percent by 2001-02 which is a healthy sign.

Graphic Presentation of Landuse Data for the Block Years
1966-67, 1970-71, 1974-75, 1978-79, 1982-83, 1986-87, 1990-91, 1994-95, 1998-99, 1999-2000

Area in '0000 hectares

	1966-67	1970-71	1974-75	1978-79	1982-83	1986-87	1990-91	1994-95	1998-99	1999-2000
Forest	63.60	63.80	63.84	70.46	80.86	92.30	103.89	104.90	109.23	109.42
Not available for cultivation	28.68	29.08	33.39	35.41	30.70	39.29	37.69	34.80	113.88	115.91
Other uncultivated land excluding fallow land	137.98	139.65	135.62	132.88	136.93	137.03	130.87	136.03	166.55	165.51
Fallow land	6.83	6.06	5.95	5.36	5.70	5.80	6.00	7.66	8.45	7.19
Net area sown	53.51	54.63	54.43	56.08	57.14	58.09	58.27	56.83	54.94	55.14
Total reported area	290.63	293.24	293.25	300.20	311.34	332.52	336.75	340.24	453.06	453.18

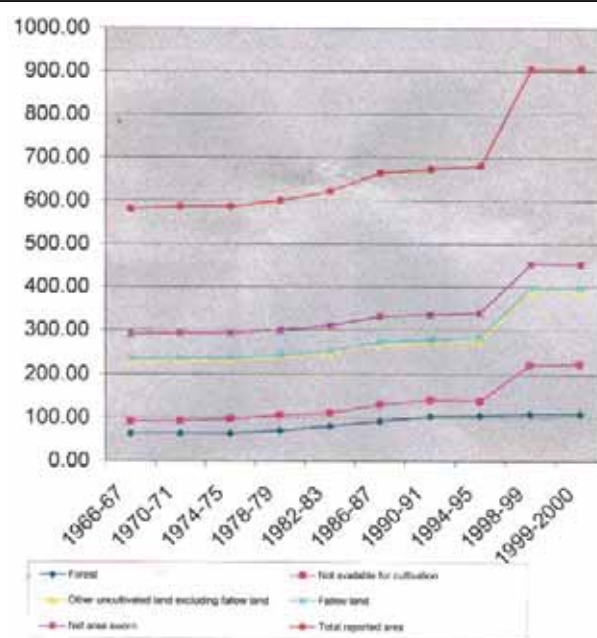


Fig. 1.27

10.2.8 Other Fallow Land:

The area under this category includes all lands which are taken up for cultivation but are temporarily out of cultivation for a period not less than one year but not more than five years. The analysis of the data shows that area under this category is negligible as it was only 26 Km² in 1966-67 which was only 0.1 percent of the reported area. It increased to 207 Km² by 1994-95 and it has again come down to 131 Km² out of a total reported area of 45417 Km² which is only 0.28 percent. However, the downward shift in this category is also a healthy sign.

10.2.9 Current Fallow:

The area classified under this category comprises of cropped area which is kept fallow during the current year. The area under this class of land was 657 Km² in the year 1966-67 and it decreased to 559 Km² by the year 1994-95 and it has registered a nominal increase to 562 Km² by 2001-02 though the reported area has increased from 29063 Km² in 1966-67 to 45417 Km² by 2001-02. There is no proportionate increase in this category which is a healthy trend as it shows that the people are making optimum use and are not letting the lands lie fallow. The percentage of this category was 2.3 percent and is now only 1.2 percent.

10.2.10 Net Area Sown:

The area under this classification shows the area sown with crops and orchards but the “Area Sown More than once” in the same year is counted only once. The area under this category was 5351 Km² in the year 1966-67 which was 18.4 percent and it was 5683 Km² in the year 1994-95 which was 16.7 percent and it has come down to 5496 Km² in the year 2001-02, which is 12.1 percent. The decrease in the percentage is due to the fact that in the districts of Shimla, Kinnaur and Spiti sub-division of Lahaul & Spiti district the area under this category has not increased much whereas the waste lands, barren and unculturable lands and lands put to non agricultural uses which have now been surveyed are proportionately very large. The down-ward shift is by 187 Km² from 1994-95 to 2001-02, which could be due to the reason of completion of various power projects such as Nathpa Jakhri and Chamera projects, as well as cultivatable areas damaged by natural calamities and weathering effects and other geographical conditions.

Summing up of Nine Land Use Classifications:

To sum up, the reported area has increased from 34024 Km² in 1994-95 to 45417 Km² in the year 2001-02. Thus the surveyed area is now 81 percent of the geographical area and only 19 percent remains to be surveyed in the districts of Kullu and Lahaul Division of Lahaul & Spiti district and small parts in Sirmour, Shimla and Solan districts which need to be surveyed on priority. The area under forests as per village papers is 24% of the reported area and as per Forest Department's figures it is 66.5 percent of the total geographical area out of which 5% percent are reserved forests, 30.8% are D.P.Fs, 58.4% are U.P.Fs, 2.7% are unclassified forests, other forests are 3%. The density of forest areas as per forest department is as under:-

Dense forests with crown density above 40% area	10429 Km ²	=	28%
Open forests with crown density 10% to 40%	3931 Km ²	=	10.6%
Forest blanks with down density 6297 less than 10%		=	17%
Uncultivable barren land	16376		
(Alpine pastures, snow areas)		=	44.2%

As per Forest Department reports the actual forest cover is only 14360 Km² which 25.8% of the geographical area as per 2001 assessment report. The increase from 1994-95 is 3.4%.

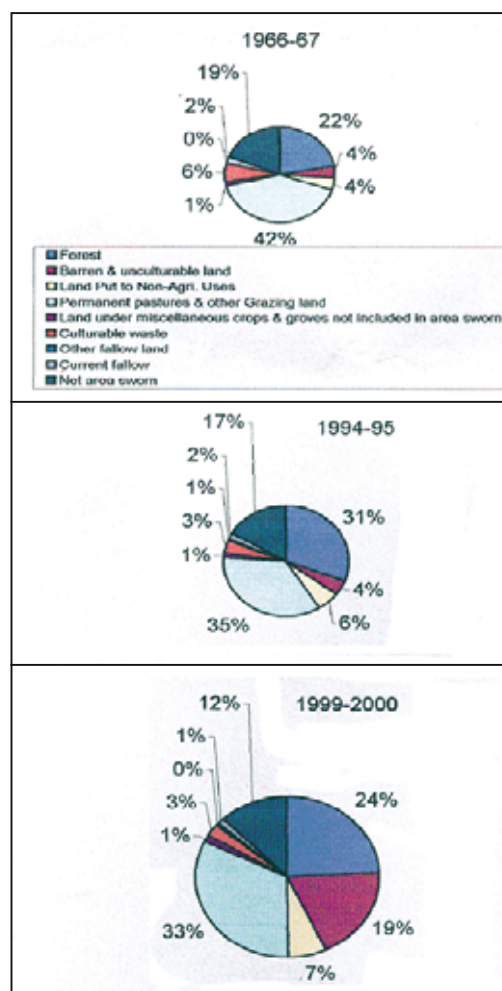
Barren and unculturable lands have increased from 1493 Km² in 1994-95 (excluding Kangra for which these were not reported) to 8065 Km² in 2001-02 which is now 17.75% of the reported area. It has increased in the districts of Bilaspur, Chamba, Kullu, Mandi, Sirmour and Solan apart from the increase in the districts of Kinnaur and Lahaul & Spiti due to settlement operation, but it has decreased in the districts of Hamirpur, Shimla and Una. The land put to non-agriculture use has increased from 1986 Km² in 1994-95 to 3174 Km² in 2001-02 which is mainly due to settlement works in the districts of Kinnaur, Shimla and Lahaul & Spiti. Apart from this the normal shift towards increase has been recorded in the districts of Chamba, Hamirpur, Kullu, Sirmour and Solan, whereas it has decreased in the districts of Bilaspur, Kangra and Una.

The area under permanent pastures has increased from 11936 Km² in 1994-95 to 15176 Km² in 2001-02 and is now 33% of the reported area. The increase under this category is due to settlement work in the districts of Hamirpur, Kinnaur, Lahaul & Spiti, Shimla and Una. However, there has been shift downwards in the districts of Bilaspur, Chamba, Kangra, Mandi, Sirmour and Solan which shows that, but for the settlement work, there is a downward trend under this category and the pastures have actually decreased as there has been diversion to other categories.

The land under miscellaneous tree growth etc. has increased in the districts of Bilaspur, Kangra, Kullu,

Ninefold Distribution of Reported Area in Hectares

	1966-67	1994-95	1999-2000
Forest	636096	1049039	1094209
Barren & unculturable land	109383	149388	856911
Land Put to Non-Agri. Uses	117483	198669	302194
Permanent pastures & other Grazing land	1163402	1193602	1471536
Land under miscellaneous crops & groves not included in area sown	39716	48634	64161
Culturable waste	176760	118126	119413
Other fallow land	2630	20695	15714
Current fallow	65759	55938	56233
Net area sown	535107	568338	551457
Total area according to village papers	2906336	3402429	4531828



Lahaul & Spiti, Mandi, Sirmour and Una districts whereas it has a downward shift in the remaining districts. The overall area has increased from 486 Km² to 602 Km². It is only 1.3% of the total reported area which is negligible.

The area of culturable waste has increased from 1181 Km² to 1221 Km² in spite of settlement operations in some districts. The increase is marginal and is in the districts of Bilaspur, Chamba, Hamirpur, Shimla, Sirmour and Una districts and it has a downward shift in the remaining districts in spite of increase in the reported area. The area under other fallow lands has decreased from 206 Km² to 130 Km² in spite of increase in the reported area. The land under this category is only 29% which is negligible and the shift is in the right direction.

In the cultivated area the shift has been downward and the area has decreased from 6242 Km² in 1994-95 to 6059 Km² in 2001-02 in spite of the large increase in the reported area. The percentage has decrease form 13.74% in 1994-95 to 13.34% in the year 2001-02. This is not a healthy trend as the total cultivated area should have been increased which has not happened. The decrease could be due to climatic change and also due to implementation of some power projects.

Other Concepts:

Apart from the nine fold classification, some more important concepts related to land use are summarily discussed as under:-

10.2.11 Area Sown More Than Once:

Under this classification, the area of each crop which is cultivated more than once during each agricultural year is shown. The analysis shows that the area under this category increased from 3996 Km² in 1994-95 to 4059 Km² in 2001-02. In spite of the fact that the total reported area increased from 34024 Km² in 1994-95 to 45417 Km² in 2001-02, there was no proportionate increase under this category. This is presumed to have happened due to large newly surveyed areas being mountaineous and snow covered and also due to severe climatic conditions in the newly surveyed areas. There has been shift upwards in the districts of Chamba, Kangra and Kullu, whereas there has been a downward shift in the remaining districts.

10.2.12 Total Cropped Area:

Total cropped area has also come down from 9680 Km² in the year 1994-95 to 9555 Km² in 2001-02. The up ward shift has been recorded in the districts of Chamba, Kangra, Kullu and Lahaul & Spiti whereas there has been a downwards shift in all the remaining districts which is also not a healthy indicator and requires a serious consideration at the Government level.

10.2.13 Degraded and Waste Lands:

According to the Remote Sensing Cell data collected in the year 1998, shows that the extent of degraded and waste lands in the state is 31659 Km² which is 56.87% of the total geographical area of the state and is 69.7% of the total reported area and is the biggest area of land in the state. The largest area of 11177 Km² is in the district of Lahaul and Spiti followed by 5266 Km² in Kinnaur district, 3400 Km² in Chamba district, 2735 Km² in Kullu, 2370 Km² in Mandi, 2177 Km² in Sirmour, 1486 Km² in Kangra, 1069 Km² in Shimla, 757 Km² in Solan, 564 Km² in Bilaspur, 494 Km² in Una and 164 Km² in Hamirpur.

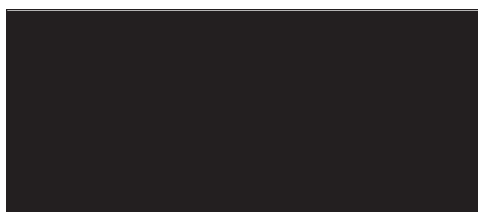
Out of the above areas 12559 Km² is under snow and glaciers, 4590 Km² are notified degraded areas, 4278 Km² are degraded pastures/grazing lands, 3858 Km² are barren rocky areas, 2458 Km² mainly in Chamba district are degraded lands under plantations, 2056 Km² are with or without scrub, and 1530 Km² are steep sloping areas; the remaining categories have negligible areas. Out of all these categories, the areas of concern where afforestation/regeneration programmes should be carried out are degraded pastures/grazing lands, degraded lands under plantations and lands with or without scrub, which cover a total area of 8792 Km².

Out of the total reported area in the state, if we add up areas under permanent pastures, area under miscellaneous tree growth and cultivatable waste, the present total in these three categories comes to 17000 Km² as per crop and Season report where afforestation, regeneration and improvement schemes should be launched.

10.2.14 Soil Degradation Status:

Soil degradation is a process, which lowers the current and/or future capacity of the soil to support human life. The human-induced processes like deforestation, construction of roads, dams, excessive irrigation, enhanced industrial growth etc have resulted in over exploitation of natural resources with little consideration for maintaining the eco-balance which has lead to the setting of degradational processes like soil erosion, flooding, salinization, waterlogging and drought. Such degradational processes in turn reduce agricultural productivity and cause social insecurity. The NBSS&LUP has made an attempt to assess the soil degradation status of H.P. by assessing the type of soil degradation which refers to the displacement of soil material by water and wind, in situ deterioration by physical, chemical and biological processes. The degree of degradation refers to the present state of degradation e.g. slight, moderate, strong and extreme. The severity of soil degradation is expressed as low, medium, high and very high by the combination of the degree and the relative extent of the type of degradation process. The major degradation problems as observed in H.P. are water erosion including topsoil loss and terrain deformation, flooding and acidity.

The above table shows that 54 percent of the total geographical area of the state is affected by soil degradation problems. Besides areas not fit for agriculture, which include rock outcrops account for 20.7 percent of the TGA





Map 1.18 Soil Erosion

Source: HPSPCB

Trends in Flood Affected Areas and Flood Damages:

The following table shows the trends in natural disasters and flood affected areas and the connected damages losses.

Table 10.130: Trends in Natural Disasters and Flood Affected Areas

Year	Agriculture area affected	Net area sown affected	Affected Houses	Loss Human life	Loss of cattle
1990-95					
1991	1,64,947 ha	NA	4132	34	2085
1995	2838 lakh ha	NA	25183	114	5624
1995-2000					
1996	2579 lakh ha	NA	5774	51	2250
1997	249 lakh ha	NA	3763	223	4809
1998	2210 lakh ha	NA	3431	71	221
2000	42192 ha	NA	3863	35	1411
2001-03					
2001	8188 ha	NA	2683	45	915
2002	32583 ha	NA	2924	89	452

Table 10.131: District-wise Cropping Patterns Trends

Sl. No.	Name of the Distt.	District wise cropping year 1990-91							Year 2001-02						
		Rice	Cotton	Sugar-cane	Wheat	Pulses to oil seeds	Veg. & Fruits	Others	Rice	Cotton	Sugar-cane	Wheat	Pulses to oil seeds	Veg. & Fruits	Others
1.	Bilaspur	2867	5	76	26769	2700	928	28,158	1773	1	54	27284	888	911	26,872
2.	Chamba	2963	-	-	19259	6175	2137	25,965	2796	-	-	22139	6349	2660	34,365
3.	Hamirpur	3533	2	139	35504	1289	172	32,881	2524	-	56	34245	286	238	32,713
4.	Kangra	37235	51	131	91547	15566	5821	68,332	37272	17	483	96130	10692	10088	67,472
5.	Kinnaur	20	-	-	795	1022	2267	5,103	29	-	-	399	1496	2971	4193
6.	Kullu	2285	-	-	20717	4232	9606	27,224	1618	-	-	21326	4281	11527	22,655
7.	Lahul & Spiti		-	-	275	815	1094	1127	-	-	-	121	1562	896	798
8.	Mandi	22308	4	-	66310	5679	10145	60076	19762	1	1	64419	4407	11840	56032
9.	Shimla	36,10	-	-	29821	7171	32045	30178	2368	-	-	17668	5592	45387	26,384
10.	Sirmour	5014	8	807	29055	5930	3958	33551	5885	-	1451	28123	5099	5499	30,511
11.	Solan	3646	42	274	24452	6199	3638	30613	3305	1	197	23779	4270	4453	28049
12.	Una	1458	18	1033	31774	4439	913	31660	3248	-	393	30885	2815	2032	29504
13.	Total	84,939	130	2460	376278	61217	72724	374868	80580	20	2635	366518	47737	98502	359548

[Source : Annual Season & Crop Report: DLR Shimla 9]

The above table shows the district-wise cropping pattern trends for the cropping years 1990-91 and 2001-02. The analysis shows that the area under rice has decreased from 84939 hectares in 1990-91 to 80580 hectares in 2001-02. The district-wise analysis shows that the area under rice has slightly increased in Kangra district whereas it has increased by 870 hectares in Sirmour and it has more than doubled in Una district but in all other districts it has decreased. The area under wheat has also decreased from 376278 hectare in 1990-91 to 366518 hectares in 2001-02. It has increased in the districts of Chamba, Kangra and Kullu whereas it has decreased in all other districts. Areas under cotton have also decreased though negligibly. The area under sugar cane has increased from 2460 hectare in 1990-91 to 2635 hectare 2001-02. The maximum increase has been registered in the districts of Sirmour by about 644 hectares followed by Kangra where it has increased by about 350 hectares. In other districts it has decreased. The area under pulses and oil seeds have also decreased from 61217 hectares in 1990-91 to 47737 hectares in 2001-02. The increase has been in the districts of Chamba, Kinnaur, Kullu and Lahaul & Spiti districts whereas it has decreased in all other districts. The area under vegetables and fruits has taken a quantum leap from 72724 hectares in 1990-91 to 98502 hectares in 2001-02. The area under this category has decreased in the district of Bilaspur and Lahaul & Spiti districts only and in all other districts it has increased which is a healthy indicator. The maximum area of 376278 hectares under wheat in 1994-95 has come down to 366518 hectares. The area under other crops has come down from 374868 hectares in 1994-95 to 359548 hectares in 2001-02. The maximum shift is towards vegetables and fruits which is a healthy trend.

**H.P. Cropping Intensity for the Block Years
1972-73, 1994-95, 2001-02**

	1972-73	1994-95	2001-02
Bilaspur	174.70	186.80	190.30
Chamba	149.90	151.40	160.60
Hamirpur	178.00	195.50	198.00
Kangra	179.90	180.40	190.50
Kinnaur	139.60	122.10	119.90
Kullu	157.50	162.60	165.60
L&S	104.20	104.40	102.50
Mandi	170.00	173.30	179.20
Shimla	156.30	143.30	140.60
Sirmour	171.20	188.80	184.70
Solan	153.20	168.10	167.40
Una	157.50	170.40	170.10
Total HP	166.40	170.30	173.80

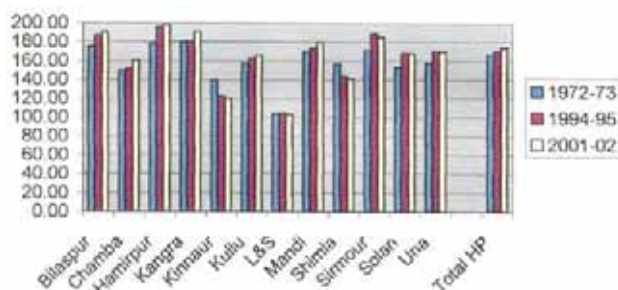


Fig. 1.28

10.3 Cropping Intensity:

The table and bar chart shown at fig 1.28 show that, except for the districts of Kinnaur, Lahaul & Spiti, Una, Solan, Sirmour and Shimla, where it has decreased, the crop intensity has increased for the year 2001-02 in all districts. The highest intensity in Hamirpur district which 198% is followed by Kangra and Bilaspur 190.30 and the lowest 102.50 is in district Lahaul & Spiti followed by Kinnaur 119.90. The reasons are obviously geographical as well as climatic conditions.

10.4 Common Property Land Resources:

The village common lands or shamlat lands of various categories had been vested in the Govt. under section 3 of the (H.P. Village Common Lands Vesting and utilization) Act ,1974. Prior to this the village common lands were being managed in the merged areas of the Pradesh, under the provisions of the Punjab Village Common Lands (Regulation) Act 1961 which was repealed by the H.P. Act 18 of 1974. In the old areas of the Pradesh there was no law regarding common lands. As per the Punjab village common lands (Regulation) Act , 1953 all shamlat lands were vested in the village Panchayats but by the 1961 Regulation Act (18 of 1961), the cultivated lands which were in the possession of the co-sharers, who were assessed to land revenue and not beyond their respective shares in shamlat on or before 26th January 1950, were exempted from vestment in the panchayats and were vested in such persons as per the 1961 Regulation Act in the merged areas.

However, such exempted lands had vested in the panchayats by Punjab Village Common Lands Regulation Act 1953 and the panchayats were required to hand over such lands to those persons

who were in possession prior to vestment in panchayats. But before such lands could revert to the shareholders and before revenue records could be corrected, the merged areas were transferred to Himachal Pradesh and such entries continued in the record of rights. When the H.P. Village Common Lands Vesting and Utilization Act was enforced in H.P., all lands which were entered in the names of the panchayats in the merged areas were vested in the state. The State Govt. therefore amended the H.P. Village Common Lands Vesting And Utilization Act, 1974 by Amendment Act No. 20 of 2001. By which, apart from other amendments, the Govt. exempted “lands recorded as Shamlat, Tika Hasale Rasad Malguzari or by any such other name in the ownership column of Jamabandi and assessed to land revenue and have been continuously recorded in cultivating possession of the co shares so recorded before 26th January, 1950 to the extent of their shares therein.”

In furtherance of this amendment, the following lands have been reverted to co-sharers from the Govt.:-

Table 10.132: Land Reverted to Co-shares

Sr. No.	District	Area	No. of Beneficiaries
1.	Shimla	2030 Bighas	3621
2.	Sirmour	662676-13 Bighas	123870
3.	Una	10442 hectare	21842
4.	Hamirpur	73 hectare	NA
5.	Solan	1696 hectare	-

The information about Kangra district has not been given by the district authorities to the Revenue Department. These lands were vested in the govt. prior to the 2001 amendment and have now gone back to the sharers. Though this step is in the interests of the village people but it is apprehended that under the provisions of this amendment the areas which were not assessed to land revenue have also reverted in some parts of the state which; is required to be looked into by the Govt. The reverted land could be used for specified purposes by the govt. but now most of it will be cultivated and added to the individual use.

10.5 Pressures:

10.5.1 Shifts in Land Use Patterns:

The analysis of each individual category is discussed as under:-

Forests:

Forests play a major role in land use, and their preservation and planned development through regeneration of degraded forests and new afforestation of wastelands and potential forest areas.

Out of the total geographical area of 55673 Km² in the state, the total legally classified forest area as per the Forest Department is 37032 Km² which comes to 0.61 hectares per capita in the state and it is 66 percent of the total geographical area as per the Forest Department Administrative Annual Report 1999-2000. As per the same report, 20657 Km² is 37 percent of the geographical area with good forest cover, whereas 16376 Km² area is rocky, above snowline and uncultivable. As per survey of India “State of forests Report 2001”, the State of H.P. has 4.8 percent of the country’s forest area out of only 1.7 percent of the country’s geographical area. The reported forest area as per village papers is 10942 Km² as per Annual Crop and Season Report 1999-2000, which was 6375 Km² in 1972-73, 10490 Km² in 1994-95 and is 10486 Km² in 2001-02. The addition due to settlement works in Kinnaur, Shimla and Lahaul and Spiti districts. The present area is 24 percent of the reported area as per village papers. As per Forest Survey of India Report 2001, the actual forest cover in Himachal Pradesh has increased to 14360 Km² which is 25.8 percent of the state’s geographical area and accounts for 2.1 percent of the country’s forest cover. Thus, the forest cover in the state has increased from 22.4 percent in the year 1994-95 to 25.8 percent in the year 2001-02, registering an increase of 3.4 percent over the said period. The per capita forest cover in the state is 0.24 hectare.

The reasons for major difference in area figures of the Forest Department and Revenue Department are because of unmeasured areas of forests in Kullu, Lahaul Spiti and parts of Sirmour district as well the different definitions of forest adopted by department.

The district-wise forest area figures are given in tables 10.128 & 10.129. An analysis of the table shows that there has been an increase in forest areas from the year 1994-95 of 15 Km² in Bilaspur, 4 Km² in Chamba, 97 Km² in Kinnaur, 77 Km² in Kangra, 253 Km² in Lahaul & Spiti, 23 Km² in Mandi, 147 Km² in Shimla district whereas there has been decrease of 14 Km² in Hamirpur, and 105 Km² in Una district. The increase in the districts of Kinnaur, Lahaul & Spiti and Shimla due to settlement being done, whereas no reasons have been assigned to the decrease in the districts of Una and Hamirpur which needs to be reconciled. If we compare the figures for 1972-73 with those of 2001-02, a glaring fact is noticed that in Una district the area under forests was 317 Km² in 1972-73 and it has now come down to 181 Km² in 2001-02.

As per “Himachal Forests – 2004” a Forest Department of H.P. publication the total sum of Rs. 90669 lakh been invested in the State Sector only, apart from the Central Sector, for afforestation programmes of 9154 Km² areas which comes to about 9.90 lakh per Km². The post-plantation evaluation is being done individual scheme-wise and there is no overall evaluation at state level to ascertain the survival rate of the plantations done. Thus, there is a need to get these areas evaluated from some independent agency.

Forest Settlements:

The progress of forest settlement operations carried out in the past as per the Forest Department notes is as under:-

Table 10.133: Forest Settlement Operations (Area in hectares)

Sr. No.	Name of District	Area to be measured	Actually measured	Notified	Entry made in Revenue Record	Balance area
1.	Mandi	154231	83528	82805	153435	796
2.	Chamba	461689	461689	427437	34252	427437
3.	Shimla	334039	343982	130065	106257	227782
4.	Kinnaur	465635	23727	23555	33592	432043
5.	Una	51934	-	-	9197	42747

The progress of Forest Settlement presently being made in the state is as under:-

Table 10.134: Current Forest Settlement (Area in hectares)

Sr. No.	Name of District	Area to be measured	Actually measured	Notified	Entry made in Revenue Record	Balance area
1.	Palampur (Una, Kangra, Chamba)	288717	72620	825	65204	223513
2.	Kullu (Kullu, Lahaul & Spiti)	962233	126228	83170	82738	879495
3.	Hamirpur (Hamirpur and Bilaspur)	67269	21036	4158	24310	42958
4.	Nahan (Sirmour, Solan, Shimla and Kinnaur)	246472	22747	69388	71580	174892

The perusal of the above data will show that the pace of the forest settlement in the state is far from satisfactory and the main reason is the paucity of Revenue Staff working on these operations. The Department of Consolidation of Holdings is breathing its last and the existing staff is mostly without work. It would be worthwhile for the government to decide to use the services of that department's staff for this work. The manner in which the forest settlements are being handled is far from satisfaction. These operations need to be put under settlement officers in their respective circles with a proper settlement calendar and policy guidelines; strict monitoring at the highest level is required.

10.5.2 Forest Fires:

As per the reports of the Forest Department, there has been an alarming increase in the number of forest fires over the last few years as may be clear from the following Table 10.135.

Table 10.135: Forest Fires (Area in hectares)

Year	Area affected	No. of incidents	Loss
2000-01	5719	301	Rs. 46.72 lakh
2001-02	4204	282	Rs. 40.27 lakh
2002-03	9896	550	Rs. 74.31 lakh
2003-04	12865	769	Rs. 86.42 lakh
2004-05 (Up to 14 June, 2004)	5932	382	Rs. 34.85 lakh

This situation warrants the immediate concern of the state government to protect the forests. The general public and the rights holders need to be made aware of their duties and the ways to protect forests from fires. Involvement and awareness amongst the people is of the utmost importance. At presently they feel that it the duty of the state to protect the forests. The government may consider suitable legislation for this purpose. The government is already considering fresh look on the T.D. rights which will be a step in the right direction. Enjoyment of these rights should be linked to their duties towards forest protection.

10.5.3 Encroachment on Forest Lands:

The problem of encroachment on forest lands has become monstrous as per the latest figures of the Forest Department. The following statements supplied by the Forest Department to depict the latest position of encroachment cases states as under:-

Table 10.136: Forest Encroachment:

	No. of Cases	Area in Hectares
Challaned in Revenue Courts cum Collectors	5002	946
Challaned in DFO's Courts	5146	1040
Total	10148	1986
No. of Cases decided		
Challaned in Revenue Courts	378	55
Challaned in DFO's Courts	1541	709
Total	1919	764

Apart from the above, as per the decision of the state government in July 2002 to regularize the encroachment on govt. lands, a spate of encroachment cases were filed for regularization of forest lands, through the Rules for regularization did not allow regularization of forest lands. The following table shows the details forest-circle-wise:-

Table 10.137: Regularization of Forest Encroachment

Name of the Circle	No. of Cases	Area in Hectares
Kullu	3295	632
Mandi	15429	2268
Rampur	10217	2696
Bilaspur	5938	806
Chamba	8084	1732
Shimla	11047	2327
Nahan	436	155
Dharamsala	5350	1008
Wild Life Circle Dharamsala	432	39
Wild Life Circle Shimla	156	116
Great Himalayan National Park Shamshi	84	5
Total	60448	11783

Out of the above 60448 cases, in 15621 cases involving 3294 hectares encroachment files have been prepared departmentally and action for ejectment has been initiated and encroachments removed from 762 hectares; in the remaining cases action is yet to be initiated.

Apart from the above as per the reports of the Revenue Department of the State the following table shows the details of the applications received by that department for regularization:-

Table 10.138: Number of Applications for Regularization for Encroachments

Sr. No.	Name of the district/ SO Circle	No. of applications	Area involved in Hectares
1.	Kangra	40980	4321
2.	Shimla	17340	5303
3.	Una	13459	1271
4.	Kullu	3571	1073
5.	Chamba	9857	1403
6.	Hamirpur	13888	1523
7.	Kinnaur	4947	671
8.	Lahaul & Spiti	1428	371
9.	Solan	8177	1867
10.	Bilaspur	10152	976
11.	Mandi	32810	3192
12.	Sirmour	2154	1041
13.	SO Kangra	5408	722
14.	SO Shimla	3168	566

This is a fit case for conducting a Special Study to show how a wrong policy decision can give impetus to encroachment, though the rules prohibited regularization of forest encroachments. Thus, there is a need for laying down a firm policy for sternly dealing with encroachment on govt. lands, especially the forest lands. Existing legislation needs to be amended further to deal with such cases effectively and there has to be a time bound programme with periodic monitoring. The existing law though it provides for prosecution of those who fail to prevent encroachments and who fail to report such encroachments, yet no one has ever been prosecuted, which makes a mockery of the law. If action is taken against the officials who fail to prevent or report cases of encroachments, things will improve.

10.6 Impacts:

Decline in soil fertility

Reduction in soil organic status

Progressive diversion of agriculture land for non-agriculture uses

Acceleration in soil erosion

Sedimentation of water bodies

10.7 Responses:

10.7.1 Afforestation Programme.

As per H.P. Forest Department publication, “Himachal Forests-2004” a total area of 915442 hectares has been afforested since the first Five Year Plan up to 2002-03 with a total investment of Rs. 90668.67 lakhs. The evaluation is being done scheme and individual project wise and there is no overall evaluation of all the schemes and projects at the state level. It would be better if such an evaluation at the state level is done to ascertain the actual survival rate.

10.7.2 Combating Degradation and Desertification:

Presently afforestation/regeneration schemes are being implemented by the Forest Department Programme (IWDP), Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP) of the Govt. of India Ministry of Rural Development Department of Land Resources, which is being implemented in the State through the Rural Development Departments.

There are as many as 13 schemes being run by the Forest Department and three above mentioned schemes being run by the Rural Development Department. The achievements of all the 13 schemes under the Forest Department for the years 2001-02 and 2002-03 are as under:-

Table 10.139: Achievements of all the 13 Schemes under the Forest Department for the Years 2001-02 and 2002-03

Plantation Schemes		
	2001-02	2002-03
Total area planted	174 Km ²	127 Km ²
Total amount spent	1638.46 lakhs	1077.70 lakhs
Plantations under said conservation schemes (State and Central Sectors)		
Total area covered	30 Km ²	24 Km ²
Total amount spent	445 lakhs	279 lakhs

10.8 Achievements of the schemes being implemented by Rural Development Department:

10.8.1 Integrated Wastelands Development Projects

These projects are going on in the districts of Chamba, Hamirpur, Kangra, Kinnaur, Kullu, Mandi, Shimla, Sirmour and Solan. These have been taken up from 1994-95 onwards. As per the figures supplied by the IRD Department progress up to June 2004 is as under:-

Table 10.140: Integrated Wastelands Development Projects

No. of Schemes	Area treated up to 30.4.2004	Expenditure up to 30.6.2004
510	1011 Km ²	6002.43 lakhs

Out of these 42 schemes have been completed at a cost of 1302.80 lakhs covering an area of 150 Km².

10.8.2 Drought-Prone Area Programme:

Drought-Prone areas as reported by the Revenue Department are as under:-

Table 10.141: Drought Prone Areas:

Year	No. of Villages affected	Population affected	Area Affected in lakh hectares
1990-95			
1993-94	-	-	4139
1995-2000			
1999	8461	51.70	2890
2001-03			
2001	16537	49.41	52373
2002	-	51.70	432535

The Drought-Prone Area Programme is being implemented in the districts of Bilaspur, Solan and Una through the department of Rural Development and Panchayati Raj. Under this programme 278 schemes were taken up at an expenditure of 3047 lakhs and a total area of 1328 Km² was targeted to be treated against which 437 Km² has been treated up to June 2004, which also includes 40 schemes completed.

10.8.3 Desert Development Programme:

This programme is being implemented in the districts of Kinnaur and Lahaul & Spiti. As per the data supplied by Rural Development Department a total No. of 420 schemes have been taken up for treatment of 1552 Km² area in both the districts. Out of this an area of 393 Km² has been treated up to June 2004 with an expenditure of Rs. 3883 lakhs.

Under all the above schemes, both the Forest Department and Rural Development, no data about the net results from the hundreds of crores of rupees spent are available. The Forest Department is evaluating the programme under each individual scheme/project, but no data are completed at the state level to assess the net achievement, without which no proper evaluation of the work done can be made. Similarly, for the three schemes being implemented by the Rural Development Department, a general type of mid-term evaluation is done but no specific data about the areas successfully treated with a reasonable survival rate are available or generated.

The guidelines under the title “Haryali” (2003), prescribe that the Gram Panchayat will submit a quarterly progress report to the Project Implementation Agencies, after it is scrutinized and approved by the Watershed Development Team comprising four members. The PIA will submit the reports to the P/DRDA for further submission to the Department of Land Resources through the State Govt. Secretary of the Rural Development Department who is responsible for regular monitoring of these projects. The DOLR have also appointed some independent individuals to carry out concurrent as well as post-project evaluation. The District and State level vigilance and monitoring committees are also required to review the progress of these projects. The concurrent as well as post-project evaluations/ impact studies are required to be conducted for which the proforma have been circulated to all, but so far no such evaluation or impact study is available in the department. It is presumed that these essentials for ensuring correct implementations are not conducted. The State Govt. as well as the Department of Land Resources Govt. of India should ensure that concurrent and post-evaluation/impact studies are regularly done and carried out by independent institutions/individuals to make these projects successful.

10.9 Legislation, Policies and Programme for Land Management:

The following legislation exists in the state:-

- i) Indian Forest Act, 1927,
- ii) The Forest Conservation Act, 1980 and Rules, 1981,

- iii) The H.P. Utilization of Lands Act and Rules, 1973,
- iv) The H.P. Land Preservation Act 1978, Rules 1983,
- v) The H.P. Forest Produce (Regulation of Trade) Act, 1982,
- vi) The H.P. Private Forest Act, 1954,
- vii) The H.P. Private Forest Rules, 1969,
- viii) The H.P. Forest (Settlement) Rules, 1965.

The above legislation is more than sufficient for the proper management of lands in the state. However, the need is to implement all these laws strictly.

Apart from the above Section 163 –A of the H.P. Land Revenue Act provides for regularization of encroachments in certain cases. This amendment of the H.P. Land Revenue Act has done maximum damage though it did not allow regularization of forest lands yet the number of encroachments swelled overnight and when the govt. invited application for regularizations of encroachments a total No. of 1,67,339 applications covering an area of 24198 hectares were received in the Revenue Department; out of these 60 448 cases involving an area of 11783 hectares pertained to forest land, though the regularization of forest land was not allowed as per Regularization Rules. Though Section 163-A does not provide for regularization, yet so many people applied for regularization of forestlands. Thus, the net conclusion which can be made is that, though this section does not provide for such regularization, it has given a great fillip to encroachment on forest lands. Thus, this needs to be amended with strict and immediate action is required against encroachers.

T.D. rights also need to be curtailed and necessary amendments with regard to rights, by way of suitable legislation are required to be made immediately.

10.10 Issues of Concern:

Organized Work of Settlement:

The settlement work is going on in a most unorganized manner in the state. The districts of Una, Hamirpur and Bilaspur were already settled these have unnecessarily been taken up afresh, whereas districts of Kullu and Lahaul sub-division of Lahaul and Spiti districts where most of the areas have never been surveyed should have been taken up first. The utmost need is to shift all the settlement staff of Kangra circle to Kullu and Lahaul & Spiti districts on top priority and urgency basis. There are certain unmeasured areas in districts Sirmour and Solan. These should be taken up by Shimla Settlement Circle after completion of Shimla district. The work of forest settlements should also be put under the control of the Settlement Officers in their respective Circles and the surplus staff of Consolidation be also used, after training, in the Settlement Department. Thus priority should be given to surveying the unsurveyed land which is still 19 percent of the geographical area and not to resettle areas already surveyed.

Policy for Wastelands:

A correct policy has to be laid down at state level for the management and supervision of wastelands. The wasteland development programmes, such as watershed development projects under the Rural Development Department and the Forest Department, should be put under the supervision and control of one authority and strict monitoring of the projects and post-project evaluation should be made. The Watershed Development Teams and the District and State Level Vigilance and Monitoring Committees should be made to work and properly to monitor these programmes.

Awareness in Community:

Awareness about maintenance, preservation and regeneration of forests in the village common lands has to be instilled in to the minds of the village community as their responsibility. The over exploitation of forest produce needs to be curbed as it results in soil erosion.

Management of Erstwhile Shamlat Lands:

A major part of the erstwhile Shamlat lands previously vested in the state has been re-vested in the rights holders. A sensible policy for their management through the people has to be laid down, and a percentage of such areas need to be reserved for fodder and fuel requirements.

Improvement in Reporting Systems of Land Statistics:

The recording system of statistical information through the Land Records Agency needs to be improved with a view to correct recording of areas under various crops, fruits and vegetables. The deterioration in efficient recording of statistics needs to be checked through correct training, supervision and mechanism of monitoring.

Correct Evaluation of Forestation Projects:

Exact evaluation of each project and programme has to be ensured at state level to assess the success of each project and to evaluate the actual benefit and survival rate.

Tackling Menace of Encroachments on Govt. Lands and Forests:

The menace of encroachments on all Govt. land especially forest land needs to be dealt with a heavy hand. A special drive needs to be planned and started for this purpose and those who fail to check such encroachment should be strictly punished.

Lack of Landuse Policy:

The HP State Landuse Board seems to have become defunct and there is a need to revive it responsibly with accountability. Immediate steps must be taken for framing a balanced landuse

policy for the state keeping in view the latest developmental thrust in the state especially in the fields of industrialization, housing, setting up of economic zones, major and medium power projects and infrastructural development. The overall policy should be to preserve the forest, agriculture and horticulture land and non cultivatable land patches should be used for industry and other development projects.

Forest Fires:

Forest fires are on the increase and it is of the utmost importance that village committees are trained and made aware about the safety and preservation of forests and tree wealth. The village panchayats should be given the responsibility of ensuring the safety of forests.

Increase in Irrigation Potential:

Irrigation potentials need to be exploited to the maximum extent. As per Annual Crop and Season Report 2000-01 the percentage of irrigated area has increased from 18 percent in the year 1996-97 to 22.63 percent in 2000-01. This means that the remaining 77 percent area is rain or snow fed. Thus it is necessary to improve and add more and more irrigation projects to increase the irrigated area. Proper plan subsidizing irrigation schemes by framing community irrigation schemes such as the construction of kuhls, sinking of tubewells, water storage tanks, providing on-the-spot electric connection to tube wells without incurring any cost of electrical lines by the farmers, reclamation of agriculture lands affected by floods and natural calamities at the cost of the state or at highly subsidized costs.

Diversification of Farming:

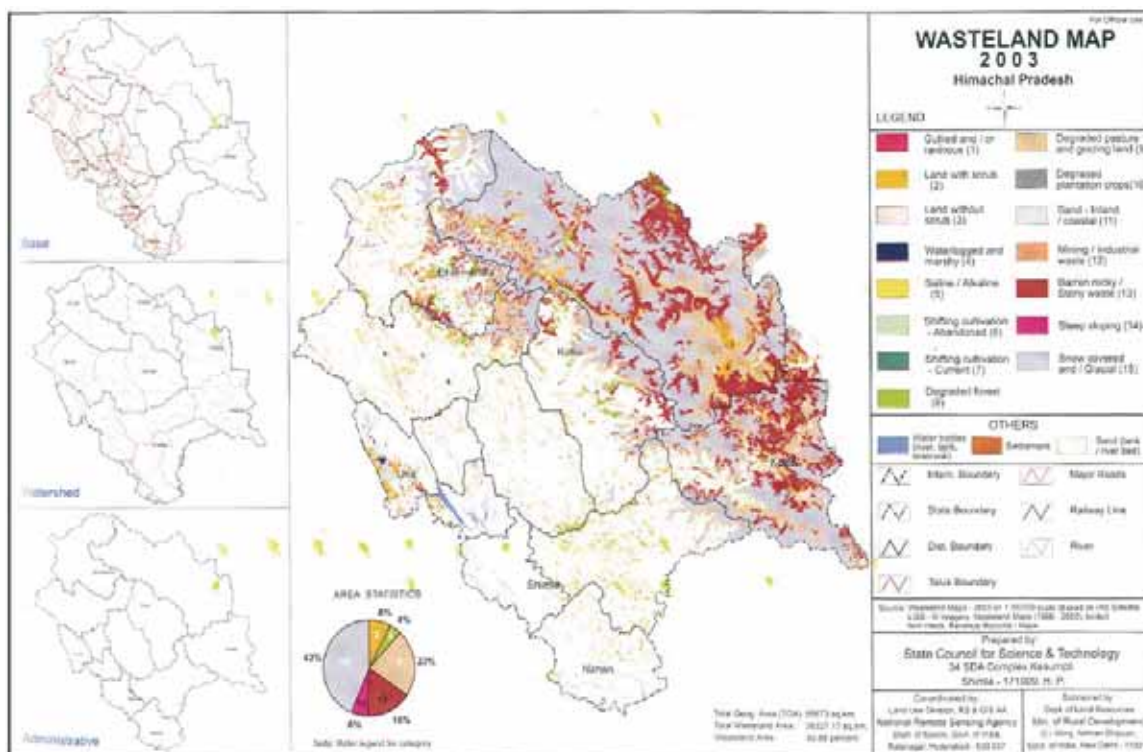
There is an immediate need for diversification in farming activities in the State. Incentives should be given at large scale for diversification of crops : floriculture, cultivation of medicinal herbs, pulses and best quality of fruits and out of season vegetables.

Checking Soil Erosion and Reclamation of Damaged Lands:

The soil conservation has not caught the requisite attention of the state govt. at the highest level. There should a separate department in the state for this purpose with adequate funds and schemes for preserving the agriculture and horticulture lands by check dams and if these are damaged by natural calamities the cost should be reclaimed from state the cost or with highly subsidized reclamation schemes.

Shift to Organic Farming:

The excessive doses of chemical fertilizer, pesticides and insecticides are causing degradation of agricultural and horticultural lands. Reports state that now there are poisonous residues not only in groundwater cereals, vegetables and fruits, but also in milk, including the mother's milk. As such the state should go in a big way to shift from chemical fertilizers and pesticides to organic and biofertilizer and pesticides which will go a long way to preserve the already scarce land resources.



Map 1.19 Wastelands map of Himachal Pradesh

Table 10.142: Category of Wastelands in Himachal Pradesh

HIMACHAL PRADESH

(Area in Sq km)

Category	Bilaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
1	0.00	7.14	0.00	2.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.63
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	11.48	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.13	0.00	2.09	31.74	45.50
4	35.34	313.89	25.53	344.82	338.53	51.45	426.68	132.97	165.20	44.60	20.56	273.60	2173.17
5	0.00	19.99	0.00	4.21	0.00	48.10	0.00	0.00	0.00	0.20	0.17	75.57	148.24
6	0.00	0.00	0.00	3.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.39	16.16
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	12.38	157.77	42.46	59.34	47.29	252.48	72.90	127.15	127.42	48.40	12.89	27.63	988.11
14	5.51	3.63	0.05	5.28	0.00	10.18	0.00	16.63	82.30	29.30	2.48	0.00	46.11
15	3.44	1568.83	0.00	472.43	1038.64	577.40	2372.49	32.72	230.25	9.50	5.51	18.86	6330.07
16	0.00	0.00	0.00	0.00	0.36	0.00	45.75	0.00	0.00	0.00	0.00	0.00	46.11
17	0.00	8.80	0.00	78.61	16.06	0.00	60.09	0.00	0.00	0.00	0.00	4.19	167.75
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.16	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.16	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09

Category	Blaspur	Chamba	Hamirpur	Kangra	Kinnaur	Kullu	Lahul & Spiti	Mandi	Shimla	Sirmaur	Solan	Una	Total
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.00	0.45
26	0.15	0.00	0.00	12.75	1493.73	370.31	2591.00	0.52	0.02	0.30	0.52	9.97	4479.27
27	5.05	800.79	2.22	118.00	130.00	50.13	500.53	7.09	9.99	4.70	6.61	0.00	1632.11
28	0.00	557.41	0.00	586.62	2377.60	1456.33	6866.97	0.37	297.78	0.00	0.00	0.00	12142.78
Total	73.35	3431.27	70.32	1686.51	5442.21	2816.38	12936.41	317.45	913.09	137.30	48.93	453.95	28327.17
TGA	1167	6528	1118	5739	6401	5503	13835	3950	5131	2825	1936	1540	55673
% to TGA	6.29	52.56	6.29	29.39	85.02	51.18	93.50	8.04	17.80	4.86	2.53	29.48	50.88

01. Gullied and/or ravineous land (Shallow)	11. Shifting cultivation area (Abandoned Jhum)	21. Sands (Semi Slab, Slab Mober, High 15-40 m)
02. Gullied and for ravineous land (Medium)	12. Shifting cultivation area (Current Jhum)	22. Sands (Semi Slab, to Slab, low<15 m)
03. Gullied and/or ravineous land (Deep)	13. Under utilised degraded notified forest land	23. Sands (Closely Spaced Inter-Dune Area)
04. Land with scrub	14. Under utilised/degraded notified forest land (Agri.)	24. Mining Wastelands
05. Land without scrub	15. Degraded pastures/grazing land	25. Industrial Wastelands
06. Waterlogged and Marshy land (Permanent)	16. Degraded land under plantation crop	26. Barren Rocky/Stone Waste/Sheet Rock Area
07. Waterlogged and Marshy land (Seasonal)	17. Sand (Levees)	27. Steep Sloping Area
08. Land affected by salinity	18. Sands (Levees)	28. Snow covered and/or Glacial Area
09. Land affected by salinity/alkalinity (Moderate)	19. Sands (Coastal Sand)	Total Wasteland Area
10. Land affected by salinity/alkalinity (Slight)	20. Sands (Semi Slab, Slab, 40m)	TGA : Total Geographical Area

[Source: *Wastelands Atlas of India*]

TOURISM, CULTURE AND ENVIRONMENT

Tourism, Culture and Environment

11.1 Status:

Tourism, Culture and Environment:

Historically, Himachal has been one of earliest ‘tourist’ destinations in our country. This started from the sages and pilgrims of yore and arrived at the ‘hill stations’ of the nineteenth century – which became retreats for a section of colonial and Indian society. Tourism in the post-Independence era continued to stem from pilgrimage and the old hill stations – and only gradually stepped into fresh areas. These included new destinations as well as adventure, trekking, camping and sport. Yet it is only in the last few decades that both the positive and negative impact of tourism have been felt in the State. These impacts have been markedly visible on the economy and in employment – as well as on the built and natural environment of the state and, certainly to a degree, on the cultural fabric.

11.2 Pressure:

The phenomenon of travelling for leisure, cultural growth and the quest for knowledge about different places connotes the concept of tourism. The growth of tourism is closely related to economic gains. In the global context, tourism grew gradually over the years – especially when faster ways of travel became available. Mass tourism started in Europe in the late 19th century – and today, this has acquired a worldwide reality. This ‘industry’ has emerged as one of the most lucrative businesses in the world, and has tremendous potential for earning foreign exchange, generating income and employment and developing industrially backward regions through its various link. Tourism has become a highly organized industry representing 10.2% of the world’s Gross Domestic Product, and is ranked as one of the largest industries in developing countries with rapid expansion in its range and dimensions. According to the World Tourism Organization, 698 million people travelled to a foreign country in 2000, spending more US\$ 478 billion. International tourism receipts combined with passenger transport currently total more than US\$ 575 billion - making tourism the world’s number one export earner, ahead of automotive products, chemicals, petroleum and food. In a developing economy like ours, one of the primary motivations for a region to promote itself as a tourist destination is the expected economic improvement it will bring

11.3 Impacts:

In India, tourism as a sector of economic significance received recognition after Independence in 1947, and was boosted at the commencement of planning in India. It is the second largest industry the world and is the sixth largest in India. India’s tourism resources are immense and the historic

and cultural mosaic is highly varied. Between 1971 and 1992, there was a perceptible and steadily rising trend in world tourism earnings. Tourism earnings in India also displayed an upward trend. The most substantial benefit of the international tourist inflow lay in the foreign exchange earnings of the country. This benefit has significantly increased and is now comparable to some of the nation's merchandise exports. Tourists from the United Kingdom dominate the foreign tourist inflow to India. At 14%, this constitutes the highest segment of the total tourist arrivals, followed by other West European countries and the U.S.A. It has been observed that the average duration of stay varies from 15 to 40 days. East European tourists stay for longer periods - followed by West Europeans and tourists from South East Asia. The expenditure per tourist is the highest in the case of West Asian tourists followed by Russian and American tourists. And yet our country has not been able to increase its tourist arrivals beyond 2.5 million whereas countries like China, which started years behind us, have crossed the 62 million mark. This is considered to be the result of lack, regulations and vision, appropriate infrastructure, marketing and no serious or sustained commitment.

Regarding the 'purpose of visit' of foreign tourists, it was observed that 62% in 2000 were for the purpose of enjoying and sightseeing - which was only 56% in 1999. But the tourist flow for business purposes fell from 23% to 19%. The tourist arrival for educational purposes constituted only about 5% of the total flow.

11.4 Responses :

In Himachal, during the year 2004, tourist arrivals in the state were 5.5 million, of which 1.80 lakh were foreigners. Reflecting the nationwide data, there are similar profiles of foreign tourists to the state and visitors from the U.K. dominate the list of foreign arrivals. The details are given in Tables below.

Table 11.143: Detail of Foreign Tourists Visiting Himachal Pradesh

Country	Year 2002		Year 2003		Year 2004	
	No. of visitors	Bed nights spent.	No. of visitors	Bed nights spent.	No. of visitors	Bed nights spent.
U.K.	17524	37877	23881	43986	28496	40966
France	13435	28889	15155	26910	16182	23716
Italy	5325	11303	5857	10574	11500	16260
Canada	3909	8357	4377	7660	5734	8645
UAE	31	63	155	283	180	280
Pakistan	0	0	241	541	155	241
USA	8159	17617	10584	19935	12001	17231
Germany	8069	17245	12311	21809	12955	18158
Malaysia	1173	2491	1884	3542	2031	3171
Australia	5809	12541	6463	11558	7831	11857
Switzerland	4050	8592	4956	7700	4239	6345

Country	Year 2002		Year 2003		Year 2004	
	No. of visitors	Bed nights spent.	No. of visitors	Bed nights spent.	No. of visitors	Bed nights spent.
Bangladesh	1696	3919	1599	3012	890	1348
Sri Lanka	206	477	73	126	346	542
Japan	5009	10414	5015	9122	4457	6426
Saudi Arabia	5	16	119	187	315	492
Singapore	674	1407	954	1834	1136	1776
Iran	67	142	258	499	322	525
Others	69242	146534	74020	159583	95574	144088
Total	144383	307884	167902	328861	204344	302067

Source :Department of Tourism and Civil Aviation, Himachal Pradesh.

However, domestic tourists continue to dominate the market as is apparent from the tables which also give the district-wise break-up.

Table 11.144: Break-up by District and Year of Domestic and Foreign Tourists in Himachal.

District	Year 2002		Year 2003		Year 2004	
	Indians	Foreigners	Indians	Foreigners	Indians	Foreigners
Bilaspur	477201	166	518299	220	584706	87
Chamba	357060	1211	404609	1177	450803	1466
Hamirpur	21786	54	36190	75	41532	92
Kangra	828653	29060	891516	32146	1012567	38713
Kinnaur	9629	3439	12109	3751	14219	4609
Kullu	1072695	48352	1290438	57833	1477324	69649
Lahaul & Spiti	28175	20130	35411	23585	40897	28615
Mandi	2244554	2240	220202	3052	269479	3581
Shimla	1227710	37860	1373635	44400	1597246	55382
Sirmour	346321	676	354128	544	393596	726
Solan	236715	1164	263499	1102	288546	1424
Una	128418	31	144378	17	174154	0
Total	4958917	144383	5544414	167902	6345069	204344

Figures include religious tourists.

Source - Department of Tourism and Civil Aviation, Himachal Pradesh.

As is apparent from the tables, there are certain areas of Himachal that attract far greater numbers of tourists than others - and there are certain areas that attract foreigners, such as Lahaul-Spiti where, in comparison to other districts, there is almost a parity of numbers between foreigners and domestic visitors. Other areas attract primarily domestic tourists – and the districts of Una, Hamirpur and Sirmour get hardly any foreigners. As regards the profile of visitors from within the country, this continues to follow a traditional pattern with visitors from certain areas and states continuing to dominate the market.

What is also indicated in the above tables is the steady rise in both domestic and foreign visitors as well as the number of bed nights spent in the state. Apart from the tables, in 1990, the state had 440 registered guest houses and hotels and the number of visitors (foreign and domestic) was 19.42 lakh. In 2004, the number of hotels and guest houses rose to 1,710 with a bed capacity of 37,948 and, as the table above shows, the number of visitors is now over 65.49 lakhs. It may be noted that these figures do not represent the substantial number of tourists who visit the state and stay with friends and relatives or of the numbers who stay at *dharamshalas* and other religious or charitable establishments.

The number of people directly employed in the tourism industry (including employees of hotels, bars and restaurants, guides, travel agents and photographers) in 2004 stood at 15,418 – out of these 13,504 were Himachalis. This figure however, does not include those who are indirectly employed by the tourism industry like in transport, as porters or in handicrafts or souvenirs. Nor does it represent the people who are suppliers to tourism based units – food, flowers. The positive side of informal or unreported employment is that the money is returned to the local economy, and has a great multiplier effect as it is spent over and over again. The World Travel and Tourism Council estimates that tourism generates an indirect contribution equal to 100% of direct tourism expenditures

At the same time there is the factor of seasonality to the work and the consequent fluctuation of employment. This is especially more so in the unorganised sector, for example, taxi driver-owners, guides and porters. It has been observed worldwide in the tourism industry that ‘Problems that seasonal workers face include job (and therefore income) insecurity, usually with no guarantee of employment from one season to the next, difficulties about training, employment-related medical benefits recognition of their experience, unsatisfactory housing and working conditions.’

11.5 Pressures:

Speaking from a tourism viewpoint, world over, it has been observed that successful tourism organisations today must be involved not only in destination marketing, but also in destination management. In this context the Convention on Biological Diversity (CBD) states, “Tourism is one of the world’s fastest growing industries as

People Concern

During the Bhandara organized by the various pilgrim centres, the waste is thrown indiscriminately which attracts animals as well as being a source of disease, so it should be ensured that the pilgrims centres must be made responsible for the scientific disposal of waste generated by them.

well as the major source of foreign exchange earnings and employment for many developing countries, and it is increasingly focusing on natural environments, Biological and Physical resources are in fact the assets that attract tourists. However, the stress imposed by tourism activities on fragile ecosystems accelerates and aggravates their depletion. Paradoxically, the very success of tourism may lead to the degradation of the natural environment by depleting natural resources reducing the site attractiveness to tourists, the very commodity that tourism has to offer... To be sustainable, tourism should be managed within the carrying capacity and limits of acceptable change for ecosystem and sites, and to ensure that tourism activities contribute to the conservation of bio-diversity. Tourism should be restricted, and where necessary prevented, in ecologically sensitive areas.”

11.6 Impacts:

In the case of Himachal, the foundations of the destination lie on the State’s natural, built and cultural environment. This is the base on which the walls of the industry stand and is the core product that is being marketed. Anything else that has come in the way of hotels or services has essentially been a means of utilising this product and transforming it into an employment and revenue generator. Of all business enterprises and industrial forms, it is perhaps tourism that has the greatest interaction among individuals, communities and the environment. It is a two-way traffic and the traffic in both lanes is required to be smooth and equitable.

11.7 Responses:

UNESCO stresses the following on tourism and the management of natural areas, “... tourism is ambivalent, by its very nature. On the one hand, tourism generates well-known advantages - visitor fees, concessions and donations provide funds for restoration and protection... Tourists can support artisan activities and help to strengthen threatened cultural values. Tourism also generates well-known problems. Tourism growth is difficult to control. Guiding development is a time-consuming process involving establishing policies, ongoing dialogue with stakeholders, and monitoring to determine if desired conditions are being met. Tourism activities require environmental impact assessments and carrying capacity studies. At sites with limited budgets and staff, increasing tourism can stretch scarce resources taking managers away from protection. While tourism’s benefits can contribute to protection and restoration, it can be difficult to strike a balance between economic gain and unacceptable impact.”

11.8 Pressures:

In the global context, it is broadly accepted that the three prime movers of mountain economies are horticulture and select agriculture, hydro-electricity and tourism. At the moment, only 2% of Himachal’s GDP comes from tourism. Yet it is estimated to be much higher as there is substantial income generation even in the non-organized sector. For example, it is estimated that at least Rs. 150 crores is earned per annum by the hospitality sector, another Rs. 100 crores by food and bar sales. Shopping by tourists ploughs about Rs. 150 crores into the state’s economy. Transport generates another estimated Rs. 100 crores, and ancillary services provided by porters,

guides generate at least another Rs. 20 crores. It is estimated that a million rupees invested in tourism creates 47.5 new jobs. This compares favourably with other sectors including traditional sectors like agriculture, where a similar investment yields only 44.7 new jobs. The role that tourism can play in a land-locked state with a hill terrain like Himachal is considerable. Job opportunities are limited since the economy is basically agrarian and the scope for industry is limited owing to geographical and ecological constraints.

11.9 Impacts and Responses:

The Department of Tourism and Civil Aviation has announced a vision for tourism in the year 2020. This encompasses :

1. In infrastructure, every major tourism destination to be well linked by roads of international standard and these highways to be well serviced by both air and rail connections.
2. A substantial number of luxury and deluxe resorts to be based in Himachal.
3. Lakes – especially the Maharana Pratap Sagar to become important destinations.
4. Apart from leisure, conference tourism, family and corporate bonding, the segment of ‘wellness’ tourism - with health and rejuvenation, yoga and other therapies - is expected to grow significantly.
5. Himachal to emerge as the core of the world’s ‘Buddhist circuit’.
6. Himachal by the year 2020 should be the adventure sports capital of Southeast Asia.
7. Centres of Hindu and Sikh pilgrimage that already draw a substantial number of devotees are to be provided with better facilities. Marketing of these places amongst the Hindu and Sikh communities within the country as well as overseas.
8. At least 25% of the State’s GDP to come from tourism and its allied industries.

At present, an inventory of the State’s tourism product consists of the following –

- There are two broad heads of the tourism product – natural and manmade heritage. Then there is the substantial but more intangible tourism segment that comes from pilgrims to the many religious places in the state.
- Himachal has been generously endowed by nature – there is the presence of the mountains and the State is one of the few places in the world that experiences five distinct seasons in the year – spring, summer, the monsoon, autumn and winter.
- Himachal’s forests have the uniqueness of being temperate to alpine ones in what is otherwise a tropical zone. These forests still have a substantial amount of wildlife and the area covered by sanctuaries and National Parks is over seven thousand square kilometres. There are 32 Sanctuaries, 2 National Parks and 3 Game Reserves. The sanctuaries include Simbalwara (Sirmour), Churdhar, Chail (Solan), Maharana Pratap Sagar (Kangra) Manali (Kullu),

Kanawar (Kullu), Kalatop Khajjiar (Chamba), Daranghati (Shimla). The National Parks are Pin Valley National Park, Spiti and the Great Himalayan National Park, Kullu, the Nature parks are at Kufri (Shimla), Manali (Kullu) and Gopalpur (Kangra).

- The major rivers of the state are the Yamuna, the Satluj, the Beas, the Ravi and the Chenab. There are several lakes all over the state and water, in some form or the other, covers over 1% of the state land area. Many of these lakes are home to a variety of aquatic and avian life, for example, the Maharana Pratap Sagar, formerly known as the Pong Dam Reservoir, is a declared bird sanctuary and over 220 species belonging to 54 families have been sighted. These include black-headed gulls, plovers, terns, ducks, waterfowl and egrets - and the first sighting in the region of the red-necked grebe, was made at the Sagar. The lake's location at the head of the Indian plains has made it a suitable habitat and stopover for migratory birds that enter India from Central Asia. Both in terms of numbers and species, some studies place this sanctuary ahead of even Bharatpur. Twenty-seven species and sub-species of fish belonging to six families have been recorded in these waters. Some of the important commercial varieties are - *Labeo dero* (*Gid*), *Labeo rohita*, *Labeo calbasu*, *Tor putitora* (*Mahsir*), and *Mystus seenghala* (*Singhara*).
- The state has several ancient Hindu temples and places of pilgrimage. Himachal is home to many of the 'Shaktipeeths' revered by Hindus. These are at Kangra (Vajreshwari Devi), Chintapurni (Chinmastika Devi), Jwalaji (Jwalamukhi), Naina Devi and Sarahan (Bhimakali). There are other shrines that draw thousands of pilgrims, such as Chamunda Devi, Deot Sidh, Baba Balak Nath and Trilokpur. Centres of Sikh pilgrimage are at Manikaran, Paonta Sahib, Baba Barbhag Singh and Rewalsar. Many of the towns have charming churches and these are at Shimla, Dagshai, Kotgarh, Kasauli, Palampur, Dharamsala, Dalhousie and Chamba. Practically every village has its own deities housed in temples that speak eloquently of local building skills and refined aesthetics.
- There are several Buddhist sites in Himachal. With dozens of old and new, large and small monasteries, Buddhism has a powerful presence in the state – which is also home to His Holiness the Dalai Lama and his followers. McLeodganj, the seat of the Dalai Lama attracts several visitors from overseas. Tabo monastery in Spiti dates back to 996 AD and in terms of sanctity for Trans Himalayan Buddhism, this is considered only second to the Tholing monastery in Tibet.
- Himachal's attractions include the unique 'hill stations' that were built by the British. These include the State Capital, Shimla, which was the 'summer capital' of British India and from where one-fifth of the human race was ruled for over a century. These towns hold excellent examples of colonial architecture and provide a window to a bygone age. Other smaller towns that were developed by the British are Kasauli, Dalhousie, Palampur and Dharamsala. Several elements of the past and an aura of nostalgia may be found in their architecture and ambience.
- There is the dramatic landscape and unique culture of the Trans Himalayan districts of Kinnaur, Lahaul and Spiti. A portion of the district of Kinnaur lies south of the Greater Himalaya and

the remainder lies across the mountains. The district of Lahaul-Spiti lies wholly in the Trans Himalaya. This is a unique part of the world where thick forests steadily give way to the almost lunar-like landscape of the cold desert.

- In the century-old Kalka to Shimla Railway line and in the Kangra Valley railway, Himachal has two of the country's five heritage railway lines.
- In recent years, other resort towns such as Dharamsala, Palampur, Kullu and Manali have also developed in the state and now draw a substantial number of tourists. Fresh destinations are emerging in pockets all over the state.
- Also in the last few decades, a range of activities has grown in Himachal Pradesh. Much of this is nature and outdoor related and the state is rapidly becoming a focus for adventure sport. This is the only place in India that hosts heli-skiing. Activities already available and likely to grow in the coming years are trekking and camping, skiing, para-sailing and paragliding, watersports and whitewater rafting, ballooning, iceskating, mountain cycling, vehicle safaris, mountaineering and rock climbing, golf and angling. Plenty of existing activity and areas for future expansion already exist throughout the State. The State has successfully hosted international and national level events in parasailing and whitewater rafting. Many of these come under the broad heading of 'eco-tourism'.
- Himachal's built heritage includes age old forts and palaces, its remarkable wood and stone 'towers', the architecture of the colonial towns – and practically every village is a picture of pastoral perfection. There are the remarkable wall and miniature paintings of the Kangra region, Buddhist *thangkas* and a wealth of folk carving in wood. Culturally, the state is rich in its folk lore, costumes, shawls, jewellery, dance forms and the 'karali' dance-dramas.
- Of the nascent markets, it is felt that 'health tourism' is likely to grow rapidly in the coming years. The clean and invigorating environment, the substantial forest cover and the number of herbs that grow in the state, provide a natural setting for this.
- Visitors to Himachal continue to visit the four main destinations of Shimla, Kullu-Manali, Dalhousie-Chamba and Palampur-Dharamsala. These places still have the maximum number of hotels and bed-strength. In addition, despite limited accommodation, the 'tribal areas' of Kinnaur and Lahaul-Spiti have started attracting several tourists – especially foreigners, though road links to Kinnaur have been repeatedly cut-off during the past few years.

Apart from this inventory, it will be appropriate to list the primary factors for the special position of Himachal Pradesh in the context of tourism, environment and culture -

1. Wide geographic spectrum - with altitudes ranging from 350m to 7,000m.
2. Vegetation ranging from thick forests to arid cold deserts.
3. Perception as a long haul destination for the international traveller.

4. Essential component of the Himalayan mountain system.
5. Wide cultural and religious diversity.
6. Special interest areas - hill stations, Buddhist monasteries, adventure, centres of pilgrimage.
7. Limited infrastructure in terms of air and rail.
8. Ecologically fragile.
9. Requirement of a tourism related economic ethic.
10. Perception as seasonal destination.
11. Degradation of existing destinations.
12. Problems special to the state - absence of adequate all-weather roads, role of touts and porters, seasonality.
13. Absence of skilled tourism personnel.
14. Need for greater stability for returns on investment.
15. Problems of garbage and pollution.
16. Limited number of existing destinations. Dispersal of tourist traffic.
17. Low per capita expenditure by tourists.
18. The bulk of domestic and international travellers is limited to arrivals from specific states and countries.
19. Planning required for incentive and tax policies.
20. Controls and guidelines required on freshly built environment.
21. Protection of the socio-cultural base.
22. Promotion of specific activities that are earners and have low environmental fallouts such as skiing, walking, trekking.
23. Mechanisms that pass the benefits of tourism to local communities.
24. Protection and development of sensitive monuments and artifacts.
25. Establish market position for the state and its destinations / circuits / activities.
26. Establish feasibility of movable infrastructure in the form of tents, dismantlable homes and caravans / mobile homes.
27. Strengthening of existing non- environmental stress activities such as eco-tourism and adventure and the appropriate expansion of these.
28. Development of water bodies - both lakes and rivers-from tourism and eco-sensitive perspectives.
29. Accounting of existing tourism-related infrastructure and facilities.

Pressures and Impacts:

In 1991, the Government of Himachal Pradesh announced a tourism policy and certain points that addressed the issues of the time were taken up. Yet tourism continued to be number-driven and was unable to contain the fallout that led to haphazard and damaging growth of the existing destinations. A visible negative impact on the environment was also seen. At the same time, there was the danger of eroding the base for future thrusts in tourism – like adventure tourism, eco-tourism and heritage tourism.

It was realized that unbridled expansion and the burdening of the existing destinations was leading to considerable ecological damage and an increasingly negative perception on the part of the tourist. Simultaneously, the local people were not receiving the true benefits that tourism could provide.

Responses:

This policy was revised and the present one declares in its preamble, “...it is crucial that we develop an appropriate regulatory framework to ensure that all tourism activity takes place in a safe and orderly fashion and to make sure that all future development takes place in a manner that will enhance and protect our natural and cultural environment.”

The objectives of the current policy document are -

1. To promote sustainable tourism which is not only environmentally compatible but also leads to economic betterment of the rural people.
2. To establish Himachal Pradesh as a leading tourist destination in the country and abroad.
3. To make tourism a prime engine for economic development and prosperity of the State and as a major means for providing employment.
4. To encourage a strong and sustainable private sector participation in creation of tourism infrastructure especially through public/private partnerships.
5. To attract quality tourists and to increase their stay in the State.
6. To safeguard the state's natural and manmade heritage.
7. To encourage civil societies and non-governmental organizations to promote and the conduct tourism related activities.
8. To position Himachal Pradesh as a one-stop destination for adventure tourism.

Basic thrust areas have been listed in the policy and these are –

- Rural Tourism
- Eco Tourism
- Wildlife Tourism

- Development of Lakes and Wetlands
- Pilgrimage Tourism
- Adventure Tourism
- Promoting Unexplored Himachal
- Health Tourism
- Arts Crafts and Souvenirs

The government has also notified a Tourism Development Board that follows the pattern of other boards elsewhere in the world and is capable of cross-cutting management with multiple linkages. These are all indicators that there is a strong realization in government and among policy makers that tourism has to become sustainable – but this is not necessarily how it translates on the ground. Nor is this an indicator that the concept of sustainable tourism is, currently at least, supported by the industry at large – and this may have something to do with the fact that a substantial number have already established a stake or are not professionals in the hospitality or tourism sector and treat the environment that sustains the industry only as a source of revenue.

Pressures and Impacts:

The World Tourism Organization (WTO) defines sustainable tourism development as, what “... meets the needs of the present tourists and host regions while protecting and enhancing the opportunity for the future. It is envisaged as leading to management of all resources in such a way that economic, social and aesthetic needs can be fulfilled, while maintaining cultural integrity, essential ecological processes, and biological diversity and life support systems.”

While sections of industry may support this statement, unfortunately the overwhelming bulk does not seem to. Here, it also a question of the stake the investor has in the industry and for how long does he perceive himself as a player. An example may be given of the Fingask area in Shimla which had an overwhelming number of hotels cramped by narrow alleys – all of which were built after 1980. The only advantage was of the area’s situation close to the Mall. Today, business is falling in the area as this is perceived to be a downmarket locality, with no open spaces, views or parking facilities, many hotels have been converted into other business establishments or into apartments. But in terms of ecology and aesthetics, the damage has been done.

Often enough, this has to do with both the service provider in the industry and the tourist. Simultaneously, the host community and its environment is often passive, while cultural changes occur through interventions and the creation of often negative images through various methods such as ‘festivals’ - where some may be regarded as regressive for the growth of tourism if they have to slot in with government policy of ‘quality tourism’. At the same time, where there is authentic culture as in practically every traditional fair and festival in Himachal, these are rarely exposed to the impact – again both positive and negative – of the tourism industry.

Regarding socio-cultural alterations that may take place, the UNEP states, “For a variety of reasons, host communities are often the weaker party in interactions with their guests and service providers, leveraging any influence they might have. These influences are not always apparent, as they are difficult to measure, depend on value judgments and are often indirect or hard to identify. The impact arises when tourism brings about changes in value systems and behavior thereby threatening indigenous identity. Furthermore, changes often occur in community structure, family relationships, collective traditional life styles, ceremonies and morality. But tourism can also generate positive impact as it can serve as a supportive force for peace, foster pride in cultural traditions and help avoid urban relocation by creating local jobs. As often happens when different cultures meet, the socio-cultural impact is ambiguous: the same objectively described impact is seen as beneficial by some groups, and is perceived as negative - or as having negative aspects - by other stakeholders.”

While no detailed studies are available, broad indicators point to low spending on the part of the average tourist and also to insensitive behaviour on the part of many. The losses cannot often be quantified, but are clearly visible in terms of expenditure required for law and order, pressure on civic amenities, roads and parking, and the visible degradation of the destination. Regarding the aspect of ‘regulation’, a move that is mooted is the creation of a ‘Tourist Police’ wing within the police establishment. A role that is being defined for this body is ‘To Assist, Benefit and Protect’. The presence of this force is expected to help both the tourists and the local people.

At the same time, with ecological deterioration, destinations get categorized as ‘down-market’ ones in the public eye. And after all that, the quality of life is negatively impacted for the community. It would perhaps be appropriate if industry creates an internal monitoring body that ensures that the intransigence of some does not affect the reputation and standing of others – or of the destination. A comparison of case studies of success and failure of tourism, in similar geographic and ecological initial situations, is important in being able to understand the dynamics of the process of tourism development and its interaction with the local environment and the host culture.

Another negative impact is in infrastructure costs. Tourism development can cost the local government and local taxpayers a great deal of money. Studies in other parts of the world indicate that developers may want the government to improve the airport, roads and other infrastructure, and possibly to provide tax breaks and other financial advantages, which are costly activities for the government. Public resources spent on subsidised infrastructure or tax incentives may reduce investment in other critical areas such as education and health. Prices may also increase as a rising demand for basic services and goods from tourists will often cause price hikes that negatively affect local residents whose income does not increase proportionately. A San Francisco State University study of Belize found that, as a consequence of tourism development, the prices for the locals increased by 8%.

Tourism development and the related rise in real estate demand may dramatically increase building costs and land values. Not only does this make it more difficult for local people, especially in developing countries, to meet their basic daily needs and, in severer cases, eventually dis-empower residents.

While again, no conclusive studies are there, these indicators are often cited Shimla, Manali and Dharamsala where it is stated that the number of tourists who visit these places every year is up to ten times the local population – and those who are not stakeholders in the industry, often resent tourist presence as depriving them of basic civic amenities, causing deterioration of the environment and erosion of local culture. While no analysis, far less a carrying capacity report, exists at the moment, it will be interesting to see a cost benefit analysis of tourism in the context of the primary destinations. For example, it can well be argued that the money earned from tourism in say, Shimla do not necessarily, match the expenditure both in terms of money and deterioration in both physical and perceived terms of a destination. Shimla, at one time, was likened in elegance to the finest cities of the world – Paris, St. Petersburg and London. While it may have had a colonial base, that base was substantial enough to sustain the tourism industry in the post-Independence years. It is unfortunate to admit that there has been no value addition at all – only a chipping away at the base.

At the same time, the pressure placed by tourism often helps in improving infrastructure. In this context, at least to some extent the proposals of additional rail services, expanded airports and additional highways in Himachal certainly have something to do with tourism in the state. For example, a broad gauge line is expected to extend from Kiratpur in Punjab up to Rampur. An airport capable of landing larger craft is mooted for Sundernagar. The National Highway network in the state has already expanded from two roads to eight.

It is also likely that the tourism sector will experience further growth after the announcement of the Concessional Industrial Package by the Government of India, Ministry of Commerce and Industry. The highlights of the package are : Projects related to Eco-Tourism, Hotels, Resorts, Spas, Entertainment and Amusements Parks and Ropeways are included in the list of thrust industries that are entitled to concessions. New projects in these thrust areas are entitled to 100% income tax exemption for an initial period of five years. Thereafter, 30% exemption is available for a further period of five years. New projects are entitled to capital investment at the rate of 15% of their investments in plant and machinery subject to a ceiling of Rs. 30 lakh. The package of Rs. 4,000 crores announced by the Central Government for Himachal, in August 2005, encompasses many tourism-related projects and is likely to lead to further growth.

It has been stated that ‘tourism activities often originate a self-destruction cycle. As tourism becomes more massive, intensive and spread out in a region, and when there is an excessive urban growth, there is progressive degradation of bio-diversity. This negative impact is especially important concerning the diversity of landscapes, and the type of exploitation that takes place in them. It may eventually lead to a lack of quality and a diversification that will no longer attract tourists. The economic profitability of tourism decreases, the return on investments is too low, and there is a progressive trend towards uniformity of both tourists and landscapes. Tourism operators are forced to lower prices to attract tourists, tourism becomes even more massive and lower quality, so the self-destructive cycle is increasingly strengthened, up to the moment that tourism may eventually end. In a number of cases, the only solution is to demolish existing settings in an attempt to re-establish a quality and diversity of landscapes, in order to attract tourists again.’ Drastic measures like this are often a last resort. For example, during the last few

months of 1999, 14 hotels were demolished on the coasts of Majorca in the Balearic Islands in order to upgrade the destination.

Responses:

At the same time, in Himachal, there are examples in the industry where a lead has been taken both in environmental protection and in cultural promotion – and does not have the stigma of being exploitatively commercial or mono-cultural. In 2004, three units located at different places in Himachal were singled out for mention as ‘best practice’ players at a presentation made to the Government of India by the State’s Department of Tourism.

They all had the following common indicators –

1. Appropriate building design – aesthetic, functional and in keeping with hill character.
2. Built-up area to green area ratios.
3. Concern and protection for both the natural and built-up environment – as well as the enhancement of both.
4. Good waste management.
5. Good energy management.
6. Good water management.
7. Air and noise management.
8. Community participation – including employment opportunities and the purchase of necessities like milk and vegetables from the local people.
9. Innovative and appropriate in-house management and concepts.
10. Encouragement to local culture, including cuisine.
11. Guest information and the positive influencing of consumer behavior with the local communities and with the environment.
12. Promoting an interactive environment with the surroundings - including forests and built heritage.

These units had the following common points -

1. All have been commissioned in the recent past.
2. All have had cost more from trying to protect even the smallest tree that grew on the site at the time of construction.
3. All have given employment to local people and have successfully trained many of them in advanced hospitality operations.

4. All purchase essentials such as milk and vegetables from the local population.
5. All offer 'village visits' where residents can interact with the local community, share their cuisine and experience local architecture and lifestyles at first hand. This creates an avenue for income to directly enter local hands. Nature and 'heritage' walks, interactive adventure with nature, conducted by experts, are also a part of the activities on offer.
6. All three have troupes of local artistes performing regularly on the premises.
7. All have eco-friendly methods for disposing of their waste.
8. There are special activities to involve and educate children staying on the premises creatively.
9. All are successful business enterprises and have received good guest and press reviews.

11.10 Some innovative concepts that protect and promote environmental concern and a sensitivity to local culture that have been used are -

1. The concept of 'grow your own tree' for residents – especially for honeymooners where they plant a tree which is looked after by the management. This also makes sound business sense in encouraging return visits – if only to see the tree planted by them.
2. Using the property as an 'art gallery' where exhibits on the walls are for sale. This gives local artists an opportunity to display their works, the property is able to change its décor at no extra cost and also cover administrative expenses incurred on this by a nominal gallery commission.
3. Empty milk pouches and cut-off mineral water bottles are used to prepare the plant nursery.
4. Waste water from the kitchen and bathrooms is drained to the adjoining villages for irrigation purposes. Bio-waste from the kitchen is also taken by agriculturists for manure.
5. Local people come to sell handicrafts.
6. Water harvesting to supplement requirements. The use of this is further optimized by drip irrigation and sprinklers.

These are examples of tourism, the environment and the local communities moving in synergy and not in conflict. But here, it may be mentioned that all three are not located in urban areas and are either semi-detached or have a totally rural or forest setting.

Value addition to the destination holds at least one of the keys in enhancing the tourism experience as well as in protecting or even improving the environment. The concept of 'maximum value addition' places the highest possible value on culture and natural heritage while providing visitors with value for their money and time. This strategy is arguably appropriate for Himachal's delicate fabric – and it is already the avowed policy of the Government to shift from number-driven tourism to a low-volume high-value one. There is however a transition that has to be made both by educating the players of the industry and by sensitising tourists that this idea for and not against tourism. Here, one basic concept has to be understood that, when a tourist travels, he enters someone else's home that has to be respected. While this may sound unnecessarily rhetorical,

ruining the destination leaves nothing for anyone – neither for the people who live there, nor for the industry and certainly not for the tourist.

A concept of codes for the principal players is often mooted. These are taken to address (i) the general tourist industry, (ii) specific sectors and activities, (iii) tourists and, (iv) the host populations. While legislation and law may be valid for the first two sectors, it is education, information and informal actions such as market positioning and promotion that seem more valid for the efficacy of the latter two.

One important viewpoint expressed repeatedly by the tourism industry in Himachal is the issue of accessibility. It is pointed out that as long as Himachal is seen as a ‘long haul’ destination where the tourist has to spend a long time travelling, the state limits its market. This sets a vicious circle into motion : better markets are not tapped and the market position, which in this case is the tourism industry as well as the environment and the larger cultural fabric of the state, is notched down.

At the same time, the public at large within the State needs to be educated at least to a reasonable level regarding tourism – the phenomenon of this industry concerns a far wider range of people than those who are immediately connected with it and, directly or indirectly, this means a substantial bulk of the state’s population. And here it may be a good idea to place some basic tourism concepts in school curricula. This would not only create awareness regarding the handling of tourists – especially in the context of the environment and culture, for every Himachali particularly the rural family, is powerfully tied to the environment with the area’s cultural tradition. Simultaneously, it will hopefully, prevent him from foreclosing on a future economic opportunity. In one of the interactions with local people, he met a person who owned a large and aesthetically built traditional house in the village. The owner felt that as the area had no hotel (apart from the HPTDC’s structure under construction), and was emerging as a potential destination, he wanted to demolish this and build a new structure ‘just like the one that was next to his’ which was a building with standard concrete ugliness and housed a bank. In the process, he would incur a major financial liability and also destroy an intrinsic part of what makes the area attractive in the first place. His perception was that ‘this is what tourists want’. And this may be read as a situation that exists in other places and with other people, too.

Yet on its own the idea of ‘preservation’ is rarely enough seen in the context of tourism. This requires a multi-pronged strategy that will help him modify his house by the addition of bathrooms and other services – nor as a small rural entrepreneur can he handle the marketing required and would benefit from a marketing umbrella that could guide him and others like him. At the same time, a level of skills also have to be imparted to local potential local players, especially if rural tourism is to become a reality, such as in hygiene, housekeeping and catering.

Pressures:

At this juncture, two weak points of the tourism industry in Himachal need to be addressed. These are inadequate human resource development which compels employers to look for staff

outside the state and places local people in positions that require low skill levels. The other point is lack of investment that is financial, entrepreneurial and far-sighted. These weaknesses do not remain confined to the tourism industry alone but can carry negative connections into the environment and the host culture.

Impacts:

Here, it is appropriate to cite that the impact is negative when tourism results in decreased bio and cultural diversity and when this can adversely affect the potential of tourism itself. Positive interactions may include an increase or steady maintenance of bio-diversity, enhancement of cultural diversity, economic growth, as well as increasing the potential for quality tourism. The UNEP DTIE highlights three main impact areas, which all entail physical alteration and destruction of habitat –

1. Depletion of natural resources, including water resources, local resources and land degradation.
2. Pollution, such as air pollution and noise, solid waste and littering, sewage, and aesthetic pollution.
3. Physical impact of tourism development such as construction activities and infrastructure development, deforestation and intensive or unsustainable use of land and the physical impact from tourist activities.

Positive tourism can also contribute to conservation to increased awareness of the values of bio-diversity and sustainable management of the natural environment in general and protected areas in particular. As summarised by UNEP DTIE, positive environmental impacts of tourism could be:

1. Financial contributions in the forms of direct financial contributions and contributions to government revenues.
2. Improved environmental management and planning.

For this the mechanisms required are –

1. Rising of environmental awareness.
2. Protection and preservation.
3. Alternative employment.
4. Regulatory measures to offset negative impact.

UNEP DTIE, on the environmental impact of tourism, points out that the quality of the environment, both natural and man-made, is essential to tourism. “However, tourism’s relationship with the environment is complex. It involves many activities that can have adverse environmental effects.

Much of this impact is linked with the construction of general infrastructure such as roads and airports, and of tourism facilities, including resorts, hotels, restaurants, shops, golf courses and marinas. The negative impact of tourism development can gradually destroy the environmental resources on which it depends”.

Regarding the three main impact areas, UNEP DTIE concludes that negative impact from tourism “...occurs when the level of visitor use is greater than the environment’s ability to cope within the acceptable limits of change. Uncontrolled conventional tourism poses potential threats to many natural areas around the world. It can put enormous pressure on an area and lead to soil erosion, increased pollution, discharges into the sea, natural habitat loss, increased pressure on endangered species and heightened vulnerability to forest fires. It often puts a strain on water resources, and it can force local populations to compete for the use of critical resources”.

This, however, is at times perceived as working against the tourism industry as it stands. It is not. This is only to protect the base of the industry and allow it to retain its options and growth modules of the future.

Another important issue is of leakages that puncture the system and carry away the bulk of revenue from the host community. There is a strong case to state that tourism must benefit the host community and its people - if the benefits of tourism do not pass on to Himachal’s people, there might as well be no tourism at all. For this to happen certain mechanisms have to be developed and the human resource base strengthened. The final income for the state is the amount of tourist spending that remains locally after taxes, profits, and wages are paid outside the area and after imports are purchased. The subtracted amounts will be the ‘leakage’. According to *Sustainable Living*, ‘In most all-inclusive package tours, about 80% of travellers’ expenditure goes to the airlines, hotels and other international companies (which often have their headquarters in the travellers’ home countries), and not to local businesses or workers... Estimates for other Third World countries range from 80% in the Caribbean to 40% in India.’

Other forms of leakage commonly occur when there is a demand for standards of equipment, food, and other products that the host community cannot supply. This can take the form of food and drinks even. Here again, a vicious cycle exists. As the demand is often seasonal, local suppliers either cannot cope with it, or due to the seasonality are unable supply. For example, practically all star category hotels and large resorts in Himachal demand lettuce that can easily be grown by local farmers. However, due to the fact that there may be high demand in summer and none immediately afterwards, the farmer is stuck with the produce and the hotelier has no choice except to purchase at higher prices elsewhere.

Responses:

The issue of ‘leakages’ and incompatible tourism, among others, has been treated in varying manners in different places. One example in Himachal’s neighbourhood is the Annapurna Conservation Area Project (ACAP) in Nepal. While the functioning of this has been affected by recent political developments in that country, its structure and success is worth examining. The

ACAP is managed by the King Mahendra Trust for Nature Conservation (KMTNC), an NGO that was created in 1986 in an attempt to safeguard the natural beauty of the Annapurna region.

The mission statement is –

“To conserve the natural resources of the ACA for the benefit of present and future generations; to bring sustainable social, institutional and economic development to the local people; and to develop tourism in such a way that it will have the minimum negative environmental impact.”

As the working of the ACAP has several points that may be worth repeating Himachal; these are given in detail below –

The Annapurna Conservation Area is home to ten distinct and diverse ethnic groups, - totalling some 120,000 people, whose prosperity ACAP seeks to balance with environmental needs. Entrusted to the government as caretaker of the Annapurna Conservation Area, a system has been set in place where all non-Nepali visitors to the region have to pay a permit fee which in late 2004 was Rs. (Nepal) 2000, approximately, US\$ 30. This is valid for three weeks.

The ACA implements the concept of multiple land-use management to achieve site-specific goals of conservation and development. ACA has been classified into 5 land-use management zones – (i) wilderness zone (ii) protected forest/seasonal grazing zone (iii) intensive use zone, (iv) special management zone, and (v) biotic/anthropological zone.

To implement the concept of multiple land-use management appropriately, a GIS based database allows the identification of site-specific thematic management options paying due attention to the local community's needs and the bio-physical setting of the area. The ACA is one of the most popular trekking destinations in Nepal and had 75,000 visitors in 2000. The ACAP mobilises local people in all of its conservation and development interventions. There are 539 local level institutions in the ACA area for this purpose. The ultimate goal of the ACAP is to make these local institutions self-reliant so that they can operate on their own. It is, however, appropriate to mention that the problem of litter along some trails is fairly serious and some have been named ‘the Coca Cola trail’ and ‘the toilet paper trail’.

Countries like Bhutan have addressed the issue of ‘over grazing by tourists’ by imposing a limit on the maximum number of visitors that can enter the country every year.

Today in Himachal, to promote eco-tourism, forest rest houses have been opened to tourists. While the mechanisms of this are still not in position, this may open a previously totally off-limits and pristine area of Himachal to tourists. It may be strongly stressed here that extra care needs to be taken regarding the tourists who visit these to ensure that they are sensitised. Simultaneously, despite the remarkable location of each of these, the infrastructure is often limited.

According to the Quebec Declaration on Ecotourism, ecotourism “embraces the principles of sustainable tourism and the following principles which distinguish it from the wider concept of sustainable tourism:

1. Contributes actively to the conservation of the natural and cultural heritage.
2. Includes local and indigenous communities in its planning, development and operation, contributing to their well-being.
3. Interprets the natural and cultural heritage of the destination to visitors.
4. Lends itself better to independent travellers, as well as to organized tours for small size groups.”

Time and again it has been stated that tourism is a double-edged activity. It has the potential to contribute in a positive manner to socio-economic improvements. Simultaneously, rapid and often uncontrolled growth can be responsible for the degradation of the environment and an erosion of local identity. Culture, with all its complexity, may also be impelled by the forces of tourism to transform itself into a demand and supply relationship. Mildly stated, tourism’s connections with the environment are also highly complex. There are obvious economic benefits and equally obvious cases that press for conservation for nature and the environment. The UNEP DTIE, states that tourism can lead to a variety of consequences :

1. Change or loss of local identity and values, brought about by several closely related influences (commodification, standardisation, loss of authenticity and staged authenticity (that are an) adaptation to tourist demands.
2. Culture clashes (through economic inequality, irritation due to tourist behaviour, job level friction).
3. Physical influences causing social stress - Resource use conflicts, cultural deterioration, and conflicts with traditional land-uses.
4. Ethical issues, such as crime generation, child labour, prostitution and sex tourism.

The Convention on Bio-Diversity points out that, “Tourism is also a major source of income and employment. Sustainable tourism can serve as a major educational opportunity, increasing knowledge of and respect for natural ecosystems and biological resources. Other benefits include the provision of incentives for maintaining traditional arts and crafts, traditional knowledge, and innovations and practices that contribute to the sustainable use of biological diversity”. Simultaneously the UNEP DTIE also summarizes the possible positive social-cultural impacts of tourism, “Tourism can contribute to positive developments, not just negative impact. It has the potential to promote social development through employment creation, income redistribution and poverty alleviation.”

Conservation and a protective nurturing of the state’s natural and built-up environment as well as its culture is not an abstract idealistic concept in the context of tourism. This is a powerful developmental tool with the state. From Himachal as it stands, were we to remove nature and all its wonders, the rich and varied cultural fabric, the diverse forms of built-up heritage we should be left with nothing to offer tourism. It is all very well to talk just of hotels and resorts, or casinos

and gaming houses – and there is no doubt that they fulfil the important role of providing employment and generating revenue. But they are not the core product – and at least at this stage, or in the foreseeable future – even if this were the chosen path – will we be able to match these in the international market.

Appendices

Appendix 1: Pacific American Tourism Association (PATA)’s Code for Responsible Tourism includes

- Identifying environmentally compatible practices, with special emphasis on renewable energies.
- Conserving ecosystems and development in protected areas.
- Integrating local communities in tourism development.
- Enforcing international, national and local environmental regulations.
- Participating in the planning process, providing access to this for the local population.
- Prevention of tourist activity-related environmental impact.
- Implementing management measures, especially in waste, water and
- Energy.
- Environmental training for personnel working in the sector.
- Providing customers with information about responsible environmental practices and behaviour.
- Generating best practices guides for the different sectors of the tourism industry.

Appendix 2

The Tour Operators Initiative (TOI) is an initiative developed by tour operators for tour operators with the support of UNEP (UNEP DTIE hosts the TOI secretariat), UNESCO and the World Tourism Organization (WTO), who are also full members of the initiative. Under this international umbrella, member tour operators will be able to respond to international agendas while creating a platform to develop ideas and projects to address the environmental, social, economic and cultural aspects of sustainable development within the tourism sector.

Social sustainability is thus defined by the TOI – “Commitment to respecting the integrity of local cultures to prevent negative effects on social structures and to conserving of cultural heritage.”

Economic sustainability is thus defined - “Committed to co-operating with local communities and people and to use local products and skills.”

TRANSPORT, COMMUNICATION AND ENVIRONMENT

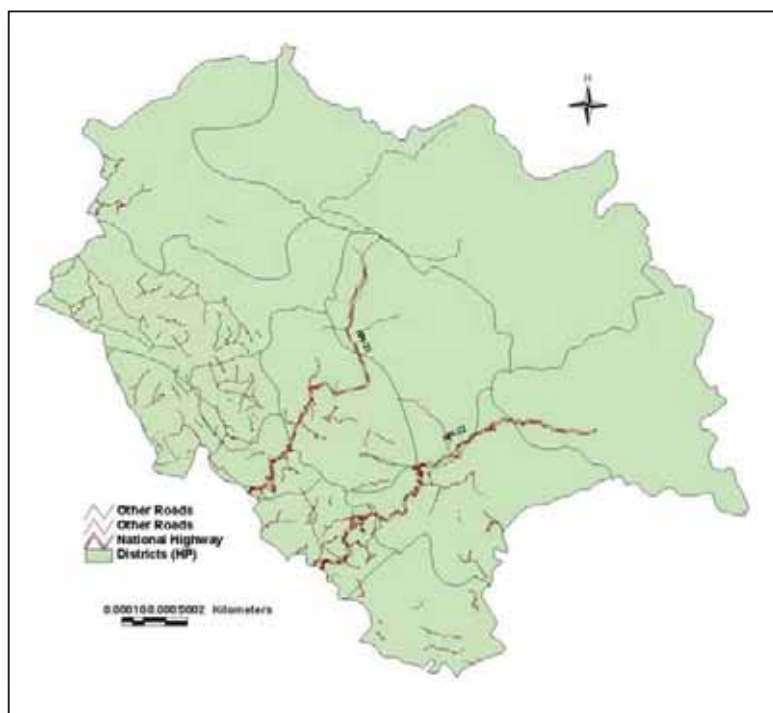
Transport, Communication and Environment in Himachal Pradesh

Introduction:

An efficient transportation network is a pre-requisite for sustained economic development. A good connectivity of habitations is often the primary means of supplementing the public effort directed at providing basic health and educational services as well as infrastructural support for production, trade and commerce. Efficient means of transportation and communication gain particular significance in the circumstances (as in India) where 70 percent of the population lives in the rural areas 50 percent of which are still not connected with road. Though the road transportation network has expanded manifold in the first fifty years of planned development (Table 12.145), it, however, remains inadequate in terms of spread, is unable to handle high traffic density at many places and has poor riding quality in some segments (MORTH 2005). One of the major reasons for its inadequacy is the far rise in the transport demand greater than the road capacity during this period. Among the key factors that have affected the transport demand are increases in population, household incomes, industrial and commercial activities and leisure travel demand.

Within the transport sector, road transport generally constitutes a bigger segment. It is estimated that in India as against 5.5 percent GDP contributed by all means of transport, 3.69 percent comes from road transport alone (MORTH 2005). Many factors contribute to the dominance of road transport. First is the location of enterprises with production centres moving away from the urban centres to specific industrial zones, which often lie outside the urban sphere of influence and lack adequate connections to railways and inland navigation. Second, there has been a strong evolution towards new production structures.

Whereby transport has been integrated into the production



Map 1.20 Source: Water Resources Management of H.P.

logistics of enterprises, the greater the value of the goods concerned the more important speed and flexibility become in transportation. Finally, with the nature of the goods produced changing overtime, there has been a reduction in transportation of bulk goods like raw material having high specific gravity and low value added. The trend towards the transportation of finished products with a high value added has benefited the road haulage sector.

Even as the benefits from transport can never be overstated, there are a series of transport related externalities¹ that should be considered in assessing the relative advantages. Such costs are usually external to those who make use of transport and are often unaccounted for. When households and firms decide whether or not to travel, when and at what distance to travel and by which mode and route, they take into account only their own costs and benefits. Each additional transport user also generates costs to other transport users and to the society in general, which he does not or only partially takes into account in his decision process. The resulting traffic demand is too high in comparison with the social optimum, and is concentrated too much at particular times of day with the share of the different modes being sub optimal. The costs that are not taken into account are external costs. The main external costs of transport use are congestion, accidents and environmental costs. These costs consist not only of costs in the monetary sense, but also of, for example, time losses, pollution, noise and so on.

The marginal external congestion costs are present whenever an additional vehicle in the transport network reduces the speed of the other transport users. A lower speed has several effects. It affects the operating costs of the other transport users, and their time costs that depend on the value of transport time. The marginal environmental costs, on the other hand, include the costs imposed by the emission of air pollutants and noise on society in general and on future generations (in the case of air pollution and global warming).

The marginal external accident costs are not straightforward to define. When an additional vehicle joins the traffic flow, it causes three types of costs to the society (Mayeres 2003). First, the transport user himself is exposed to accident risk. The social costs of this consist of his own loss due to the accident risk (which is internal), the pure economic costs associated with the accident risk (net output loss, medical costs, and police costs), and possibly also the utility loss of relatives and friends. Second, the additional transport user may have an impact on the accident risk of the other infrastructure users and therefore on the associated costs for society. Third, other transport users will adapt their behaviour when confronted with a changed traffic situation. They can do so in many ways, for example, by installing safety equipment, by switching to safer modes or by taking more care. Naturally, therefore, risk avoidance entails costs that need to be accounted for. As the accidental risks are insured, the extent of externality in this case depends on the liability and compensation rules that are in effect, and on the type of insurance pricing. Any analysis in this regard will also need to take into account this factor.

The paper dwells on two prime concerns in the transport and communication sector: the road infrastructure and policy and the transport sector growth and issues. The theoretical framework of transport economics is reviewed to analyse the problems and find out appropriate policy solutions. While the focus of discussions is Himachal Pradesh, examples from other states (of the Indian

Union) and other countries are drawn to highlight the issues. Paper is organized as follows. Divided in four parts, part II of the paper presents discussions on road network in the state, its growth trends and the concerns and options; and part III gives an overview of the transport sector in the state, the key areas of concern and the policy options. Finally, part IV gives the conclusions of the study. It is concluded that the ultimate goal of a transport policy should be to use road space efficiently, and allow users to take into account the true cost of their decisions to maximize social welfare. Given the wide variety of measures and technical possibilities, combined with the growing seriousness of excessive fuel consumption, congestion and environmental impact, this challenge could be overcome. It will, however, require institutional reforms adopting integrated planning methods and coordinate implementation, development of suitably skilled manpower and access to substantial financial resources.

12.1 Road Infrastructure and Policy:

Infrastructure Development and Growth:

Most transport (be it public or private, passenger or freight, and motorized or non motorized) uses the road system. However, despite its importance, the road system is usually managed in a fragmented and uneconomic way. Decisions on the management, expansion and maintenance of the roads networks are generally taken by a gamut of agencies ranging from the state Public Works Departments, to local urban bodies, Block Development agencies and the Panchayats. It is estimated (MORTH 2005) that of the total roads in India (24.66 Lakh Km), 42.6 percent are Panchayat roads, 38 percent are PWD roads, 9.4 percent are urban roads and 10 percent are project roads. Akin to the supply side, on the demand side are the small individual entities mostly in the private sector. The worst problem arises with its being a public good. Its feature of being a public good does not allow the normal market mechanism to function with the price regulating the demand and supply in the market. Such a situation of market failure² results in juxtaposition of extremely buoyant private demand demonstrated by high levels of congestion and cash starved infrastructure supply agency.

Table 12.145: Road Network (National Highways) in India

Periods	Total Length (Km)	Widening to two lanes (Km)	Widening to four lanes (Km)
1949-69	24000	14000	Nil
1969-90	33612	16000	267
1990-97	34298	3138	483
1997-2002	58112	1955	710
2002-03	58112	710	418
2003-04	65569	671	799
2004-05	65569	221	841

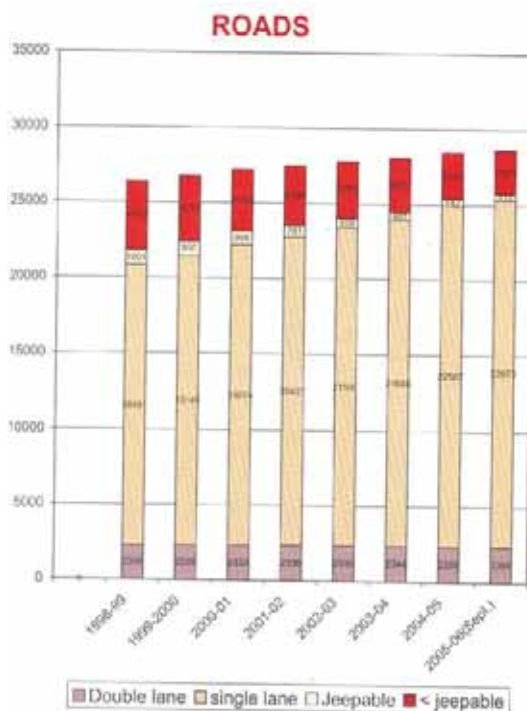
Source: MORTH (2005)

The scene in Himachal Pradesh is no different: there are four agencies handling roads. The National Highways are looked after by the Government of India, the State Highways by the state PWD, the town roads by the Municipal bodies and the rural roads partly by the PWD and partly by the rural development department. There is unfortunately no agency to coordinate all these which often work in a compartmentalized manner. The development of roads in the state since the formation of the state has been as under:

Table 12.146: Road Infrastructure in Himachal Pradesh

Plan period	Road length (in Km)
1951-56	504
1956-61	1300
1961-66	2114
1966-69	6196
1969-74	9042
1974-79	10394
1980-85	13637
1985-90	15560
1992-97	18376
1997-2002	20837
2002-03	23436

Source: Planning Department (2003): 194-95



Source: Economic Survey of Himachal Pradesh

On an average about 2500 kilometers of road length is added every five years in the state. The growth rate of road network was higher in the initial years of development, and slowed down in the subsequent years after the basic connectivity at district and subdivision level was provided, the demand for funds for other sectors of the economy such as health, education and social services, increased.

Table 12.147: Category of Roads in Himachal Pradesh

Sr.No.	Category of Road	Single Lane	Double Lane	Total
1	National Highways	486	749	1235
2.	Border Roads	422	269	691
3.	State highways	901	617	1518
4.	Rural Roads	19291	701	19992
	Total	21100	2336	23436

Source: Planning Department (2003): 194-95

Over 90 percent of the road network consists of single lane roads. With the high growth rate of vehicle population and use, the problems of congestion arise.

12.2 Concerns and Options:

Among the areas that the Road policy in a Himachal Pradesh should focus on are:

- (a) Road maintenance organization and finance;
- (b) Traffic management to improve traffic system capacity, quality, safety;
- (c) Demand management to secure maximum social value for network use;
- (d) Infrastructure expansion planning and appraisal.

(a) Road Maintenance:

It is estimated (MORTH 2005) that, out of the total road length of 65569 Km in India, about 25000 Km is under severe strain due to heavy traffic. The allocation of budget for maintenance of roads in the central sector is only 40 percent of the requirement. The position in the state sector is thought to be still worse. Owing to a persistent demand for connectivity, often a major share of the budget allocated to the Public Works Department is spent on developing new roads. Being a hill terrain, per kilometre expenditure on roads in the state is far higher than on the plains. There is, therefore, a tendency to under-fund maintenance. Among the main issues in the maintenance of roads in the context of Himachal Pradesh are: preparation of road inventories, analysis of defects, determination of requirements and types of interventions, arranging financial resources and preparation of maintenance plans. Any sound road policy ought to address these issues.

Funding the maintenance of roads are of prime concern. Now, there is no effort or mechanism to tap the user based second-generation road funds³ financed through fuel duty charges or other user-based charges. Even where such duties are levied (for instance as a cess on fuel price) the proceeds of the same go to the overall kitty rather than being spent on the maintenance of roads. Therefore, the condition of roads gets bad especially in segments of high use such as the national highways leading to tourist destinations like Kullu-Manali, Shimla, Dharamsala and Dalhousie. While the Himachal Pradesh Budget Manual provides for creation of a Road and Infrastructure fund, no such fund has been created yet.

The idea of second-generation road fund is based on the dictum that the road infrastructure should be maintained with funds collected from users. It is believed (World Bank 2002) that normally direct and indirect charges to the users should be enough to cover the full cost of traffic including environmental impact and road maintenance. As the road damage caused by vehicles depends on vehicle axle weight, introduction of a kilometre charge that is a function of the number of equivalent standard axle loads of a heavy vehicle is efficient in reducing this type of externality. A tax that is closely linked to the road damage caused by vehicles would give truckers an incentive to reduce axle weights (Small, *et al.* 1989). Fuel taxes are less appropriate for this purpose since that gives perverse incentive as the fuel consumption increases with the number of axles.

(b) Traffic Management:

The objective of traffic management is to make the safest and most productive use of existing transport system (road based) resources. It seeks to adjust, adapt, manage and improve the existing transport system to meet the specified objective. By maximizing the efficiency, capital expenditure can be avoided. Many traffic management systems, like traffic signals, increase the efficiency of movement with negligible side effects. However, the traffic management policy involves choices: pedestrian and non-motorized traffic versus motorized traffic. Given the limited road space, both may have conflicting interests. For instance, priority to pedestrians may imply reduced road capacity for the vehicles. An integrated traffic management system will require compromises between the competing interests of various users.

The traffic management measures that may be useful in the context of Himachal Pradesh are roadside parking management, traffic circulation measures, bus service priority and regulatory measures under the Motor Vehicle Act. To prevent roadside parking of vehicles, it is essential that special parking areas be developed. The basic cause of lack of parking facilities in India is that it is presumed that parking has to be provided at a social cost without any additional charge to the users. However, the biggest limitation with this assumption is that funds are not often available from public resources to provide this facility since no bank loan would be available for a venture with no returns. To facilitate the making of parking areas, it may be appropriate to treat parking space as a normal commodity, such as gas or electricity, and to follow the implications of a commercial or market approach for prices and investment policy. Basic principles enunciated by Roth (1965) on parking space allocation are still relevant:

- That existing parking space in towns should be made available to people with most need of it, and
- That since space in towns is scarce; the demand for it must compete with the demand for other land uses (space should be allocated to car parking only if the car parkers need it more than the other users).

Providing a special priority to bus services in road has twin benefits: it reduces road congestion and helps the poor. It is argued (World Bank 2002) that, at peak loading, a bus can carry 30 times as many passengers as a car, in only three times the road space. As it is used more by the poor, it facilitates travel by the poor.

However, traffic management cannot be seen as a one-shot measure. It needs to be seen as a continuous process. Otherwise the benefits of congestion reduction achieved by any such intervention will be overtaken by the increasing population of vehicles. Emphasis, therefore, has to be on creating a favorable institutional environment that encourages effective operation and development of technical skills to implement new techniques.

12.3 Demand Management:

The economic rationale of demand management is that if the price directly incurred by travellers in making journeys is lower than the full cost of the journey, then some trips will impose a net cost to the community. The full cost of a trip includes personal cost borne by the traveller and the social costs imposed by the traveller on the community in the form of contribution to congestion, the increase in accident potential, and the polluting effects on the environment. The objective of the demand management is to secure the total level of traffic, and its distribution by modes, locations, and times of day that would exist if traffic by each travel mode were to be charged prices equal to its full marginal social cost. With that objective in view all demand management measures aim at increasing the cost of travel, either explicitly through charges like parking fees, congestion charges and fuel prices, or implicitly by limiting traffic through traffic control measures.

Physical restraint measures used in transport management so far have now become ineffective as, with the rising population of vehicles and expansion in the road network, it is becoming increasingly difficult to cope with the rising demand of enforcement agencies. Therefore, the trend internationally now is to use charges on vehicle use in place of police powers. Introduction of charges has a double dividend property: they generate financial resources while controlling traffic. Receipts from an entry tax to the Manali town in Himachal Pradesh prove the point⁴.

12.4 Infrastructure Provision:

It is often argued that, as the townships expand, so should road capacity. Early planning of and reservation of space is thus a necessity. Cities with only 10 to 15 percent of their area devoted to the transport infrastructure cannot support unlimited motorization. Besides, once the township is established it becomes rather difficult to superimpose additional transport infrastructure. Moreover,

where congestion is suppressing demand, as is the case with most towns in Himachal Pradesh, additional roads normally mean additional traffic and hence more congestion. Thus a strategy that combines necessary road capacity adjustment to support city expansion with clear policies on the allocation and use of the road space is likely to reconcile city expansion with livability (World Bank 2002).

Of particular importance in infrastructure provision is the poverty focus. It could be achieved by a two-pronged strategy that focuses infrastructure development in the areas inhabited by the poor and strengthening the modes of transport used by the poor. One of the very common ways of contributing to poverty reduction used in the developing countries is adopting labour intensive methods of road construction and maintenance that generate employment in the rural areas.

12.5 The Transport Sector in Himachal Pradesh:

The Policy Regime

All matters relating to registration of motor vehicles, issuance of permits, fitness certificates, driving licenses and adherence to the pollution norms in India are dealt under the Motor Vehicles Act 1988 and rules made therein. In most of the states, this work is handled by the Transport Departments and State and Regional Transport Authorities set up by the Transport Departments. These authorities are responsible for granting permits and controlling motor vehicles in the state. There has been a drastic change in the way in which the matters relating to granting permits of transport vehicles and their fitness are handled ever since the amended Motor Vehicle Act came into being. The precursor of the present Act (the Motor Vehicle Act, 1939) was based on a total command and control regime with the State Transport Undertakings (STUs) getting a priority over the private sector. With the thorough revision and redrafting of the Motor Vehicle Act in the late eighties and introduction of the Motor Vehicle Act 1988, the entire transport management has undergone a sea change.

The current policy regime can be studied in two parts: legal and institutional framework, and the fiscal policy relating to motor vehicles. The motor vehicle operation in the state is governed by the provisions of the Motor Vehicle Act (the Act) and rules made thereunder. Transport Authorities constituted under the Act decide the grant of permits to commercial vehicles of all kinds. These commercial vehicles are subject to Inspection and Maintenance (IM) checks conducted by the officers of the Transport Department at regular intervals. The enforcement of the provisions of the Act is done by the Transport Department, Police, and the Courts. While the Act lays down norms for maximum pollution emissions, regrettably, the enforcement is totally ineffective in the face of mass violations. Furthermore, the Act makes little contribution to mitigating traffic congestion and improving road safety.

The structure and incidence of taxes and fees that the motor vehicles registered and operating in the state are liable to pay varies with the type of vehicle, cost of vehicle and its area of operation. The major taxes are token tax, passenger tax and the special road tax. *Token tax* is akin to a licence fee that the owners are supposed to pay in lieu of the usage of road by them. The rates of token tax vary with the kind of use the vehicle is likely to be put to. There are two distinct categories

under this kind of tax: personal vehicles and commercial vehicles. The personal vehicles are under a one time taxation regime, that is, they pay tax at the time of registration for a period of 15 years. The commercial vehicles, on the other hand, pay tax on an annual basis. The rates and incidence of tax also vary between these two categories. While the personal vehicles pay tax in a lump sum calculated as a percentage of the price of the vehicle and collected once in 15 years, the commercial vehicles have to pay tax annually charged on per seat basis in case of passenger vehicles and on a lump sum amount based on the gross weight of the vehicle for goods carriers. The rates of the Special Road Tax vary depending upon the nature of the road with users of the national highways paying the highest rates per seat per kilometre and users of the rural roads paying the lowest rates per seat per kilometre.

Like the Special Road tax for the Stage Carriage buses, there is a passenger and goods tax charged from the cabs, tourist buses and the goods carriers. The contract carriages (cabs and buses) pay passenger tax charged on a quarterly basis depending upon the seating capacity of the vehicle. The goods carriages are liable to pay goods tax charged on a lump sum basis at varying rates depending upon the class of vehicle (Light Commercial Vehicle, Medium Goods Vehicle and Heavy Goods Vehicle). In addition, all vehicles pay different fees such as the registration fee, special registration fee, permit fee, inspection fee, license fee and the composite fee. All these fees, except the registration fee, are charged on a lump sum basis irrespective of the cost, size and the mechanical strength of the vehicle.

As any analysis of the Motor Vehicles Taxation policy in the state would reveal, the policy does not reflect any clear-cut strategy for achieving any definite objective or for handling transport externalities. It may be appropriate to say that the state has not used tax as an instrument of control. Instead, it has been used only for generating resources. A few examples of the taxation policy being contrary to the transport policy objectives are seen in the tax structures of personalized vehicles *vis à vis* public service vehicles, and tax rates in different categories of public service vehicles. The personal vehicles are growing rapidly and causing problems of traffic congestion and pollution, however, personal vehicles are still charged a one time tax at nominal rates while commercial vehicles pay taxes annually. Further, with the rates of token tax of personal vehicles being a ratio of the price of the vehicle, vehicles conforming to Euro II norms and having state of the art safety features cost more and hence end up paying more taxes whereas cheaper vehicles using obsolete technology creating more pollution and unsafe travel pay less taxes.

12.6 Areas of Concern:

12.6.1 Vehicle Population and Growth Rates:

The growth rates of vehicle population in the state have been quite phenomenal. From an average growth rate of 2.7 per cent during 1980-85, growth rate of vehicle population increased to 7.8 per cent in 1995-2000. After 1998, the annual growth rates of vehicle population increased substantially to 12 percent due to the availability of easy finance and new models being launched in the market. The vehicle population, as at the end of December 2003, comprised the following:

Table 12.148: Motor Vehicle Population in Himachal Pradesh

Sr.No.	Category of Vehicle	Population	As Percentage to Total
1	Two Wheelers	1,49,286	58
2	Cars and Jeeps	63,249	24
3	Trucks	37,805	14
4	Buses	4,417	2
5	Three Wheelers	2,611	1
6	Others	3,656	1
	Total	2,61,024	100

Source: DOT (2003)

The two wheelers and cars comprise 82% of the total vehicle population. The commercial vehicles are only 25% of the total vehicle population. The motor vehicle population in Himachal Pradesh is thus rising with a higher share of personal vehicles. Within the personal vehicles as well, the share of two wheelers is very high (about 60%). This composition of vehicle population coupled with high growth rates of personal vehicles has caused serious problems with congestion, accidents and pollution. This raises an important issue: in order to ensure good mobility should we encourage the personal vehicles to grow as they are doing now by providing adequate road space and right of way, or should greater use of public transport be encouraged. Though the data on road space utilization and pollution in the state is not available, going by the national averages, public transport utilizes much less road space and causes less pollution than personal transport.

Table 12.149: Vehicle Wise Road Space Utilization and Pollution in India

Type Or Vehicle	Average Passengers per Vehicle	Pollution Load in gm/passenger per Kilometre	Congestion effect in PCU*/passenger
2 Stroke 2 Wheeler Petrol Engine	2	7.13	0.375
4 Stroke 2 Wheeler Petrol Engine	2	4.76	0.375
Car with Catalytic Converter Petrol Engine	4	0.93	0.25
Bus with Diesel Engine	40	1.00	0.075

* PCU = Passenger Car Unit where 1 car = 1PCU, 1 Bus = 2.5 PCU, 1 Scooter =0.75 PCU

Source: MORT (2003): 3

Though cars and buses have the same pollution effect on a per passenger basis, buses have the advantage of occupying far less road space. On the other hand, two wheelers not only have a far more damaging effect on the environment than cars and buses, but are also undesirable from a congestion point of view. Hence, from the table above, buses are clearly the more desirable and

two wheelers are the least. The transport policy has, therefore, to support investments in facilities that would wean people away from the use of personal vehicles rather than build facilities that would encourage greater use of personal motor vehicles. This would also require a tax and fee regime that discourages ownership and use of personal vehicles.

The increased vehicle population is often attributed to two factors. First, with liberalized licensing regime coupled with availability of easy finance, the ability of the middle classes to own a vehicle has improved substantially. Second, lack of a comfortable, reliable and safe public transport system. Frequent and irregular stops for passenger loading and unloading and lack of dedicated bus lanes contribute to serious traffic congestion and increased fuel consumption. These features increase the journey and waiting time and vehicles are often overcrowded, resulting in increased preference for personalized transport.

12.6.2 Transport Sector and the Socio-economic Priorities:

With 30% of its population living below the poverty line (E & S 2003), the equity and welfare aspects of transport management also gain significance in Himachal Pradesh. It is often argued (World Bank 2002) that the transport patterns of the poor people exhibit a complex tradeoff between residential location, travel distance, and travel mode, in an attempt to minimize social exclusion associated with low earning capacity. The World Bank (2002) analyses the role of transport in the concept of exclusion. The income poor make fewer trips, which restricts them to whatever services available at walking distance making them ‘accessibility poor’. As walking consumes time and energy, it makes them ‘time poor’ and ‘energy poor’. As they are more vulnerable to accidents, they are ‘safety poor’ as well. Therefore, transport becomes a merit good⁵ making its minimum supply a social imperative.

However, as concessions are extended to the poorer sections of the society, the public transport managed by the Public Sector Undertakings (PSUs) suffers heavy losses (MORT 2003). These losses are attributed to the fact that, since public transport is mostly used by the poorer sections of the society, it is difficult for the management of these PSUs to increase fares. However, with low fares, it is difficult to recover costs of operation so adding capacity becomes an issue. Hence, first maintenance, then service reliability and finally operating capacity disappear. The worst is that in the process of decline the public subsidy is often captured by organized groups like concessional passengers and government employees. It is, therefore, imperative to keep a balance between business needs and equity considerations. Among the alternatives suggested for overcoming the problem are the introduction of the dual pricing system by offering different services to the poor section and the upper income group; private sector participation in the provision of services; and budgetary funding of the deficits of PSUs.

12.6.3 Road Safety:

Road traffic injuries are a global problem affecting all sectors of society. As the World Health Organization estimates (WHO 2003), in 2000 around 1.26 million people worldwide died as a result of road traffic injuries. Road traffic injuries accounted for 2.2 per cent of global mortality and

were responsible for 25 per cent of all deaths due to injury. Around the world, injuries are among the leading cause of death for people aged 15 to 44, and road traffic injuries are responsible for 25 per cent of all deaths due to injury (WHO 2003). Road traffic injuries also exact a heavy toll in terms of the ill health they cause. The ill health, or morbidity, that results from road traffic injuries also differs widely by region, with South-East Asia accounting for more than one third of the morbidity resulting from road traffic injuries each year.

Public authorities all over the world are concerned about how to take efficient steps towards lower accident rates on the roads as the volume of motorised traffic and the numbers of accidents have been growing significantly. However, interventions have to be socially optimal. In addition to the direct investment in safer roads, the public authorities have the opportunity to improve traffic safety by different kinds of interventions, such as orders and prohibitions given by law or by informational and advertising campaigns. The introduction of compulsory seat belts, speed limits on roads regulations governing the manufacturing and safety of automobiles and driving tests are all examples of public authorities' intervention. Although direct governmental regulations may not be socially preferred means in securing welfare optimal road safety due to moral hazard effects, they are commonly practiced.

As per the information supplied by the Railway and Traffic wing of Himachal Pradesh road accidents are growing at a rate of 12 to 15 per cent per annum, the casualties are growing at the rate of 18 to 20 percent per annum (R&T 2003). There are 11 deaths per 10,000 vehicles in the state (as against 20 in India) which is far higher than 1.2-1.5 per 10,000 vehicles in the developed countries (World Bank 1996). In addition are those suffering serious injuries in road accidents and requiring medical attention. While no estimates of losses due to accidents are available in GDP terms, it is believed that increasingly accidents are causing more damage to the society.

Table 12.150: Road Accidents and Casualties in Himachal Pradesh

Year	Total	Persons Injured	Persons Died
2000	2055	4302	820
2001	3163	5213	960
2002	2459	4171	616
2003	2702	4291	819
2004	2946	4406	769

Source: Railway and Traffic Wing (2003)

Seen in terms of damage caused due to accidents, the intensity of damage in the state is far higher than the national average. As against the average national accident severity index of 10, the state average is 30.

Table 12.151: Accident Severity index

Years	Accidents	Fatalities	ASI*
2000	2055	820	40
2001	3163	960	30
2002	2459	616	25
2003	2702	819	30
2004	2946	769	26

* ASI is Accident Severity Index defined as the number of fatalities per 100 accidents.

Owing to the concentration of traffic on national highways, over 35 per cent of these accidents occur on the national highways followed by 31 percent on the state highways and 34 percent on other rural roads. Going into the causes of accidents makes an interesting reading.

Table 12.152: Causes of Accidents in Himachal Pradesh

Cause	Percentage of total accidents
Fault of the Driver	36
Mechanical Faults	21
Bad road condition	26
Fault of the pedestrian	11
Natural calamity	06

Source: Railway and Traffic Wing (2003)

Fault of the driver, mechanical fault and bad road conditions account for 83 per cent of the total accidents taking place in Himachal Pradesh.

12.6.4 Traffic Congestion:

Traffic congestion is described as the situation that arises when transport networks are loaded with more traffic than its economic capacity (Reddy *et al.* 2000). The level of traffic congestion in urban transport networks is found to vary with the time of day reaching maximum level during peak hours when journeys to working places occur. Besides causing delay and enhanced emissions, congestion is responsible for enhanced out-of-pocket expenses and consequent economic losses. As per a study by Reddy *et al.* (2000), depending upon the vehicle type, the vehicle operating cost was found to vary from 1.2 to 2.8 times with the reduction of speed from 40 kmph to 10 kmph.

The high growth rates of vehicle population in the state are causing serious concern in terms of parking spaces and congestion. As the tourist season touches its peak, the regulatory system often

collapses in most of the tourist towns due to the higher number of vehicles coming from outside. With the parking facilities being insufficient, most of these vehicles are parked on the roads, which further aggravates the problem of traffic management with the road space shrinking due to roadside parking. The problem of traffic congestion reaches its peak during the tourist session. The tourism industry in the state has grown significantly in the 1990s. It is estimated on an average about 0.4 to 0.5 million tourists visit the state every year which is equal to about two-thirds of its population (Batta 2003). Major places of attraction are Kullu-Manali, Shimla, Dharamsala-Palampur and the Dalhousie-Chamba areas. The tourist season in the state lasts for almost nine months in a year during which about 0.2 million vehicles registered elsewhere enter the state. Finding the existing machinery incapable of handling the situation, the High Court of the state has recently set up a high-powered committee for recommending steps to solve the problem of traffic congestion.

Both liberalization and the carrying capacity of our infrastructure especially roads need to be balanced. As per a recent study done by the Transport Department of Himachal Pradesh (DOT 2003), the capacity of the roads to absorb further traffic is limited. The study calculated the frequency of bus services on important National Highways and found that there was a bus service available on the main National Highways every 1.5 minutes during the peak hours ranging between 7 a.m. to 7 p.m. The average road width on National Highways is 2.5 metres which further goes down in towns falling on the National Highway. In addition to the buses plying on such a small gap, there are other kinds of vehicles on the roads like trucks, government vehicles and private vehicles. Since most of the National Highways connect important destinations on the tourist circuits, there is a very heavy influx of vehicles during the tourist season spanning almost nine months per year. Therefore, these roads are fully saturated and have no capacity to absorb any more traffic at all.

12.7 Environmental Concerns of Road Transport:

The major environmental impact related to the motorised transport is from emission of pollutants from vehicle exhausts. It is important to distinguish between local air pollutants, such as carbon monoxide, nitrogen oxides, particles and hydrocarbons, and greenhouse gases, mainly carbon dioxide, nitrous oxide and methane. In most countries like India, the most serious environmental impact is that of air pollution, particularly because of its effects on human health. Pollutant emissions from motor vehicles depend on the type of fuel, the vehicle operating conditions and the intensity of the human health impact from these emissions is a function of the level of exposure. Many people in developing countries, because of lifestyle, economic condition, and occupation, spend large amounts of time in close proximity to road traffic and so are more exposed to harmful emissions. The problem is further aggravated by traffic, which reduces travel speeds and in turn leads to environmental and economic problems because the traffic is congested with a mix of pedestrians and a wide variety of traffic modes. As a result, fuel consumption increases and so vehicle emissions, which further exacerbates air pollution and increases the noise levels do.

Table 12.153: Health and Ecological Effects of Air Pollution

Pollutants	Effects on human health	Effects on natural environment
Carbon monoxide (CO)	Can affect the cardiovascular system, exacerbating cardiovascular disease symptoms, particularly angina: may also particularly affect fetuses, sickle cell anaemics and young children; can affect the central nervous system, impairing physical coordination, vision and judgment, creating nausea and headaches, reducing worker productivity and increasing personal discomfort.	
Nitrogen oxides (NO)	Nitrogen dioxide (NO ₂) can affect the respiratory system: Nitrogen monoxide (NO) and Nitrogen dioxide (NO ₂), where they play a part in photochemical smog formation, may indirectly increase susceptibility to infections, pulmonary diseases, impairment of lung function and eye, nose and throat irritations.	NO and NO ₂ can contribute significantly to acid deposition, damaging aquatic ecosystems and other ecosystems such as forest; NO can also have a fertilizing effect on forests.
Sulphur oxides (SO ₂)	Sulphur dioxide (SO ₂) can affect lung function	Sulphur oxides can contribute significantly to acid deposition impairing aquatic and forest ecosystems. Sulphates can affect the perception of the environment by reducing visibility even at low concentrations.
Suspended Particular Matter (SPM and PM ₁₀)	Fine particular matter may be toxic in itself or may carry toxic (including carcinogenic) trace substances, and can alter the immune system. Fine particulates can penetrate deep into the respiratory system thus irritating lung tissues and causing long-term disorders.	Fine particulates can significantly reduce visibility. High dust and soot levels are associated with a general perception of dirtiness of the environment.
Lead	Can cause brain damage, encephalopathy in children resulting in lower IQ, death, hyperactivity and reduced ability to concentrate.	

Source: Houghton and Hunter (1994)

Among the sectors of the economy that account for CO₂ emissions from energy, prominent are fuel combustion in industry (41 per cent), electricity production (34 per cent) and transport (17 per cent). Within the transport sector, it is estimated that two wheelers and cars contribute to 78 per cent and 11 per cent respectively of vehicular pollution. Three wheelers contribute around 5 per cent, buses 2 per cent and trucks 4 per cent (Patankar 2000). Among the principle factors that

determine vehicular emissions (Reddy 2000) are engine technology, vehicle mass, fuel quality, maintenance and aerodynamic drag. In Himachal Pradesh two factors contribute mainly to the vehicular pollution, namely, a large population of two wheelers and rising a population of diesel vehicles. Apart from their higher population leading to higher emissions (over two third of the total population are two wheelers), most of the Indian two wheelers are intrinsically polluting because of their design because of the short-circuiting of the charge out of exhaust without being burnt in the engine and the lubricating oil being exhausted with the short-circuited charge. In addition, the two stroke engines tend to wear faster than the four-stroke engine and their spark plugs tend to get dirty very frequently leading to further emissions.

Second, the rising population of diesel engines is also a cause of concern. The situation is further complicated due to the fact that the diesel sold in India has a higher sulphur content (Patankar 2000) and as diesel engines emit more black smoke full of suspended particulate matter if the engines are not properly maintained, and often poor maintenance and absence of life span of the vehicle adds fuel to the fire.

On the issue of environmental externalities as well the situation is no better. Owing to its geo-physical features (mountainous area and location on the Himalayas), the ecosystems here are more sensitive to environmental damage (S&T 2000). The State Pollution Control Board has set up monitoring stations at major industrial and tourist towns in the state. As per the latest report (PCB 2003), the ambient air quality in major tourist and industrial towns is deteriorating with SPM, NO and PM₁₀ reaching threshold levels.

12.8 Agenda For Reforms:

Re-orienting Motor Vehicle Taxation:

A closer look at the policy regime in the transport sector in India reveals that there is a clear-cut division of responsibilities between the federal and the state governments. The Motor Vehicles Act (which is uniform all over the country) is in the domain of the Government of India while motor vehicle taxation is a state subject. However, in the current situation do not move in tandem. While the provisions of the Act are framed keeping in view the Government of India's overall strategy on economic reforms, the same is often not reflected in the motor vehicles taxation in the states. The latter are mostly guided by the state's requirements for resource generation. Therefore, the taxation policy may either not reflect the priorities laid down under the Act or may have a tax structure which runs contrary to the overall priorities. For example, while the Act emphasizes on liberalisation and privatization in the transport sector in India, it is not uncommon to find taxation policies in the states which discourage private investment by keeping tax for the private operators much higher than their public sector counterparts. Most states do not offer a level playing field for the private sector and there is no institution such as a regulator in any state in India to ensure a fair competition. Furthermore, even the fare and freight rates in most of the states are fixed by the provincial governments, which for obvious political considerations do not want to charge fares that reflect the true cost of operation. While the public sector companies are able to afford such a fare structure due to financial support available from government budgets, it is difficult for the private

operators to survive. As per a rough estimate (DOT 2003), the problem of default in payments of the financial institutions by the private operators is rising in the state. Besides, while the Act provides for All India Tourist Permits and National permits to encourage trade and tourism between the states and envisages a uniform composite taxation for the whole country, most of the states do not follow that. Instead, they have their own tax structure with very high rates of taxation.

There are contradictions in other areas too. For example, while the Act discourages vehicles with higher pollution emissions, the taxation policy has provisions that run counter to this objective, for instance, charging one time and lower rates of taxes from personal vehicles that cause pollution and congestion, and higher annual taxes from the public transport vehicles. Such a taxation policy therefore promotes more private vehicles at the cost of public transport vehicles. Furthermore, within the tax rates for the public transport services, the incidence of tax is very high among luxury vehicles. While the strategy for reduction of private vehicles should be to encourage luxury vehicles to attract more and more commuters to the public transport, the high rates of taxes on luxury and air conditioned buses (which are 100 to 200 per cent more than the ordinary buses), act as a strong deterrent. Therefore, the taxation policy does little to solve the problem of congestion.

There is, therefore, a need to introduce a taxation policy that caters to the transport policy needs: tackling the problems of congestion, road safety and environmental emissions. It is often argued (Mayeres 2003) that taxes on vehicle ownership are not suited to control congestion since they are not related to vehicle use. Likewise, even the taxes on fuel also do little to control congestion since they do not allow differentiation according to time and place of travel. Moreover, the fuel taxes can be avoided by switching to alternate modes of fuel like LPG and electricity (Parrry and Small 2001). Subsidizing travel in the public sector is also an alternative often recommended in such situations. However, a major limitation with this is that it is not possible to use it beyond a point as subsidizing limitlessly may result in other macro economic problems and distortions. A review of literature in transport economics shows that the problem of congestion could be best attended to by a kind of road pricing. Among the easier alternatives of road prices are pay lanes, area licensing and cordon pricing.

Having a differential taxation policy based on age of the vehicles may prove to be useful from the point of view of road safety as well. To discourage older vehicles the taxes on them should be higher than on new vehicles. Besides, to discourage usage, higher insurance pricing would also reduce excessive use.

12.9 Environmental Externalities:

Air pollution in transport is a typical case of negative externality. From a vehicle owner perspective, the marginal benefits of emitting pollutants into the atmosphere, a public good, are more than the marginal costs that he has to bear. In the absence of any intervention the market failure, the social marginal costs will be higher than the private marginal benefits.

The text book solution to the problem is to impose a tax equal to the difference between the private marginal benefits and the social marginal costs. A polluter exposed to such a tax would then

internalize the costs of pollution and would take steps to reduce emissions. However, in order to levy such a tax the regulator will have to know the exact pollution caused by each vehicle, which may be difficult especially because the source is mobile, and in a large number. Therefore, the second best solution, often recommended in this case, is to impose a tax on the polluting goods such as fuel. Higher fuel prices would reduce vehicle use, reduce vehicle ownership and encourage the design of more fuel-efficient cars. However, it is often argued (Pandey 2000) that such a tax on the polluting goods has two limitations. The first is related to the failure of the tax to stimulate other initiatives that may be far more effective like the technological options. Second, its effect of discouraging the use of the polluting good equally for all the polluters who may have different marginal emission rates.

Eskeland (1994) has shown that in the absence of continuous monitoring of emissions, an effective programme aimed at emission reduction will use a combination of two instruments which induce better technology and reduce vehicle trips. However, which combination is used depends on the elasticity of demand for the polluting good and the relative cost options. In the context of transport, the reduction of emission will be provided mostly by technical changes if the vehicle fleet is old and poorly maintained and fuel quality is inferior. Conversely, if the vehicle fleet is relatively modern and the fuel is of better quality, fuel tax will have a relatively greater role in effecting vehicular emission reduction.

Looking at its impact on pollution reveals that as the token tax is charged on an ad valorem basis, vehicles using better technology and thus emitting fewer pollutants cost more and pay more tax compared to the cheaper vehicles emitting more pollutants. Other examples of a similar kind of policy failure could be seen in two-stroke versus four stroke-engines in two wheelers and Euro II compliant cars versus ordinary cars where the tax rates based on the price of the vehicle act as a strong disincentive for any prospective buyer who would prefer to buy a cheap more polluting vehicle rather than the costly less polluting vehicle.

In the case of environmental externalities, the outcome of taxes may be different. For instance, in this case both fuel tax and ownership tax could play a major role in controlling pollution. Since CO₂ emissions are directly related to fuel consumption, fuel tax can be differentiated according to fuel used and its quality though it can not make any distinction between vehicle type for which a tax on ownership may be essential. Taxes on vehicles can play a role, as they can be differentiated according to vehicle type for example, a public service vehicle or a private vehicle. A tax on ownership is simple to implement and generates revenue for the governments. A study by Fullerton and West (2000) shows that a tax on ownership based on car characteristics such as engine size, vintage and the pollution abatement technology applied, could provide maximum welfare gain.

12.10 Promoting Safe Transport:

Another important externality resulting out of transport use is the impact of the users on accident risks via their level of care reflected in the shape of their driving style and speed and their activity level reflected in the form of number of kilometres travelled. It is argued (Mayeres 2003) that reducing accident externalities rely on the use of liability and compensation rules. The Indian Motor

Vehicle Act makes third party insurance necessary for all vehicles. With risk aversion, insurance comes into play. In the Indian circumstances, the insurance premia are not assessed as per individual risk probabilities and instead provide a free riding facility for relatively risk prone individuals. The premium that one has to pay is not related to the number of kilometres travelled by the insured and the driving habits of the individual. A thorough review of the insurance procedures may be warranted to price the risk appropriately. However, in the absence of differentiated premia, a kilometre tax or road pricing differentiated as per vehicle type could play a major role.

In terms of compensation, it may be interesting to study the provisions of the Act and their implications. Singh (2004) examines the issue in detail in the Indian context. He argues that economic analysis deals with the important question of whether and how much damage payments are to be made by the injurer to the victims. The measure of the damages paid by the injurer can be considered in two respects: it influences the incentive for the injurer to take optimal care, and it determines who should bear the risk of an accident. The efficiency concerns require (Arlen 2000) that the damage compensation should be exactly equal to the harm to force the injurer to take efficient care. The literature on liability rule shows (Jain and Singh 2002) that when both parties can affect the chances of accident, the rule of negligence with the defence of contributory negligence, and the rule of strict liability with defence of contributory negligence are efficient. In the Indian context Singh (2004) evaluates the working of the law of tort in the motor vehicles context and concludes that it suffers from two types of inefficiency. First, in many cases, due to court errors, the liability payments are restricted to an amount less than the actual harm making the injurer not take efficient care. Second, uncertainties in the assessment of damage reduce chances of out of court settlement and increase litigation.

In addition, road users also cause damage to the roads, which in turn becomes a cause of accident for other users. Therefore, a tax on the damage caused could also be useful in controlling road accidents while at the same time providing a resource base to repair the damage. In this case, the road damage is a function of the vehicle weight. The latter depends on the weight per axle. Introduction of a kilometre charge that is a function of the number of axle loads of a heavy vehicle could be an efficient alternative for tackling such a situation.

12.11 Alternative Technologies:

With the ever depleting supplies of crude oil and rising prices, it is increasingly felt that alternative modes of transport and alternative sources of fuel for transport-related usage needs to be found out. In addition, energy efficient modes of transport like electric trolley; buses and battery-operated vehicles would present a radically different direction in the years to come. A shift from personalized transport to public transport would also ease the problems of energy consumption, emissions, congestion, and road safety.

It has been advocated that the development of new communication technologies, such as telecommuting, tele-shopping and videoconferencing may limit vehicle use. Concerns include the fact that the available time made possible by such technologies can be used for other (non-business)

trips and that activities such as videoconferencing may generate additional travel as a complementary activity. The experience of the telephone as a substitute to the mail system constitutes a precedent.

Introduction of mixed traffic modes is yet another factor that could play a major role in reducing emission and improving public safety. Non-motorised vehicles (NMVs), such as bicycles, cycle rickshaws and carts, play an important role in urban transport in many Asian cities accounting for 23 to 30 per cent of vehicle trips in these cities (Patankar 2000). Though the ownership of such vehicles is growing in India along with the other vehicles, however, these face a serious threat of being crowded out of the roads due to the rising numbers of the motorized vehicles. It is often argued that modernization should not be confused with mechanization. The transport planning should invariably include walking and cycling. This integration can be achieved by providing extensive cycle tracks, bicycle parking at important places like market areas, railway stations and educational institutions.

12.12 Integration of Transport in Town and Country Planning:

Effective transport planning has to begin at the time of planning of a town or a facility. The sustainability of the urban transport system must be considered a critical part of the sustainability of the total urban system. Very often towns, market complexes, and industrial areas are planned without taking into consideration the transport requirements. As a result not enough provisions are made for parking. Many have observed that traffic may eventually expand to fill the road space available. Moreover, new developments around the new roads would cause an increase in the vehicle fleet and in the level of car use. Another way of tackling the problem is by spatially locating trips destinations in a way that optimizes road use. The historical configuration of many urban areas limits the scope of this solution. Moreover, land use and transport are linked by very complex relationships. In general, these constitute longer-term solutions and are characterized by a high level of inflexibility. The modification of the natural landscape could be irreversible and the cost of environmental degradation should be taken into account. To protect the built-up and natural environments, the plan should help reduce car traffic by making public transport an attractive option. Achieving such integration will require coordinated planning of services and facilities; pricing and investment regimes that reflect the full costs and benefits of the various transport modes and the close linkage of transport with economic, environmental and social policy initiatives.

Conclusion:

It can be concluded from the discussions above that there is a strong interface between road development and transport development in an economy. Roads are a necessary infrastructure for development of transportation facility which in turn is important for the growth of an economy. Inadequacy of road infrastructure often results in problems of congestion, pollution and road accidents, besides being anti-poor. A strategy for roads must therefore encompass traffic management and demand management as well as provision for maintenance of road infrastructure. In a nutshell, the strategy has, therefore, to include planning and reservation of space for transportation infrastructure, introduce sound maintenance management systems which are supported by sustainable flow of resources, appropriate traffic management systems and the demand

management systems which are based on full cost realization. Creation of an agency to coordinate and oversee the working of the system may also be extremely useful.

Providing transport services to meet future needs without causing serious damage to the environment is a major challenge. A sustainable future transportation system will comprise a mixture of many measures. Introduction of combinations of measures, impacting on the demand and supply of transport services, requires appropriate planning techniques which can take account of a wide range of transport, energy and environmental issues and options. The ultimate goal of a transport policy should be to use road space efficiently, a common resource facing the proverbial ‘tragedy’ of over use, and allow users to take into account the true cost of their decisions, so as to lead to higher social welfare. The equity implication of such a policy can be a powerful tool for poverty alleviation.

It may be appropriate to sum up the discussions on transport externalities in terms of the Pressure, State and Response model (PSR Model). Table 12.154 presents status in terms of PSR model.

Table 12.154: Transport Externalities in terms of PSIR Model

Pressure	State	Response
Rising population, urban expansion, increased human settlements, increased economic activity, demand for leisure travel,	Increased demand for transportation services, overloading, inadequacy of bus services,	Development of Road infrastructure, Transport Planning, integrating transport concerns in town and country planning.
Growth in vehicle ownership due to increased per capita incomes	Congestion, shortage of parking places, increased travel cost and travel time,	Congestion pricing, parking charges, and introduction of vehicle ownership taxes,
Congestion led increased journey time coupled with more vehicles on road and increased mileage covered	Environmental pollution in terms of higher gas emissions, idle running during congestion,	Incentives for environment friendly fuel use, promoting better technology vehicles, taxes based on environmental characteristics, scrap page programmes to phase out old technology vehicles
Increased vehicular population leading to inadequate road space	Road accidents, increased mortality and morbidity,	Incentives for vehicles with more safety features, changes in insurance pricing to load the cost of accidents on the defaulters,
Poverty and income inequalities leading to increased demand for public transport,	Increased pressure on public transport, concession based fare structure leading to increased losses among Public Sector Transport Undertakings,	Planning mass rapid transport systems, cross subsidization for shifting the burdens, integrating transport concerns in town and country planning.

The above table clearly establishes the cause and effect relationship and identifies the policy initiative required to remedy the situation. This framework could also be used as an indicator framework that could help in analysing the outcome of a development, for instance, the urban expansion, and

assist in taking appropriate policy initiatives. In this paper, an attempt has been made to identify the basic elements needed to analyse transport problems. However, implementing the different interventions requires political will, public support and commitment. It is often argued (Winston 2000) that a major problem with the transport policy is that it is shaped by political forces that inhibit constructive change. Therefore, a commonly recommended solution to the problem is to expose the system to market forces by privatizing it. Given the wide variety of measures and technical possibilities, combined with the growing seriousness of excessive fuel consumption, congestion and environmental impact; this challenge can be overcome. It will, however, require institutional reform so as to incorporate integrated planning methods and coordinated implementation, development of suitably skilled manpower and access to substantial financial resources.

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Notes

- ¹ An **externality** occurs when a decision (for example, to pollute the atmosphere) causes costs or benefits to individuals or groups other than the person making the decision. In other words, the decision-maker does not bear all the costs or reap all the gains from his action. As a result, in a competitive market too much or too little of the goodness will be consumed from the point of view of society. If the world around the person making the decision benefits more than he does (education, safety), then the good will be underconsumed by individual decision makers; if the costs to the world exceed the costs to the individual making the choice (pollution, crime) then the good will be overconsumed from society's point of view.
- ² **Market failure** is a situation in which markets do not organize production efficiently or allocate goods and services to consumers. To economists, the term would normally be applied to situations where the inefficiency is particularly dramatic, so that non-market institutions provide a more desirable result. On the other hand, to many, market failures are situations where market forces do not serve the perceived "public interest".
- ³ The philosophy of **second-generation road funds** is that road infrastructure should be maintained with funds collected from users.
- ⁴ An entry fee was introduced in the month of June 2004 as a result of an order passed by the High court of Himachal Pradesh. It is expected that the fee will generate annual revenue of Rs. 4 Crores. The money will be utilized for the development of infrastructural facilities in Manali town. Such a measure imposes cost on the vehicle user for use of facilities in the town.
- ⁵ **Merit good** is a commodity the consumption of which is socially desirable, for instance, third party insurance in case of a motor vehicle.

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WATER RESOURCES AND ENVIRONMENT

Water Resources and Environment

13.1 State:

13.1.1 General Framework of National Water Policy:

Rural water supplies in India have been a private initiative from time immemorial and formed an important component of the ruler's duty towards his subjects. The Environment Hygiene Committee (1948-49) recommended a plan of action to provide water supplies and sanitation facilities to 90 percent of the population of the country. This culminated in the National Water Supply and Sanitation Programme in 1954. Over the last five decades, there has been a significant growth in percentage allocation of funds to the rural water supply and sanitation sector especially in comparison with the outlay on urban water supply and sanitation over the same period of time.

As per the national norms the basic water requirement is 40 litres per capita per day (Lt./d). One hand pump or stand post is installed for 250 persons. Such water sources are supposed to be located at a maximum distance of 1.6 kms in plain and 100 metres elevation difference in hills. In deserts areas, an additional 30 lpcd was recommended for the use of livestock.

13.1.2 National Water Policy:

In 1987, the Ministry of Water Resources prepared a National Water Policy to provide the directions for the development of water resource throughout the country. The salient features of this policy are –

- Accord highest priority to domestic water supply
- Protection of ground resources by designing appropriate standards
- Monitoring of water quality
- Mapping of water resources

The states have been recommended to formulate their State Water Policies, in conformity with the National policy. In Himachal Pradesh the IPH department has prepared a draft state water policy. In the policy major emphasis has been given to the adaptation of an integrated approach for the development of water resources. As per the estimate the domestic water supply (rural and urban together) demands are below 5 percent of the total consumption, the majority being accounted for by irrigation.

13.1.3 Non-Government Organization:

A large number of NGOs formed the National Association for Water Resource Development Agencies (NAWDA) to intervene in the sector. Positive features with NGOs have been their

ability to penetrate remote areas, negotiate more favourable drilling prices (because they are not encumbered by government procedures), select sites without succumbing to local pressures, mobilize users and raise contributions. On the negative side, most NGOs have been small time contractors with no interest in working with people and have little technical or management capacity. Therefore, NGOs involvements have to be made with circumstances and based on their capabilities.

13.1.4 Private Sector:

This role can be enlarged if reforms are implemented to make this service of commercialized demand-oriented service in which service levels are tailored to community demands backed by willingness to pay. At present the private sector merely provide the services as contractors.

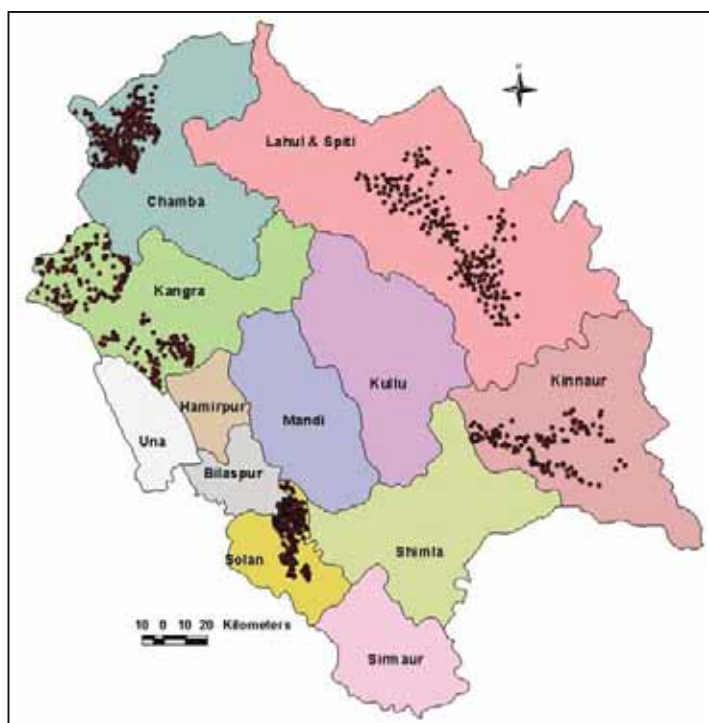
13.1.5 Institutional Arrangement after 73rd Constitutional Amendment:

In the wake of the 73rd amendment act (1992), 29 subjects were added to the jurisdiction of panchayat including responsibility for drinking water, minor irrigation, water management and watershed development. Responsibility for large or regional piped water supply schemes is likely to remain with block or district administration. Possible politicization and bureaucratization of the panchayat bodies leading to strengthening of vested interest in rural areas are a key worry that still concerns the decentralization of responsibilities to PRIs.

13.1.6 Rural Water Supply in H.P.

H.P. has a total of 16997 inhabited villages and 45367 habitations. All villages in HP have been covered under water supply schemes. A revenue village generally covers more than one habitation. In hilly terrains, small habitations have grown near cultivable lands, edges or inside forests. Most of the RWSS were constructed in 1980, under Drinking Water Decade related programmes. All villages were covered by 1994. Out of the total 45367 habitations reported in April 1996, 4590 habitations were classified as not covered, 14047 habitations were partially covered and rest fully covered. Despite efforts to cover all the villages under RWS the actual water availability situation is a matter of concern in the state. Much of the water shortage occurs in the Shivaik belt (comprising Sirmour, Hamirpur, Una, Kangra and Bilaspur). Nearly two-thirds of the partially covered habitations are situated in the districts of Kangra, Shimla and Hamirpur with a considerable proportion of area lying in the Shivaliks. General features of these dry areas are very thin soil cover, steep slope and high runoff with little water retention at catchment level. Most of the partially covered habitations are located in Kangra followed by Hamirpur. With high livestock density (varies from 121 to 315 per km²) the 40lpcd norm is not sufficient to meet domestic needs. In some Shivalik areas, during summer there is high water crisis, some inhabitants migrate to the nearest valley water source, where water is available for their an acute livestock.

At present there are 7989 water supply schemes in H.P.; out of these 1496 are lift water supply schemes, 91 are tubewell schemes and 6402 are gravity schemes. In addition to this there are 14230 hand pumps installed in the state up to May 2006.



Map 1.21. Water Supply Schemes
 [Source: Water Resources Management of H.P.]

13.1.7 H.P. State Subsidy for Rural Water Supply:

Apart from the full capital cost investment by the state, the government of H.P. bears more than 90% of the O & M cost of rural water supply scheme. For gravity systems the O&M cost is negligible but costs escalate to Rs.6/- per kilolitre in case of lift water supply schemes in which power alone may account for 90 percent of cost. Public taps are totally subsidized. The IPH department used to charge only Rs.5/- per private tap per month and Rs.3/- for additional tap in rural areas which has been now been changed to a flat rate of Rs.10/- per household. Private connection accounts for less than 5 percent of the total water supply schemes (Partial) Connections. Net recovery of O & M cost is only a small fraction of operating costs.

13.1.8 Resource Situation in Himachal Pradesh:

Himachal Pradesh can be divided into four zones, based on physiography and agro-climatic factors.

Zone – I Subtropical Low-Hill Shivalik Zone

This terrain is rugged with low mountains. Rainfall is between 800 to 1600 mm. The areas suffer from perpetual summer shortage due to high runoff. Valleys are generally narrow with few small flat areas where good agriculture is possible. Most of the streams are situated within narrow gorges and the terrain shows signs of rapid uplift in the recent past. The altitude ranges between 500 m and 1200 m msl.



Map 1.22. Drainage Map
 [Source: Water Resources Management of H.P.]

Zone – II : Mid hill Zone

The lesser Himalayas south westren of the Dhauladhar range and valley areas of the Ravi and Chenab rivers form this zone. It occupy 32 percent of the geographical area and 53 percent of the cultivated area of the state. Altitude ranges between 800 and 1600 m amsl. The average annual rainfall is about 1800 mm.

Zone – III: Dry hill Zone

The upper parts of the catchment of the zone II can be classified as Zone III. This zone occupies 25 percent of the geographical area and 11 percent of the cultivated area of the state. Altitude ranges between 1600 and 2700 amsl. The annual rainfall ranges between 1000 and 1500 mm.

Zone – IV: Cold hill Zone

The trans himalayan zone lying between Great Himalayas and Zaskar Ranges is a cold desert. Altitude is generally above 2700 m. Due to rain shadow of great Himalayas, the annual rainfall is less than 200 mm. This zone occupies 8 per cent of the geographical area and 3 percent of the cultivated area of the state.

13.1.9 Habitation and Local Water Sources:

Most settlements are traditionally located around local water sources like springs and streams. However, considerable variation in settlement locations is found across all kind of physiographic situations like slopes, ridges and valleys. Depending on water availability, habitations in the regions can be broadly categorized as under-

- Habitation in snow fed river valley with year round water availability
- River valley settlements fed by monsoon runoff and spring flow
- Spring fed valley slope settlements
- Ridge and upper slope settlements
- Settlements in gently undulating plateaux
- Scattered Shivalik ridge villages

Springs are common in the lower slopes but yields are very low (<5lps) except in some limestone terrains. Ground water conditions are highly variable due to high lateral inhomogenities in soil cover, lithology and vegetative cover. Ground water resources can be used at most only in alluvium filled valleys.

13.1.10 Traditional Technologies:

Main traditional water sources are springs. Often the quality degradation has occurred due to non-use and flow of dirty water into sources. Khattris (underground tanks which store rainwater harvested from uphill areas) are very common in many parts of the Shivaliks especially in districts Hamirpur and Kangra. These need highly impermeable rock (generally cemented conglomerates) and a sloping area where they can be dug. They range in volume from 10 to 50 Cumec. Wells are found in valley and plateau areas. The circular part of a well is the deepest and a series of steps leads into it. People have to walk down to the water and collect it. These small shallow sources (less than 8 m below ground level) can be converted into an underground chamber and fitted with a hand pump to avoid source contamination and so meet the demand of small settlements.



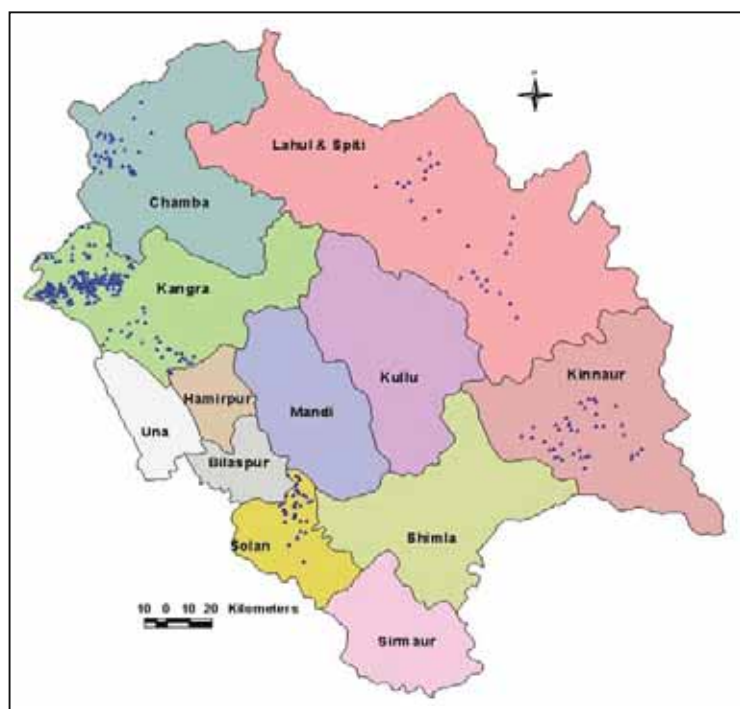
Bhagsu Nag

Many households, however, do not feel the necessity of a piped supply as they have adequate storage in their Khattris and are also of the view that piped water has the taste of chlorine.

13.1.11 Water Supply Arrangement in HP:

Main sources of rural water supply are streams and perennial springs. Three typical sources used for RWS are-

- Spring and perennial nala (drains) for gravity feed schemes
- Tube wells and hand pumps
- Perennial or seasonal stream with sub surface flow in summers.



Map 1.23. Irrigation Schemes in H.P. (Partial)
 [Source: Water Resources Management of H.P.]

Pumping systems and long pipelines have been installed to cater to the needs of hill slopes and ridge top habitations. Gravity fed schemes are still common (Palampur, Kullu, Lahaul & Spiti and Chamba) and constitute 50 percent of the schemes across the State. Tubewells are a good source of water in riverbed areas (Una, Nurpur, Nalagarh) with thick alluvial cover. Hill hand pumps are also being installed in easily accessible areas. Springs are the only other source of water supply but generally have insufficient yield and are contaminated.

13.1.12 Ground Water Resources:

The State has a total replenishable groundwater reserve of 0.0366 hectare metres (ha m) per

Table 13.155: Completed Irrigation Schemes

District	Circle	Division	Medium	FIS	LIS	Tubewell	Total
Chamba	Chamba	Chamba		59	1		60
		Dalhousie		59	9		68
		Salooni		33	4		37
		Total		151	14		165
Kangra	Dharamsala	Dharamsala		2	6		8
		Palampur		25	13		38
		Thural		3	14		14
		Shahpur			12		12
	Nurpur	Nurpur		2	17	29	46
		Indora			11	58	69
		Dehra		3	24		27

District	Circle	Division	Medium	FIS	LIS	Tubewell	Total
		Jawali			7	71	78
		Total		35	102	158	295
Una	Una	Una Div. No.I	2		25	98	125
		Una Div. No.II			34	120	154
		Total	2	0	59	218	279
Hamirpur	Hamirpur	Hamirpur		6	33		39
		Barsar		2	21		23
		Total	0	8	54	0	62
Bilaspur	Hamirpur	Bilaspur		14	12		26
		Ghumarwin		3	41		44
		Total	0	17	53	0	70
Mandi	Sundernagar	Mandi		21	13	0	34
		Sarkaghat		57	13	1	71
		Sundernagar		32	10	15	57
		Karsog		22			22
		Paddar		44	9	0	53
		Baggi	1	11	26	0	38
		Total	1	187	71	16	275
Kullu	Kullu	Anni		11	3		14
		Kullu Div.No.I		12	1		13
		Kullu Div No.II		8	11		19
		Total	0	31	15	0	46
Lahual Spiti	Kullu Reckong Peo	Keylong		37	1		38
		Kaza		73	2		75
		Total	0	110	3	0	113
Shimla	Shimla-9	Suni		11	4		15
		Shimla Div.No I		40	16		56
	Rohroo	Rohroo		25	3		28
		Jubbal		24	2		26
		Nerwa		30	1		31
	Reckong Peo	Rampur		21	0		21
	WS&S	Shimla Div					
	Shimla-3	No. II					
		Total	0	151	26	0	177
Solan	Shimla-9	Arki		44	9		53
		Nalagarh		12	29	74	115
	Nahan	Solan		16	17		33
		Total	0	72	55	74	201
Sirmour	Nahan	Nahan		60	35		95
		Paonta	1	47	20	15	83
		Total	1	107	55	15	178
Kinnaur	Reckong Peo	Pooh		29			29
		Reckong Peo		38			38
		Total	0	67			67
		State Total	4	936	507	481	1928

year and a net draft of 0.0053 ha m per year. In an effort to provide safe drinking water, a total of 5418 hand pumps has been installed in the State.

Table 13.156: District-wise Water Sources

District	Ground water	Surface water	Rain water	Traditional source	Other conventional sources
Bilaspur	827	786	0	461	0
Chamba	1717	2433	3	2598	836
Hamirpur	1057	485	0	231	1
Kangra	1602	1317	11	1369	466
Kullu	0	3392	0	0	0
Lahaul & Spiti	1	290	0	57	0
Mandi	833	3924	0	1483	840
Shimla	233	3917	5	2518	9
Sirmour	644	2249	0	535	9
Solan	344	1090	0	1215	316
Una	832	123	1	21	116
Himachal Pradesh	8186	20,223	20	10,512	2595

Table 13.157: Ground Water Availability

1.	Total replenishable ground water sources	0.03660 ha m yr.
2.	Provision for domestic, industrial and other areas:	0.00731 ha m yr.
3.	Available groundwater resources for irrigation in net terms	0.02929 ha m yr.
4.	Balance groundwater resources for future use in net terms	0.02399 ha m yr.
5.	Level of groundwater development	18.1%

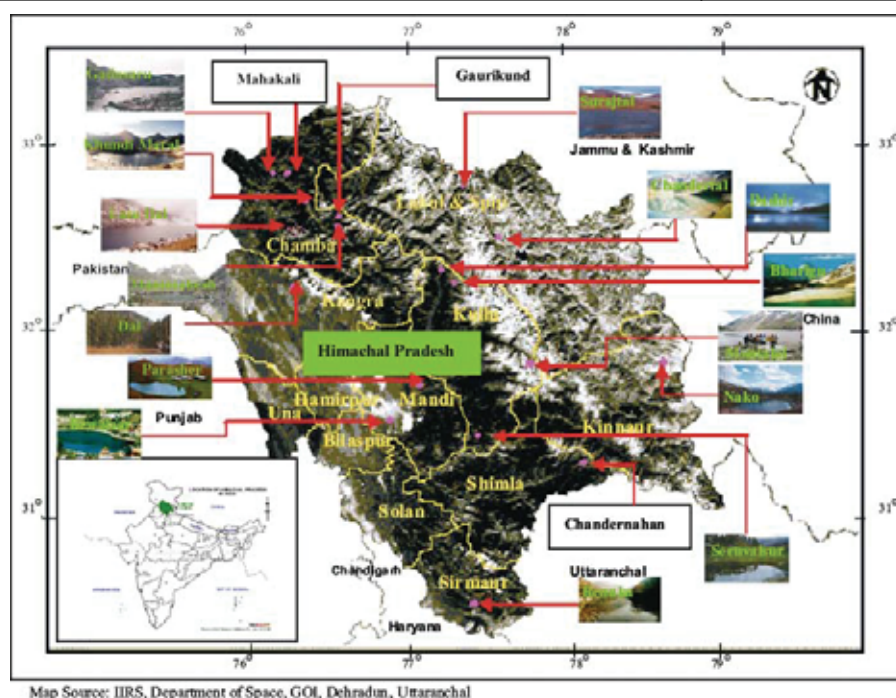


Fig. 1.29 Location of Sacred Lakes in Himachal Himalayas

13.2 Lakes of Himachal Pradesh:

The State of Himachal Pradesh is dotted with dozens of large and small lakes on high mountain tops. Natural lakes are spread over an altitude range of 450 to 5093 metre and cover tropical, sub tropical, temperate and alpine regions of the state. The majority of lakes are part of the culture ethos of the local inhabitants and religious sanctity is given to them.

Some of these may date back million of years and are held sacred and are the venue of many religious fairs. The Streams of pure snowmelt feed these lakes or by ground water springs and some of these are sources of the rivers. The crystal clear water of these lakes reflects the glorious scenery of the Himachal' varied landscape. Several of these lakes also home to a variety of resident and migratory birds.

Table 13.158: Location of Lakes in Himachal Pradesh

Sr. No	Name of Lakes	District	Sheet No.	Quadrant No.	Longitude (E)	Latitude (N)	Altitude (Meters)	Area (hectare)
1	Bhrigu	Kullu	52H/3	C ₃	77°14' 41"	32°17' 37"	4240	3
2	Dashair	Kullu	52H/3	C ₂	77°13' 28"	32°22' 24"	4200	4
3	Mantalai	Kullu	53E/13	A ₂	77°47' 08"	31°51' 44"	4160	3
4	Seruvalsar	Kullu	53E/6	B ₃	77°23' 07"	31°32' 16"	3301	0.5
5	Prashar	Mandi	53E/1	B ₃	77°06' 05"	31°45' 18"	2600	1
6	Rewalsar	Mandi	53A/14	B ₂	76°50' 03"	31°38' 03"	1320	3
7	Nako	Kinnaur	53J/9	B ₂	78°37' 01"	31°52' 01"	3604	1
8	Chandertal	Lahul-Spiti	52H/11	B ₁	77°37' 00"	32°28' 52"	4280	49
9	Surajtal	Lahul-Spiti	52H/5	B ₃	77°23' 53"	32°45' 47"	4800	3
10	Chandernauan	Shimla	53 I/3	B ₂	78°06' 08"	31°22' 38"	3960	1
11	Dal	Kangra	52D/8	A ₁	76°18' 42"	32°14' 50"	1840	2
12	Kareri	Kangra	52D/7	A ₃	76°16' 33"	32°19' 26"	2960	3.5
13	Pong Dam	Kangra	53A/1	A ₁	76°03' 33"	31°58' 57"	430	21712
14	ManiMahesh	Chamba	52D/11	B ₂	76°38' 12"	32°23' 42"	4200	2
15	GauriKund Lake	Chamba	52D/11	B ₂	76°38' 14"	32°24' 06"	4000	0.5
16	Khajjiar	Chamba	52D/2	A ₃	76°03' 32"	32°32' 47"	1920	5
17	Lam Dal Lake (Combination of 8 lakes) Lakes located in B2 and B3 are known as <i>Nag Dal or Nag Chattri Dal</i>	Chamba	52D/ 7	A ₂	76°18' 03"	32°20' 58"	3640	5
				A ₂	76°18' 44"	32°20' 47"	3880	13
				A ₂	76°19' 48"	32°20' 19"	4080	3
				B ₂	76°20' 19"	32°20' 01"	4120	3
				B ₃	76°21' 43"	32°19' 44"	4120	2
				B ₂	76°20' 50"	32°20' 29"	4080	4
				B ₂	76°21' 33"	32°20' 34"	3920	1
				B ₂	76°21' 37"	32°20' 10"	4160	1
18	Gadasaru	Chamba	52D/1	C ₁	76°14' 31"	32°58' 58"	4280	1
19	Mahakali	Chamba	52D/5	A ₁	76°15' 35"	32°58' 39"	4355	2
20	Khundi Maral	Chamba	52D/6	B ₂	76°24' 20"	32°37' 16"	3750	3
21	Renuka	Sirmaur	53F/6	C ₂	77°27' 30"	30°36' 38"	660	15

Source: Topo sheets (Scale 1:50,000) Survey of India, Govt. of India, Dehradun and area has been calculated from toposheet.

Though there are more than 27 natural lakes (wetlands), yet 20 of these lakes identified being as tabulated held sacred by the people and are spread over 8 districts of Himachal Pradesh and Pong Dam is the largest manmade lake in Himachal Pradesh.

Location and Description of Lakes:

i) Bhrigu Rishi Lake:

Bhrigu lake is located at an altitude of 4240 metre above *msl* in Kullu district towards the east of Rohtang pass, 6 Kilometre from Gulaba village. The depth of the lake is 3 metre as reported and is a clear water and there is no human habitation nearby. It is faith among peoples that 'Deotas' or 'Deities' take bath here once in a year and a holy bath of 20th *Bhado* is organized here. The name Bhrigu of it is attributed to sage 'Bhrigu', who was a great seer and astrologer and in Hindu mythology the father of Venus known as Shukra. The shores of this clear water lake devoid of human habitation - it is visited by people regularly.

(**msl* mean sea level)



Bhrigu Rishi Lake, Kullu

ii) Dashair Lake:

Dashair lake is located on the connecting district Kullu and Lahul & Spiti, at an altitude of about 4200 metres above *msl* at a distance of 3 kilometres near Manali. It is also known as 'Dashaur' and Sarkund. It has depth of 3 metres and held sacred. It is believed that all the diseases of skin is cured if one takes bath in the lake during mid August and September and hence people visit to take holy bath generally during festive season.



Dashair Lake, Kullu

iii) Mantalai Lake:

Mantalai lake is located at the height of 4160 meter above *msl* at the base of Pin Parvati glaciers and is a source of the Parvati river, a tributary of the river Beas. It has an area of 3 hectares and is visited by both tourists, trekkers & religious pilgrims while passing through *Khiringanga*. It involves a six days trek to reach



Mantalai Lake, Kullu

from Mani karan to *Mantalai* via *Khirganga*. From *Khir Ganga* one needs to cross Tunda Bhuj, Thakur Kuna. On third day one has to stay either at the confluence of Dibi or Parvati Rivers. The trek route from Manikaran (accessible by road) and Barshaini is about 14 kms on the reverse journey. This lake has the importance of religious sacredness. At *Manikaran*, there are also hot water springs. Manikaran also have Gurudwara but Manikaran, Khirganga and Mantalai are associated with the legends of Lord Shiva and Parvati. Manikaran means jewel (mani) from the ear (karan). A local legend describes that the Parvati while bathing lost a mani from her earrings. Fearing the wrath of the Lord Shiva- her consort-the serpent god, Sheshnag, angrily blew in back from underground and the hot springs spewed forth and the place came to be known as Manikaran. The place is sacred to Hindus and Sikhs. Another important Gurudwara at Manikaran commemorates the visit by Guru Nanak, the first Sikh Guru, who meditated here.

iv) Seruvalsar Lake:

It is located at the height of 3300 metre above msl, 20 Kilometer from Banjar town towards Ani in district Kullu. It is a clear lake surrounded by mixed forest of *Q. incana*, *Q. latifolia*, *P. Wallichiana*, *roxburghi* and *C. deodara*. It is spread over one kilometre circumference. It is a belief among people that if a person takes a round by the lake and side by side pour “ghee” around it, ones all desires are fulfilled. It is associated with a local goddess namely ‘old nagin’ by local people. ‘Saruval’ is actually “Saraal” which means ‘a big python or serpent’. ‘Old nagin was also ‘Saraal’ and so this lake is named after ‘old nagin.’ It has been observed that sparrows (*Ambhi species*), which are found in the area pick up the fallen leaves from the surface water of the lake instantaneously when leaves fall, and help in keeping the wonderful lake clean. This lake has the importance of local deities’ sacredness.



Seruvalsar Lake, Kullu

v) Prashar Lake:

Prashar lake is also located in Mandi district about 40 Kilometre from Mandi town. The lake is located at an altitude of 2600 metre and is held sacred to the sage Prashar. Parashar has a picturesque lake and an ancient wooden temple in Pahari style of architecture. There is a circular lake with crystal clear water with greenish hue. The water turns muddy during the rainy seasons. Also according to the elders of the place the water has been made muddy after an attempt to make use of the lake for rearing fish. Once there was a floating island which has now permanently stuck at its eastern end and is not moving. Basically due to the presence of this natural lake



Prashar Lake, Mandi

the place had attracted in bygone days to be selected for construction of a wooden temple. Prashar is the principal presiding deity of all the village gods and goddesses of the paraganas of Sanor, Badar and Uttersal. In the larger context of Indian thought and belief, Parashar is supposed to be the grandfather of Ved Vyas.

This beautiful alpine pastureland with evergreen meadows remains silent, calm and aloof throughout the year but for the occasional fairs when hundreds of village folk flock together to the place along with their village godlings. One of the fairs, the principal one, is held on and around 15th June every year and is known as Saranahanli, the bathing ceremony of God in the lake. The fair tends to make the still air of Parashar saturated with melody of folk songs and night long dances with all its spontaneity and simplicity with prolonged pauses of the playing of musical instruments which lends an aura of unique charm and fascination to the beholders.

vi) Rewalsar Lake:

Rewalsar Lake is located in Mandi district at a distance of 24 kilometre from Mandi town at 1320 metre above msl. Hindus, Sikhs and Buddhists hold the place sacred and there are three temples, a Gurudwara and a Buddhist monastery at Rewalsar. Hindus believe Rewalsar is supposed to have originated when Arjun struck an arrow to sprout water to quench mother Kunti's thirst during Mahabharata time. The lake is sacred to the Hindus, and the Sikhs for various religious reasons. Rewalsar is also known as '*Padmacan*' to the Buddhist which means '*Lotus possessing*' and is considered the place where the spirit of Padmasambhava rests. Rewalsar lake is also associated with the Nag cult or serpent worshipping.



Rewalsar Lake, Mandi

vii) Nako Lake:

Nako Lake is situated on the western declivity of the large mountain of Reo Purgyal about 1.6 kilometre above the left bank of the Spiti river at an altitude of 3604 metre in District Kinnaur. The village of Nako in Kinnaur is located near a emerald lake.

Nako, the awesome magnificence of Reo Purgyal, marked on the map simply as point 6816 m, is revered on both sides of the Indo Chinese (Tibetan) border as the abode of the god Purgyal.



Nako Lake, Kinnaur

It is situated in village Nako, township Yangthang, near Maling nala on Ambala- Kaurik Highway, 350 km from Shimla Pooh sub-division in the last corner at the end of the Kinnaur.

viii) Chandertal:

Chander Tal lake is 4280 metre above msl and it is 13 km from Kunzam Pass that connects Spiti and Lahaul. Surrounded by snows and acres of scree, this deep blue-water lake has a circumference of 2.5 km. This is the source of the river Chandra. In Lahaul and Spiti, Chandertal is revered and so is the river Chandrabhaga. According to a story Chandra, the daughter of Moon and 'Bhaga', the son of the god fell in love. But the Gods were ill disposed towards their union so the lovers decided to flee and descend to the earth. 'Chandra' landed at Chandratal and Bhaga landed in a gorge called 'Baralacha', and started running as a river. Later, Chandra too started from Chandertal to meet her lover. They met at place called Tandi and merged in each other, to become Chandrabhaga river. These and many other culture manipulations of natural phenomena provide as animistic view of life and give devotional meaning to ordinary abstract notions. The various stories and rituals, and the deep faith of the people have in them mirrored a fundamental set of values that are deep rooted and basic to human nature.



Chandertal Lake, Lahaul & Spiti

ix) Surajtal Lake:

Suraj Tal lake is 4800 m above msl and below the summit of the Baralacha Pass in the Lahaul division of district Lahaul and Spiti; it is located between rocks below the summit of Baralacha pass on Manali Leh road, 250 km from Manali. It is a centre of tourist attraction with its beautiful location especially during the summer season. It is a main source of water for Bhaga and Chandra. Tandi is a confluence of Chandra and Bhaga and later known as Chanderbhagas, which is known as Chenab on the border of Jammu and Kashmir. The Baralacha connects Manali and Lahaul to Ladakh, and the lake, i.e. Surajtal, which draws a considerable number of visitors - especially in the summer - lies at its head.



Surajtal Lake, Lahaul & Spiti

x) Chandra Naun Lake:

This is a glacial lake at 3960 m above msl at Chansel range, in the main Himalayas to the north-west of Rohru in Himachal Pradesh in Shimla district. It lies at the origin of the Pabar river which

is a tributary of the Tons river emerging in Yamuna river. The Chandra Naun Lake lies in a depression formed by the glacier that feeds the Pabar river.

High snow clad peaks surround this lake. It is fed by snowmelt waters. Alpine meadows grow on the banks of this lake in summer. Its water is crystal clear and unpolluted.

Chander Naun lake is also called as Chander Naun. It is accessible to experienced trekkers and fed by a series of springs, The name signifies 'Naun' for bathing. Generally local Gods visit the lake during the year or at an interval for the baths of Gods accompanied by devotees and office bearers of traditional Deity system prevailing in Himachal Himalayas.

xi) Dal Lake:

It is situated at $30^{\circ} 17''$ / N and $77^{\circ} 14''$ E, 1840 m above *msl* in Kangra district. It has a Shiva temple on northern bank. It has importance of religious sacredness mainly associated with Shiva cult as Chamba district is on the other side of Kangra valley, so it has largely influence of Shiva cult and visited by devotees for pilgrimage and also by many trekkers. Since the access is through Macloadganj in Dharamsala district headquarter of Kangra district which is also the residence of His holiness the Dalai Lama. A fair is also held during month of June.



Dal Lake, Kangra

xii) Gadasaru Mahadev Dal:

Gadasaru Lake is in district Chamba is situated at the height of 4280 metre above *msl*. This lies in the Churah tehsil of Chamba and is 24 km from Tissa. This lake is also held sacred and has a circumference of about a kilometre and near its banks it is very deep.



Gadasaru Lake, Chamba

It is situated on the extreme end of Nosaradhar amidst high mountains. Big mountain on the south of the lake, which is said to be the abode of Rudra Mahadev, induces godly presence. The lake and its surrounding possess mysterious ambivalence; a primitive shrine made of stone walls and roof is dedicated to Lord Shiva. Yatra is held for Gadasaru Mahadev annually at par with Manimahesh yatra on the same date.

xiii) Mahakali Lake:

Mahakali Lake 4355 m above *msl*. This lies between mountain ranges in district Chamba. This middle-sized lake is held sacred to the goddess Maha Kali. This lake is associated with ‘Shakti’ cult being dedicated to ‘Mahakali’.

xiv) Lama Dal Lake:

Lama Dal is in district Chamba is situated at the height of 3,640 metre above *msl* main sea level, 45 km from Chamba town. Held sacred to Lord Shiva, this lake lies amidst bare rock, ‘*Lama dal*’ means a long lake.



Lama Dal Lake, Chamba

The lake is spread over two kilometres in the boulders surrounding on Dhauladhar range. It is as the name suggests oblong in shape. It lies in the vicinity of trek routes between Chamba and Dharamsala over Gag, Minkiani and Bleni passes. On the day of Manimahesh festival yatra is held for *Lama Dal* also via Dunali and Drakund. Like Manimahesh, *Lama dal* is also held sacred to Lord Shiva. About 200 mts shorts of Lama Dal are located Kali kund, shaped like a well and is enclosed by rising hills.

xv) Manimahesh Lake:

Manimahesh lake is located at an altitude of 4200 metres at the foot of the Manimahesh Kailash peak in Chamba district, 32 km from Bharmaur. The lake is held sacred to Lord Shiva and the lake is the venue of the annual Manimahesh yatra.



Manimahesh Lake, Chamba

Dal is local dialect for lake, the *Manimahesh Dal* is situated on a snowfield at the foot of Manimahesh Kailash and is called *Siva ra Chaugan* (playground of *Siva*). Manimahesh *Dal* is sacred and the most famous lake of the Dhauladhar mountain ranges. The bath in the *Dal* is believed to cure diseases and wash sins. Stella Kramrisch writes: “Rudra heals the ills of mortals with the remedies that he himself created in the waters into which he plunged when Brahma had asked him to create mortals.” The waters themselves have healing power; they were irradiated by his presence. It was in the water of the *Dal* that Siva had immersed in yogic trance after all the pain he had endured following Daksha *yajna*. The water flowing from the glacier to the *Dal* brings with it the essence of the medicinal herbs that grow in the course of the stream. This water also has curative effect on the devotees who take a bath in the *Dal*.

xvi) Khundi Maral Lake:

Khundi Maral Lake is located at an altitude of 3750 metres in Churah Tehsil of Chamba district and has an area of 3 hectare. Khundi Maral has three approaches, first from Chamba via Saho, second via Chanju from Churah and the third via Lith from Bharmour. The lake is situated on a green saucer at the mountain juncture in the inner folds of Chamba. Pilgrims in their colourful best descend on Khundi Maral from three different directions of the surrounding hills on yatra days, i.e. first Tuesday of the Bhadrapada (September) these pilgrims come from Saho Gudiyal, Lilh Belj and Chanju Loh – tikki. The lake is sacred to Goddess Maha Kali who, it is believed, emerged splitting a hard rock at this place. The goddess owns a large flock of sheep which can be seen grazing on the slopes of the lake.

**Khundi Maral Lake, Chamba****xvii) Renuka Lake:**

It is located 173 km Southwest of Shimla in Sirmour District at an altitude of 660 m above *msl*. Due to its biological richness, the National Wetland Management Committee has designated it a wetland of national importance.

The picturesque Renuka Lake is one of the several natural Lakes of Himachal Pradesh and is regarded as one of the most sacred places in northern India. It is named after the Goddess Renuka, the mother of Lord Parshuram. The lake is also one of the famous tourist places of the state. Renuka Lake lies in Sirmour district and is the largest natural lake in the state. It is shaped like the profile of a reclining woman that is regarded as the embodiment of the goddess Renuka.

**Renuka Lake, Sirmour**

There has been great concern about the ecological deterioration, habitat degradation and eutrication of the wetland due to silting, high levels of organic pollution, habitat degradation, dumping of non-biodegradable materials by pilgrims and tourists. This has not only resulted in habitat deterioration, shrinkage of the aquatic life, but also the terrestrial fauna of Renuka Sanctuary as this is the only perennial source of water for wild animals.

xviii) Khajiar Lake:

This lake is situated at an altitude of 1920 mts from sea level in district Chamba. That has luxuriant vegetation cover in its catchment. Khajiar lake located on the way of Chamba – Dalhousie main

road. It is 22 km away from Chamba towards Dalhousie. The location of this lake in toposheet is 32° 32' 47" latitude and 76° 03' 32" longitude with an area of 5 hectare approximately. This lake surrounding is thick forest and it is also a famous and religious place. This place is also known as Mini Switzerland of India because its topography resembles Switzerland.



Khajiar Lake

There has been great concern about the ecological deterioration, habitat degradation and eutrophication of the wetland due to silting, high levels of organic pollution, dumping of non-biodegradable materials by pilgrims and tourists. The lake is in a badly deteriorated condition and efforts are required to rejuvenate it.

xix) Kareri Lake:

The Kareri lake is located at district Kangra with an altitude of 2960 above msl with an area of 3.5 hectares approximately and having thick vegetation around the catchment. Kareri lake falls on latitude 32° 19' 26" and longitude 76° 16' 33". On the north bank of the lake there is a Shiva temple. It is 22 km away from Kotwali bazaar and 28 km from Dharmsala. This lake is held sacred and has been affected due to the accumulation of silt.

xx) Pong Dam:

Pong Dam is situated at district Kangra and the bank of the Beas river along boundary of Himachal Pradesh and Punjab states. Pong Dam is famous as a tourist place. It is situated at 31° 58' 57" N and 76° 03' 33" E, 430m above *msl* in Kangra district with an area of 21712 hectare. It is a water storage reservoir. At high water level maximum depth exceeds 59 metres and low water level a muddy shore line up to 100 metres. The reservoir contains several large islands.



Pong Dam

Issues Associated with the Lakes:

- Eutrophication of wetlands due to silting and high levels of organic pollution.
- Dumping of non- biodegradable materials by pilgrims and tourists.
- Habitat degradation.
- Shrinkage of the aquatic life.
- Weed infestation.

With the efforts of the State Govt. Renuka lake and Pong Dam have been declared lakes of International Importance (Ramsar sites) and Rewalsar lake and, Chandertal lake have been declared as the lakes of National Importance.

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13.3 Issues:

13.3.1 Problems with Existing Rural Water Supply Schemes in H.P.:

Spring sources often have insufficient yield or are contaminated. Since the sub-surface water movement is rather fast in hill areas, it is common for springs originating in the upper slopes to disappear and then reappear as down slope springs. Perennial springs are not found in the Shivalik due to the low water-holding capacity of rock formations. Considerable numbers of Shivalik villages are fed by a pumped system which could provide water up to 100 villages. Many schemes were commissioned without sufficient investigation regarding source sustainability. Available sources were used with little planning regarding the possible growth of upstream water demand. Many irrigation schemes (diversion channel) have been commissioned in H.P. which reduce the down stream flows, especially during the lean season. Most HP village comprise several habitations often with distances of more than 2 kms from each other. In most cases, only the main habitation, is provisioned – the rest manage with little supply or depend on limited traditional sources.

People report a requirement of about 150-200 litres per family. If a reliable supply is assured many households are willing to pay for water. Exposure to urban life style and the convenience of household piped water supply has led to increased aspirations for private water connections in many of the villages.

13.3.2 Wastage and Shortage:

Vegetable patch near public tap and household holding irrigates it with tap water supply , whereas the next down stream village remains starved of even their basic requirement.

13.3.3 Condition of Infrastructure:

Dedicated electricity line for distributed pumping stations does not exist. At places with high head, 2-3 stages pumping required. Failure of any of them cripples the system. Pipe breakage is quite common during the rainy season.

13.3.4 Supply Augmentation Arrangements:

Many sources have not been able to supply sufficient water due to :

- Competing upstream use for agriculture
- Drying up of source
- Catchment degradation (especially in the Shivalik region)

Lack of funds for source augmentation is a major constraint. Demand side management has not been attempted so far.

13.3.5 Water Quality:

Nearly all traditional sources are contaminated due to unhygienic methods of handling water. Slaked lime is used to settle water in Khattris, but its efficiency in dealing with pathogens is limited due to continuous infiltration of contaminated water. Khattris water has very low turbidity due to long residence time (often up to 6 months) without any light (hence no algal growth) and it is cool. Rural residents often consider clean and cool water safe and vouch for the purity of Khattris water which is used for almost all domestic purposes. Excess iron is reported in about 10-15% hand pumps of the state (Kangra, Hamirpur, Bilaspur and Sarkaghat area).

13.3.6 Implementation and Operational Modalities:

Survey and design of small and medium RWS is taken up by IPH itself and actual work is done often by subcontracting.

13.3.7 Vulnerable Section:

The limited prosperity of the region is based on its labour market linkage with the outside world. A large proportion of the men folk, especially in Shivaliks, either work in the armed forces or are employed outside. Households that do not have a working member outside tend to be poorer.

13.3.8 Situation of Women:

The brunt of water scarcity is borne by the poorer households, especially by women. In many areas of lesser and Shivalik Himalays, the men migrate to the plains in search of jobs and women are the de facto heads of the households. The entire burden of maintaining the house, agriculture, livestock rearing, fetching water and fuel, and other domestic responsibilities lie with the women. Though women perform most domestic and agricultural functions, especially in families with high male migration, traditional barriers in their work sphere remain high, enforcing their lower status and dependence on the men folk. A typical example is restriction on ploughing the land, forcing women agriculturists to pay men. In the dispersed nature of the settlements, community structure is weak. The task of collection and transportation of water is left entirely to women.

13.3.9 Sanitation:

In small dispersed settlements sanitation problems are not severe. Furthermore, with the fairly rapid movement of groundwater in the hill terrains, many of the traditional sources especially downstream of the settlement are likely to get contaminated by the soak pits. Lack of land in the dense settlements especially in the hands of the poor, is another constraint for sanitary provision. There is thus a desperate need for an integrated approach to water supply and sanitation.

13.3.10 Irrigation Water Supply Measurement:

The distribution of water for irrigation schemes such as kuhals, small canals should be done on a volumetric basis instead of surface area method through water users committees/associations.

13.3.11 Judicious Views of Potable Water:

Treated potable water may not be allowed to be used either in the construction activity, sanitary applications, irrigation and other such purposes as the cost of treatment is very high.

13.3.12 Neglect of Traditional Water Resources:

Although there are many traditional water resources in the state but they are neglected because of the govt. supply schemes, if they are properly managed on one hand they will help in augmenting the water supply schemes and on other hand they will remain in healthy condition.

13.3.13 Community Participation in Local Infrastructural Development:

IPH is the sole agency for commissioning and maintaining rural water supply systems throughout the state. There are district level programmes like Vikas Mein jan Sahayog (people's contribution towards development) in which communities or individuals contribute about 25 percent of the amount for infrastructure and rest is contributed by the government. However, the programme has not elicited a favourable response from communities.

13.3.14 Community Participation in Rural Water Supply and Sanitation:

The PRIs are now provided with some funds for local works, but they are yet to get funds for the management of water supply schemes. The PRIs receive funds under various centrally assisted schemes such as the Jawahar Rozgar Yojana (JRY). Since the settlements are dispersed in many areas, each settlement considers itself a community. Except in representation in the panchayat, there are very few activities that create strong community bonds. Activities like agriculture that need collective labour, have declined. These villages are like urban areas with each household having its own priority and very little participation in the programme. Mahila Mandal is present in most of villages but they are not formed by the initiatives of the community. Instead, the DRDA and other government department for delivery of their scheme constitute them. There are few NGOs working especially for women issues or water supply and sanitation. Rural people in Himachal are fairly individualistic. Khattris, for instance, are almost always owned by the individual households and investments at community level are limited

13.3.15 Community Priorities:

Roads and water supply are reported as the most common priorities. Traditional mountain agriculture is unable to provide sufficient incomes for the rural youth, except in areas where the cash crop has become popular. Education is another major concern but is accorded lower priority in cases where water scarcity is an issue. Since the government has the responsibility for providing water supply, community initiatives are absent, even in the areas of severe scarcity. People mostly try to provide for their household needs rather than rejuvenating their traditional sources.

13.3.16 Sector Specific Policy Environment:

Under difficult terrain and dispersed habitation, managing a water supply can become very expensive if sufficient social development input is not provided. This is one of the main problems now facing the rural water supply scheme in the state. With current level of reliability in water supply it may be difficult to realize the full tariffs. Government has so far not taken up any demand side management or refurbishing of traditional systems. It is advisable to delink village level distribution from IPH and hand over distribution from sectoral tank/village tank onwards to village Panchayats. It would be a radical shift in policy from the current reliance on IPH alone to enabling the PRIs. Revenue collection can also be left to PRI. Large RWS systems serving many villages currently suffer from high differential availability across villages. This can be dealt with by creating multilevel management systems with user group/village representatives in decision making bodies regarding water sharing arrangement.

13.3.17 Maintenance of Installed Structure:

Generally it has been observed that many of the irrigation/drinking water supply schemes where huge investment had been made go defunct because of many reasons and thereafter no effort is made for their repair and maintenance.

13.3.18 Other Unattended Issues:

- There is a growing perception that water cannot be indefinitely provided as a service however there is still no clear-cut pricing option available.
- Differences over modalities of fixing the price of water arise because water is both treated as basic need or service and a commodity.
- Besides PRI, water committees are an alternative institutional mechanism being suggested though relationship between them and PRI bodies is not yet clearly articulated.
- Participation of NGOs might be limited on account of their technical deficiencies while large-scale private participation is unlikely until new policies are firmly in place.

13.4 Case Study:

“Impact of Various Land Uses on the Infiltration in Changar”

Abstract:

Experiments were conducted to evaluate the infiltration characteristics under different land use systems in the project area. The initial and steady state infiltration rates were found to be 145.18 mm/hr and 14.51 mm/hr respectively on degraded land and barren soil condition, 197.66 mm/hr and 31.29 mm/hr on private hay land and 160 mm/hr and 85.63 mm/hr on grazing land covered under community plantation with double ring infiltrometer.



Introduction:

The design, layout and evaluation of any water conservation measures and especially farm irrigation systems revolves around infiltration, which can be defined as the entry of water into the soil due to gravitational and surface tension forces. Infiltration takes place in unsaturated soil and it approaches hydraulic conductivity of soil as it gets saturated. Soil properties (structure, texture, and porosity), vegetation, antecedent soil moisture and the land slope influence infiltration rate of soil. Apart from these the infiltration is influenced by the soil disturbance caused by the tillage operations, trampling by men and machinery, burrowing by animals and soil friability caused by temperature. It is a single parameter for measuring composite effect of texture, structure, porosity and hydraulic conductivity of the soil. Infiltration rate of soil can be enhanced by land leveling, deep ploughing, and contour farming, stubble mulching and adding organic matter. Hence infiltration characteristics of the given soil are important factors for the design of soil conservation works, irrigation and drainage systems or to appraise land use within a watershed.

Field measurements are generally taken to find out the infiltration rate accurately and consistently. Two measuring devices are generally used to determine infiltration of the soil, infiltrometer and rainfall simulator. Infiltration can be described by considering its relationship with the time expressed as a function of empirical or physical infiltration parameters. In the present experiment an infiltrometer has been used for carrying out infiltration test.

Three sets of data were recorded for each site and average values were considered (annex-1). The volume of water infiltrated during different time intervals and time duration were observed for the inner cylinder to compute the infiltration rate. For each location time intervals were kept at 2, 5, 10, 15, 20 minutes for total duration of 3 hours. The curves for Infiltration Rate and Accumulated Infiltration were plotted for these three land uses (Fig. 1.30).

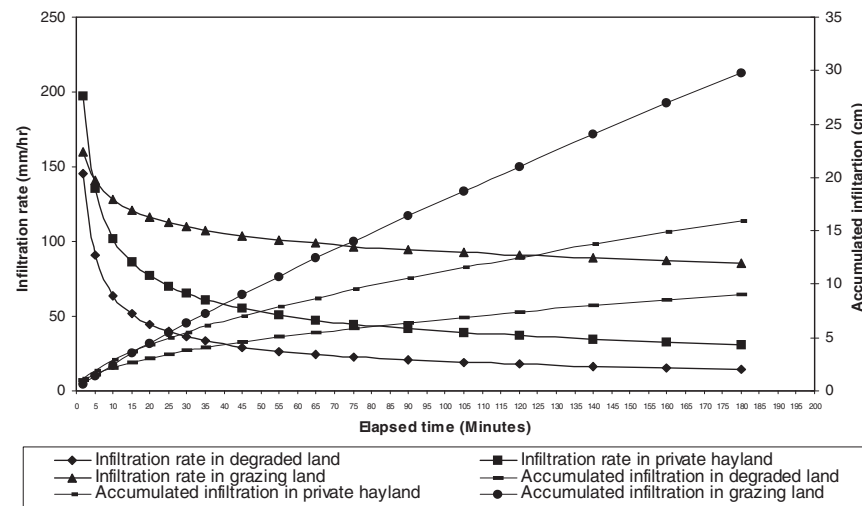


Fig. 1.30 Infiltration Rate and Accumulated Infiltration Curves for Different Land Uses

Brief Description of Test Sites:

Degraded Land: This is small catchment of about 1 hectares located in Chambi MMWS. No land treatment has been done in this area. As per record it is a part of common grazing land. The area is having open access to grazing, which has not only resulted in almost complete loss of vegetative cover from the area but also enhanced soil erosion.

Private Hayland: It is located in Galuhi village. Being private land it is managed differently from common grazing land. This area does not have open access for grazing. The area is having terraced fields, which have been provided various vegetative treatments. Grasses, like Nappier and Ceteria have been planted on the terrace riser along the contour whereas field strips are covered with stylo hamata. Besides, some broad leaf plant species, such as *Malberry*, *Lucenia*, *Toona ciliata* have been planted in such a way that there is no damage to grass production from the field.

Common Grazing Land: It is located in Village Thalerh. The area had been protected from grazing for the initial five years and put under plantation of *Toona ciliata*, *Acacia catechu*, *Lucenia*, - all broad leaf species. Apart from the species planted, a large number of natural regeneration has taken place due to enclosure of area.

Result and Discussion:

The infiltration data were analysed by using Kostiakov model ($I = Kt^\alpha$) and values of K and α were calculated. Typical half hourly infiltration rate at half hour intervals were also calculated using the equation developed.

Table 13.159: Typical Half -hourly Infiltration Rate (mm/hr) and Cumulative Depth of Infiltration (cm)

Land Uses	Half hourly infiltration values, mm/hr						Cumulative depth of infiltration in 3 hours, cm
	1	2	3	4	5	6	
Degraded land	36.32	25.47	20.70	17.87	15.94	14.52	9.01
Private hayland	65.19	49.01	41.57	36.95	33.67	31.29	15.90
Grazing land	109.83	99.75	94.29	90.6	87.83	85.63	29.84

It may be seen from the figure that the infiltration rate under these land uses tends to become constant after 2 hours. Infiltration rate values at ½ hour interval for 3 hours duration for three land uses were in decreasing order, i.e. grazing land covered with plantation > private hayland having stylo and other grass cover > degraded land with very little vegetative cover. Low initial infiltration in case of grazing land and degraded land may be attributed to the compaction of topsoil due to trampling by grazing animals. High initial infiltration rate under private hay land may be due to good vegetative cover on soil. As open grazing is not generally practiced.

Table 13.160: Experimental Data of Infiltration Rate in Degraded Land, Private Hayland and Grazing Land

Elapsed time in (min.)	Infiltration rate in degraded land (mm/hr)	Infiltration rate in private hayland (mm/hr)	Infiltration rate in grazing land (mm/hr)	Accumulated infiltration in degraded land (cm)	Accumulated infiltration in private hayland (cm)	Accumulated infiltration in grazing land (cm)
2	145.19	197.66	159.99	1	1.12	0.62
5	90.85	135.81	140.87	1.57	1.92	1.36
10	63.72	102.24	127.94	2.20	2.89	2.48
15	51.78	86.60	120.93	2.68	3.67	3.51
20	44.69	76.97	116.20	3.08	4.35	4.50
25	39.87	70.25	112.65	3.44	4.96	5.45
30	36.32	65.19	109.83	3.76	5.52	6.38
35	33.56	61.20	107.51	4.05	6.05	7.28
45	29.51	55.22	103.82	4.58	7.01	9.04
55	26.63	50.86	100.97	5.05	7.90	10.75
65	24.45	47.50	98.65	5.48	8.72	12.41
75	22.72	44.79	96.71	5.88	9.48	14.04
90	20.70	41.57	94.29	6.43	10.56	16.43
105	19.13	39.03	92.29	6.93	11.57	18.76
120	17.87	36.95	90.60	7.39	12.52	21.04
140	16.51	34.69	88.68	7.97	13.71	24.03
160	15.42	32.84	87.05	8.51	14.83	26.96
180	14.52	31.29	85.63	9.01	15.90	29.84

Private hay land, there is no trampling effect. The good vegetative cover found in hayland protected the soil from rain compaction by absorbing the energy of raindrop and prevented dislodging of soil particles by mechanical binding of roots. It is also obvious from the steepness of the infiltration rate curves that the rate of decrease of infiltration rate during the first 15 minutes was highest in case of private hay land and lowest in grazing land. However, it seems that there is a formation of hard soil layer below the shallow roots of these grasses in private hay land, which reduces the final infiltration rate. The subsoil found in grazing land put under plantation seems to be more porous and have higher permeability due to deeper roots structure of plants. Lowest final infiltration rate was found in the degraded land having almost no vegetation. In 3 hours duration the cumulative depth of infiltration in three different type of land uses, degraded land, private hay land and grazing land are 9.01 cm, 15.90 cm and 29.84 cm respectively.

Conclusion and Suggestion:

1. Water storage at house level to be increased as hills hydrogeological system has very little capacity to store water.
2. Delivery of water sources should be based on the felt need of the people and their willingness to operate and maintain the system by paying water charges.
3. Formation of separate user group for each source is more effective
4. Awareness generation programme for making judicious use of water is essential before executing water related activities and should be linked with incentive – disincentive schemes to practise water conservation.
5. Local institutions - PRIs, Mahila Mandals (Women's group), Yuvak mandal (youth club) have to be enabled to manage water equitably.
6. Local village level animator to be developed for future management.

13.5 Pressures:

Increasing demand for Quality Potable water, Irrigation, Industrial & other Household uses.

Table 13.161: District-wise Water Sources

District	Ground water	Surface water	Rain water	Traditional source	Other conventional sources
Bilaspur	827	786	0	461	0
Chamba	1717	2433	3	2598	836
Hamirpur	1057	485	0	231	1
Kangra	1602	1317	11	1369	466
Kullu	0	3392	0	0	0
Lahaul & Spiti	1	290	0	57	0
Mandi	833	3924	0	1483	840
Shimla	233	3917	5	2518	9
Sirmour	644	2249	0	535	9
Solan	344	1090	0	1215	316
Una	832	123	1	21	116
Himachal Pradesh	8090	20,006	20	10,488	2593

Table 13.162: Water Demand for Himachal Pradesh

(mld)

District/State	1999		2001		2011		2021	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
Bilaspur	2.69	22.84	2.90	23.76	4.18	28.90	6.04	35.06
Chamba	4.70	30.18	5.03	31.5	7.06	38.96	9.92	48.12
Hamirpur	3.63	27.39	3.90	28.23	5.58	32.75	7.99	37.85
Kangra	8.30	90.90	8.63	94.44	10.46	114.43	12.67	138.37
Kinnaur	-	5.75	-	5.96	-	7.13	-	8.53
Kullu	2.99	23.61	3.13	24.71	3.88	31.00	4.82	38.89
Lahaul & Spiti	-	2.47	-	2.55	-	2.96	-	3.46
Mandi	7.64	59.57	7.89	62.10	9.31	76.45	10.98	94.12
Shimla	21.75	37.70	23.81	38.47	37.45	41.60	58.91	42.52
Sirmour	6.05	28.14	6.48	29.3	9.20	35.81	13.06	43.65
Solan	7.63	27.19	8.22	29.15	11.92	36.12	17.27	44.57
Una	4.83	27.86	5.10	28.84	6.71	34.33	8.83	40.82
Himachal Pradesh	70.21	384.32	75.04	399.01	105.76	480.44	150.49	575.97

[Source : Human Development Report on Himachal Pradesh, 2002]

Sewage Discharges to the River and Streams:

It is a well known fact that sewage discharges are being dumped in to the nearby rivers or streams in the absence of sewage treatment plants. It is, therefore, pertinent to look into this problem quantitatively as well as qualitatively.

Over Exploitation of Tapped Water Source:

Whereas the resource potential of the exiting supply schemes remains the same.

The demands have increased manifold there are very few alternative arrangements.

Non - Revival of Defunct Supply Systems:

There are reports that many supply schemes have become defunct due to various causes and there are no financial provisions for their revival.

Non - Realistic Vision for Project Demands:

On many occasions it has been observed that the projected demands were not based on the actual data and hence they become non-functional because of the inadequacy.

Leakages in the Public Distribution System:

There has been a general consensus that there are huge leak in the installed systems.

Misuse of Community Water Supplies and Infrastructures in Efficient Use of the Irrigation Water Supplies:**Poor Monitoring of Industrial Supplies / Applications**

There is no monitoring system for the monitoring of the water intake and use in industrial applications.

Resource use without defining carrying capacity /potential**13.6 Impacts:****Shortages of Potable Water:**

There is a need to access available water resources and their exploitation on a sustainable basis as this has direct correlation with the growth rate of the population. The demands for water, especially for drinking purposes have a significant impact and this is likely to strain available water resources. The demand for urban areas of the state up to 2021 AD is projected at 150.49 Million litres /Day. The demand for water in the rural areas is much higher, i.e. 575.97 million litres /day by 2021 AD which is 3.8 times the demand in the urban areas.

Non Judicious Use of Treated Water:

The treated water being costlier, should not be allowed for other uses such as watering the kitchen gardens, sanitary purposes and for the construction activities.

Degradation in the Water Quality :

Surface and sub-surface water pollution is on the rise and can become a source of conflict between the upstream and downstream users. Pollution has an inverse relationship with the water quantity available for specific uses and with the rise in the pollution levels, water loses its economic value. Good quality water (Class A) that is used directly for drinking purposes loses its value once it becomes polluted, similarly water used for bathing cannot be used after a certain level of pollution contaminates it. Industrial and sewage effluents can be a great hazard. The treatment process for making water pollution free is rather costly which adds to the cost.

Depletion of Groundwater Table:

In the lower regions of the state depletion in the groundwater table has been reported.

Progressive Decrease in Potential Flow to Hydro-power Generation:

Progressive decrease in the flow to the Hydro-power has been noticed in the recent years and due to this factor uneven generation of power has been noticed.

Impact on Agriculture and Horticulture:

22.6 % of the agriculture and horticulture in the state is irrigated rest of the area, is mainly dependent on the rains which in recent years are abnormal.

13.7 Responses:

State Groundwater (Regulation and Control of Development and Management) Bill:

The Himachal Pradesh Govt. has recently introduced the state groundwater (Regulation and Control of Development and Management) Bill. According to the bill a groundwater authority will be established.

Mandatory Rainwater Harvesting:

The Govt. has made it mandatory to construct rain water harvesting in all the buildings in the State Govt. is implementing various watershed schemes through its development departments with the involvement of the PRI and community.

Water Policy:

The state is in the process of making a water policy in accordance with National Water Policy to harness and utilize the water sources judiciously and sustainably.

Modern Techniques in Irrigation:

The state is encouraging farmers to adopt modern means of irrigation such as drip irrigation and sprinkler to use the available water sources efficiently.

13.7.1 Irrigation Sector

Table 13.163: Irrigated Area

Total geographical area of the State	55.67 lakh ha.
Total culturable area of the State	5.83 lakh ha.
Area identified under Major/Medium Irrigation projects	0.50 lakh ha.
Area identified under Minor irrigation schemes	2.85 lakh ha.
Total identified area	3.35 lakh ha.

Up to the end of March, 2006, an area of 2.07 lac hect. of land has been provided with irrigation facilities, the details of which are as under :

Table 13.164: Area Covered with Irrigation Facilities

Sector	Area covered upto 31.3.2005 (ha.)		Total area
	IPH	RDD	
Minor Irrigation	101320	92796	194116
Major Irrigation	1555	0	1555
Medium Irrigation	11381	0	11381
Total	114256	92796	207052

NABARD:

For early completion of on-going irrigation, flood protection and water supply schemes, in addition to state resources, loan assistance amounting to Rs 147.45 crore was sanctioned.

Table 13.165: Brief Description of Schemes Sanctioned Under RIDF-I to XI

Item	Irrigation
No. of Schemes approved	419
No. of completed schemes	265
Total cost i/c State share (Rs. in lakh)	26899
Irrigation Potential created in hect.	22719

Accelerated Irrigation Benefit Programme (AIBP):

Persistent efforts have been made to get approval of Govt. of India for minor irrigation projects under AIBP for expeditious arrangement of funds, as 75% expenditure is borne by the G.O.I.. Accordingly, 95 schemes (Minor Irrigation) spread in the Districts of Solan, Una, Kangra, Mandi, Sirmour have been approved for Rs. 29.27 crore. Under this programme one major irrigation Project Shahnehar and two other medium irrigation projects Sidhata and Anandpur Hydel channel has also been approved under AIBP. So far G.O.I. has sanctioned Rs.6.71 crore for minor irrigation schemes, Rs. 5.15 crore for medium irrigation schemes and Rs. 50.26 crore for Major Irrigation Project Shahnehar, under central loan assistance.

New proposals of 102 Minor Irrigation Schemes amounting to Rs. 50.25 Cr. have been further sponsored to G.O.I. for approval to cover 12480.35 hect. CCA under this programme.

Major Irrigation Project Shahnehar:

An inter-State agreement was concluded on 4th August, 1987 between Govt. of Punjab and Govt. of Himachal Pradesh for construction of Shahnehar Project to provide irrigation facilities for a total CCA of 15287 ha. of Himachal Pradesh falling on both banks of river Beas below the Pong Dam. This includes CCA of 3465 hect. (existing irrigated area rendered dry) and 11822 hect. of potential irrigable area deprived of irrigation facilities due to construction of Shahnehar barrage by Punjab Government downstream of Pong Dam.

The project envisaged construction of two lined canals, left bank is 33 kms. long with carrying capacity of 3.82 cums. taking off from existing Mukerian Hydel channel to irrigate 6183 ha. of land, and right bank canal is 48.85 kms. long with carrying capacity of 6.48 cums. to irrigate 9104 ha. of land. It will take off from the existing guide bundh of Shahnehar barrage to be constructed by the Punjab Govt.

There was difference of opinion between Himachal Pradesh and Punjab Engineers regarding canal capacities and water releases to be made by Punjab to Himachal Pradesh. Various meetings were held in Central Water Commission, New Delhi. Finally CWC sent a detailed note containing their recommendations to both Himachal Pradesh and Punjab Governments during February 1993. Since these recommendations were not acceptable to both Himachal Pradesh and Punjab, CWC referred the dispute to Minister of Water Resources for Arbitration during August 1993.

To settle the dispute between the two Govts. regarding sharing of the cost of the project to be constructed for providing irrigation facilities as planned. Sh. A.B. Joshi, the then Chairman, Central Water Commission was appointed Arbitrator, who after hearing the representatives of both the govts. decided as under :-

- (a) The combined capacity of the lined canal of the project will be 10.30 cumecs with capacity of right bank canal to be 8.50 cumecs and that of left canal 1.80 cumecs.
- (b) The cost of 7.08 cumecs will be shared by Punjab and Himachal Pradesh in terms of the interstate agreement dated 4th August, 1983, and the balance cost of the difference of the capacity of channel between 10.3 cumecs and 7.08 cumecs will be borne by Himachal Pradesh.

The award was announced on 19.05.95. The project report was submitted to Central Water Commission on 8th August, 1995. The project was finally cleared for its techno-economical consideration by the Technical Advisory Committee headed by Secretary, Ministry of Water Resources on 3rd April, 1996. Planning Commission approved the project for the construction of two canals on left and right banks of river Beas having a total capacity of 10.30 cumecs for Rs. 143.32 crore, out of which Rs. 88.49 crore was to be borne by Punjab Government and remaining Rs. 54.83 crore by Himachal Pradesh Government. Shahnehar Major Irrigation Project has been approved by the Planning Commission, Government of India for Rs. 143.32 crore on 21.2.1997. The A/A and E/S has been accorded for the Rs. 143.90 crore (Inclusive of the cost of land development of H.P.) The above estimate was framed considering the base year as 1995.

Table 13.166: Funding Apportionment

Year of Constriction	Amounting as per integrated Project (Rs. in Lakh)	HP Share (Rs. in Lakh)	Punjab (Rs. in Lakh)
1997-98	2348.25	852.20	1496.05
1998-1999	2551.04	978.88	1572.16
1999-2000	2924.98	1055.07	1869.91
2000-2001	2406.39	864.04	542.35
2001-2002	3228.18	1351.86	1876.32
2002-2003	873.16	380.95	492.00
Total	14332.00	5483.00	8849.00

The Punjab Govt. was required to release funds to the extent of Rs. 88.49 crore against which Rs. 42.92 crore have been released as under:-

Amount released during 1986-87	Rs. 1.50 crore (3/87)
Amount released during 2000-01	Rs. 2.00 crore (7/2000)
Amount released during 2001-02	Rs.11.00 crore (12/2001)
Amount released during 2002-03	Rs.15.00 crore (8/2002)
Amount released during 2004-05	Rs. 13.42 crore (12/2004)

Medium Irrigation Projects:

Completed Projects:

Balh Valley in District Mandi:

During the year 1974 a reference was made by Himachal Pradesh Govt. to Northern Zonal Council for the release of a small quantity of water from BSL canal for purpose of irrigation in Mandi district. After prolonged correspondence with BSL and BBMB authorities as well the Govt. of India, an agreement signed was between Govt. of H.P and BBMB on 27/2/1986 to release 20 cusecs of water to irrigate 2410 ha. The project report was approved for Rs. 302.71 lakh.

The Balh Valley Project commenced during the year 1982-83 and was completed in 2000-2001 at a total cost of Rs.1202 lakh.

Giri Project in District Sirmour:

Giri Irrigation Project was the first prestigious project of its kind taken in hand by Irrigation and Public Health Department of Himachal Pradesh. This project was conceived during the year 1977-78 to cover 5263 ha. initially with a estimated cost of Rs.4.16 crore. The project was completed during 1981-82 at a cost of Rs.8.23 crore and an area of 5263 ha. was brought under irrigation.

Bhabour Sahib Phase-I in Una District:

The Project was administratively approved for Rs.75 lakh and approval for improvement was accorded for Rs.93.43 lakh. The project has been completed at a cost of Rs.121 lakh. The CCA covered is 923 ha.

Bhabour Sahib Phase-II in Una District:

Medium Irrigation Project Bhabour Sahib Phase-II was cleared by the Planning Commission during 1988-89 and further A/A and E/S for Rs.426 lakh was accorded to irrigate 2640 ha CCA. The source for supply of water is Nangal Dam.

This project envisages provision of irrigation facilities to 2640 ha. of agriculture land in 19 villages. The construction work was taken up during the year 1988 and completed during 1997-98 with a cost of Rs. 11.42 crore.

On Going Projects:**Sidhatha Medium Irrigation Project:**

Sidhata medium irrigation project area is situated in Jawali Tehsil in Kangra district. The project has been approved in the technical advisory committee meeting held on 9/9/1997 amounting to Rs.33.62 crore with CCA of 3150 ha. The A/A and E/S of this project has been accorded for Rs.33.62 crore.

Anandpur Hydel Channel to Changer Area:

The Government of Punjab has constructed Anandpur Hydel Channel Project in Punjab for which some land of Himachal Pradesh was to be acquired in village Dabat Majari of Bilaspur District H.P. An agreement between the Government of Punjab and Himachal Pradesh was concluded in August, 1993, according to which the Himachal Pradesh Government agreed to acquire the required land for the Anandpur Hydel Channel Project and in lieu thereof the Government of Punjab had agreed to provide some facilities for the benefit of the inhabitants of the affected areas of Himachal Pradesh. One of the items agreed by the Government Punjab is to release 25 cusecs of water from Anandpur Hydel Channel for Himachal Pradesh regularly for irrigation and drinking purposes.

13.7.2 Flood Protection Works:**Flood Protection Works:**

The flood prone area in the State is 2.31 lakh ha. The government is making strenuous efforts to protect private properties and culturable land by providing emergent flood protection measures in the shape of embankments, spurs and wire crates. Up to March, 2003 the department was able to protect an area of 11273 hect. from the fury of floods.

Channelisation of Swan River:

District Una is situated on the bank of Swan River, which flows from north to west direction. This river is known as river of sorrow as during monsoon period the flood creates havoc in District Una. Due to continuous silting, the bed of Swan River has risen constantly due to which meandering action takes place. The width of the river has increased and fertile land situated on both banks is turning barren due to silt deposits. Besides some of the fertile land situated near the banks has been eaten away during the floods. The estimated loss to crops and property is to the extent of about Rs. 15 crore per annum. The task of flood management of Swan River is therefore of utmost importance.

Swan river has a total catchment area of 1200 km² and has a length of 65 kms in Himachal Pradesh. There are 73 tributaries in the catchment area. The catchment area mainly comprises loose fragile Shivalik hills with very little vegetative cover. During monsoons, the eroded material in the catchment area gets moved through the tributaries to the main Swan River. Approximately 10,000 ha. of agriculture land is affected by floods and annually 2000 ha. of fertile

land is not being cultivated due to fear of floods. Swan River Flood Management and Integrated Development Project was framed by IPH Department in 1984 and submitted to Central Water Commission, Govt. of India, Ministry of Water Resources, for techno economic clearance. Total cost of the treatment of the catchment works out to about Rs.259 crore. After various deliberations it was decided to tackle critical portions in the first phase.

The detailed project report for providing embankments on both banks of Swan River in a length of 16.67 km. as Phase-I from Jhalera bridge to Santokhgarh bridge was prepared based on mathematical model studies carried out by Central Water Power Research Station (CWPRS), Pune. This project amounting to Rs. 102.71 crore was accepted by the Technical Advisory Committee of Ministry of Water Resources, Govt. of India at its 72nd meeting held on January 18, 2000. The Ministry of Environment and Forests, Govt. of India has also accorded clearance vide its letter No.J-12011/1.4.98-IA-I dated 9.3.2000 at the meeting held on 21.2.2000. Investment clearance has also been accorded by Govt. of India, Planning Commission.

For integrated approach of the project it is proposed to treat entire catchment instead of just the sanctioned portion of 16.67 km. For this, approval has already been received. Even prior to the clearance of this project by the Govt. of India, Govt. of HP. has been quite concerned about flood damages by Swan River every year. In all 42 most vulnerable points requiring urgent flood control works were identified and of these 40 have since been completed at a cost of Rs. 9.28 crore.

Treatment of Catchment Area:

There is a provision of Rs. 75 lakh in the approved project report of Rs.106.83 crore for treatment of catchment area of tributaries falling from Jhalera bridge to Santokhgarh bridge, and against this provision full amount already stands deposited with Distt. Forest Officer Una up to March 2003. The Forest Dept. has planted 58500 trees, in 50 ha., of different varieties. In addition to this check dams in the tributaries and planting of grasses and bushes for bank protection has been done. Further work is in progress by the Forest Department.

Approval Under NABARD:

For providing embankments on both banks of Swan River NABARD has approved the project in two phases. In Ist phase from Rd.13/660 to 19/160 (i.e. 5.5 kms.) approval was received on 2.11.2001 for Rs. 26.99 crore. In second phase from RD 6000 to 12000 i.e. 6 kms. approval was received on 31.8.2004 for Rs. 20.93 crore. For remaining portion of the project for Rs. 310.34 crore has been sent to G.O.I. for JBIC funding.

Bata River:

River Bata emerges as a Khala nearby village Kolar and passes through fertile land from Kolar to Bata Bridge and finally joins the Yamuna River. The Bata river keeps on changing its course in the rainy season and is further influenced by the fall racewater of Giri Bata Hydel Project, which adds nearly 16000 Cusecs of water and it causes ultimately the erosion of land on both banks of the river. Over the years, Bata River has been causing damage to the life and property of the inhabitants located on the banks of Bata River.

Therefore, a comprehensive detailed project report for Bata River channelization costing Rs.30.11 crore has been prepared and is process for re-submission to Ganga Flood Control Commission, Patna.

To meet the immediate threat from floods in river Bata, a flood protection proposal was sponsored under NABARD-V to provide flood protection works at most vulnerable points. The A/A and E/S of the project has been accorded for Rs. 89,293 lacs.

The approval for channelisation of Bata River at (various RDs) vulnerable reaches in Paonta Sahib Distt. Sirmour has been received from Deputy Commissioner (ER) G.O.I. Ministry of Water Resources vide letter No.5/16/2002-ER/189-229 dated 21 January 2004 for amounting to Rs. 3.09 crore out of which state share is Rs.0.77 crore and Central share is Rs.2.32 crore.

Command Area Development Programme:

In order to bridge the gap between potential created and utilized Command Area Development activities (CAD) are also extended not only to medium schemes but also to minor irrigation schemes.

The command area development programme (CADP) was initiated in the year 1974-75 under Centrally Sponsored Scheme with the objective of fast utilization of created irrigation potential and optimum agriculture production from irrigable land. Initially 3 Medium Irrigation Projects were included under the centrally sponsored command area development programme, which has since been completed. 5 more CAD projects stands completed and deleted from the CAD Programme.

Nine CAD Projects are in progress in the State.

In addition to the above 3 CAD Projects of Rohru and Chirgaon, Suni and Narkanda, Paonta and Shallai have been sent to GOI. Up to 1st April 2006, 21739 ha. field channels and 20844 ha. warabandi have been completed in the Pradesh.

13.7.3 Sewerage Sector:

As towns in the state mostly serve as health resorts, environment improvements assume special significance particularly to avoid pollution of the rivers and other water bodies of the State. Secondly, to abolish carrying of night soil on head load and scavenging system in the country/states, the government has given top priority to connect dry latrine system into water pour system. Hence, the sewage programme has assumed immense importance. Under this programme sewage facilities are proposed to be provided in all towns of the state.

10 sewage schemes have been completed (Shimla, Palampur, Mandi, Jawalamukhi Shri Naina Devi Ji, Chamba, Bilaspur, Rohroo, Ghumarwin, Manali and 2 rural schemes (Reckong-Peo and Sarahan). The work on 20 schemes is in progress (Rampur Phase-II, Una, Solan, Sundernagar, Paonta, Sarkaghat, Kullu, Mehatpur, Santokhgarh, Arki, Dalhousie, Chowari, Jogindernagar, Bhuntar, Dharamsala, Hamirpur, Kangra, Nagrota, Jubbal and Sujampur).

It is proposed to commission sewerage scheme Rampur, Manali, Arki, Joginder Nagar, Hamirpur, Dharamsala, Una and Kullu during the year 2006-07.

Table 13.167:

Shimla Sewerage Project
Shimla Sewerage Scheme from OPEC: 10 Million Dollars

Shimla sewerage project is being implemented with the aid of OPEC Fund for International Development Vienna. The estimated cost of the project is Rs.54.80 crore. The ratio of OPEC Fund and State Share is as under :

OPEC Loan (73%)	Rs. 40 crore (10 Million Dollars)
State Share (27%)	Rs. 14.80 crore
Total	Rs. 54.80 crore

The Shimla Sewerage project was started in November, 1997. The work is in advanced stage of completion. Sewage Treatment Plants at 6 places are almost completed as per details given below :

Dhalli (0.76 MLD)	Completed & commissioned
North Disposal (5.80 MLD)	-do-
Summer Hill (3.93 MLD)	-do-
Sanjauli/Malyana (4.44 MLD)	-do-
Snowdon (1.35 MLD)	Completed and tested
Lalpani (19.35 MLD)	Completed and commissioning started from 26.7.04

Out of 179 Kms. sewerlines, 179.352 Kms. sewer lines have been laid in different zone of the Shimla town.

Executive Engineer, Sewerage Network, Const. Division, Shimla-5 has been authorized to sanction the sewerage connections to the buildings situated outside the Municipal Corporation limits.



Sewage Treatment Plant at Lalpani, Shimla
[Source : I&PH department website]



Sewage Treatment Plant at Summerhill, Shimla

13.8 Glaciers in Himachal Himalayas:

Geological history of Earth indicates that glacial dimensions are constantly changing with the changing climate. During Pleistocene the earth's surface experienced repeated glaciations over a

large land mass. During the interglacial period the climate was warmer and deglaciation occurred on a large scale. This suggests that glaciers are constantly changing with time and these changes can affect the discharge of most of the Himalayan rivers. Therefore, it is important to carry out an investigation for snow and glaciers for the proper management of Himalayan water resources.

Keeping in mind this view, Space Applications Centre had initiated a programme for the mapping of glaciers and permanent snowfields in the Satluj basin. Using IRS satellite data inventory was completed for the Satluj basin right from its origin in Tibet catchment. In this programme mainly three agencies were involved, i.e SAC Ahmedabad, WIHG Dehradun and HPRSC Shimla. The results obtained from the investigation suggests the presence of 334 glaciers in the Satluj basin. The aerial extent of the glaciers in the basin has been calculated as 1515 km². The study also shows the presence of 1987 permanent snowfields having a total area of 1182 km². Thus, the total area under glaciers and permanent snowfields in the Satluj basin has been calculated as 2607 km². The glaciers and snowfields have also been identified and delineated sub-basin- wise (Table 13.168). When seen with reference to the aerial extent, it is observed that the maximum number of glaciers (92) falls in the category of 2.0 to 5.0 km² (Table 13.169). Besides this a total of 38 moraine dammed lakes have been mapped in the entire basin out of which 14 lakes falls in the Himachal Himalayas.

Table 13.168: Basinwise Distribution of Glaciers and Snowfields in Himachal Himalayas

Basin Name	Number of Glaciers	Aerial extent (sq. km.)	Number of snowfields	Aerial extent (sq. km.)
Beas	6	15.843	47	72.442
Parvati	36	450.627	131	188.188
Sainj	9	37.255	59	51.934
Spiti	71	258.237	597	368.366
Baspa	25	203.300	66	64.964
Satluj	55	154.762	194	110.843

Table 13.169: Distribution of Glaciers on the Basis of their Aerial Extent in Satluj Basin

Range of Aerial Extent (sq. km.)	Number of Glaciers	Total Area of glaciers (sq. km.)
0.5	41	10.254
0.5-1.0	47	37.167
1.0-2.0	75	108.641
2.0-5.0	92	296.208
5.0-10.0	51	377.649
>10.0	28	687.202

Similar investigations were carried out in the Chenab and Ravi basins in Himachal Pradesh. The mapping was carried out at 1:50,000 scale using LISS III- High Resolution Satellite Data. The mapping was completed at the Remote Sensing Cell and the GIS data base was created at SAC Ahmedabad. The data base has been compiled in the form of an Atlas which covers information mainly about the Chenab basin in Himachal Pradesh. The preliminary interpretation of the maps pertaining to Ravi basin has also been completed except the digitization of the maps, which will be taken up now. With this the database pertaining to the snow and glaciers in all the basins in Himachal Pradesh is complete except for the Ravi basin.

The results obtained from the investigation suggest the presence of 457 glaciers in the Chenab basin having total aerial extent of 1055.27 km². The total number of permanent snowfields in this basin is 732 having total area of 245.0 km². This makes the total number of glaciers and snowfields in Chenab basin 1189 having an aerial extent of 1300.27 km². The permanent snowfields and glaciers are covered in 55 sub-basins. The total glacial and permanent snow-cover stored water in Chenab basin is estimated at 93.033979 cu km. Most of the glaciers of Chenab basin have an area less than 1 km². There are 165 glaciers in the basins which have the aerial range between 1-5 km². There are thirty-four glaciers which have an area of between 5 to 10 km². Only 14 glaciers with areas more than 10 km² have been mapped in the basin. Analysing permanent snowfields in various ranges of aerial extent it has been observed that most of the permanent snowfields have an area of less than 1 km². The distribution of glaciers on the basis of aerial range is as in the Table 13.170.

Besides this an inventory of moraine dammed lakes has also been prepared in the basin. The investigation suggests the presence of 50 moraine dammed lakes and five supraglacier lakes. Largest lake has an area of about 1.053 km². This lake is formed in the glacier no. 52H11001 in 12448 sub-basin. Smallest lake has an area of about 0.002 km² and has been observed near 52C12S52 in 12200 sub-basin. In addition to moraine dammed lakes three hundred and one deglaciated valleys were also mapped. Deglaciated valleys cover an area of 269.013 km².

Table 13.170: Distribution of Glaciers in Different Ranges of Aerial Extent

Glacier Area (km ²)	No. of Glaciers	Total Area (km ²)
<1	244	113.832
1-5	165	394.599
5-10	34	211.284
>10	14	335.612

Table 13.171: Appropriate Technologies for Water resource Development and Management in Hills

Purpose	Technologies
<i>In-Situ</i> soil moisture conservation	- Bund and terrace renovation for in situ soil moisture conservation on farmland - Biological barriers for in situ soil conservation for agricultural land

Purpose	Technologies
	Development of better on farm water management system using pipes and micro irrigation systems. Improved cropping practices
Provision of Drinking water for Humans and cattle	- Spring development with improved design. (Use of moist clay with sufficient compaction as core wall has been very successful and low cost). - Construction of spring fed small storage tank. - Construction of unlined tank with good design consideration has been found more effective. - Roof-top rainwater harvesting - Lift/Gravity water supply scheme - Hand pumps in lower Shiwaliks - Tubewell
Provision of water irrigation	- Construction and repair of diversion weirs with irrigation canal (Kul) along with construction of storage distribution tank wherever necessary. - Construction of sub-surface dams. - Construction of small lift irrigation scheme. - Development of mobile irrigation systems. - Installation Hydram

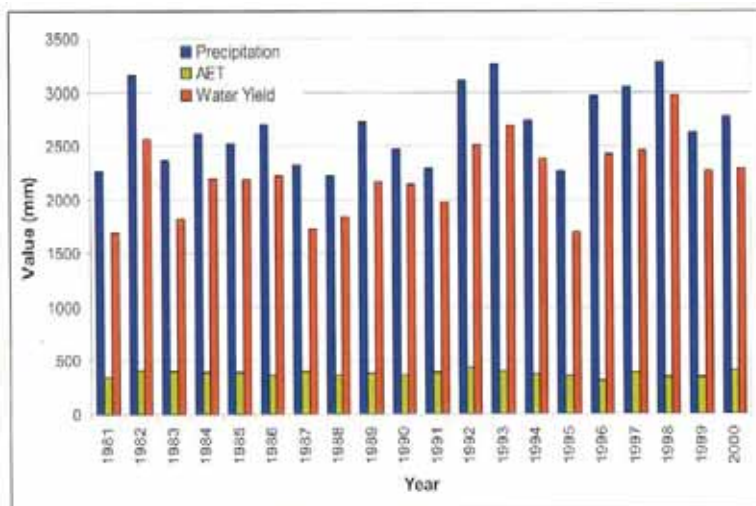


Fig. 1.31 Annual water balance components for Sutlej River
[Source: Water Resources Management for H.P.]

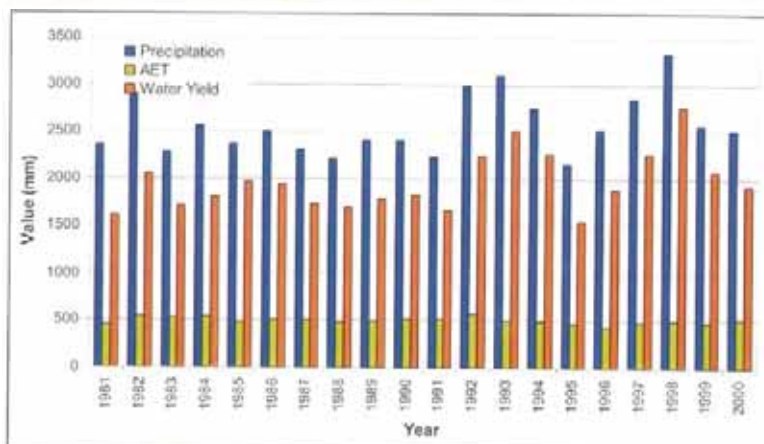


Fig. 1.32 Annual water balance components for Beas River
[Source: Water Resources Management for H.P.]

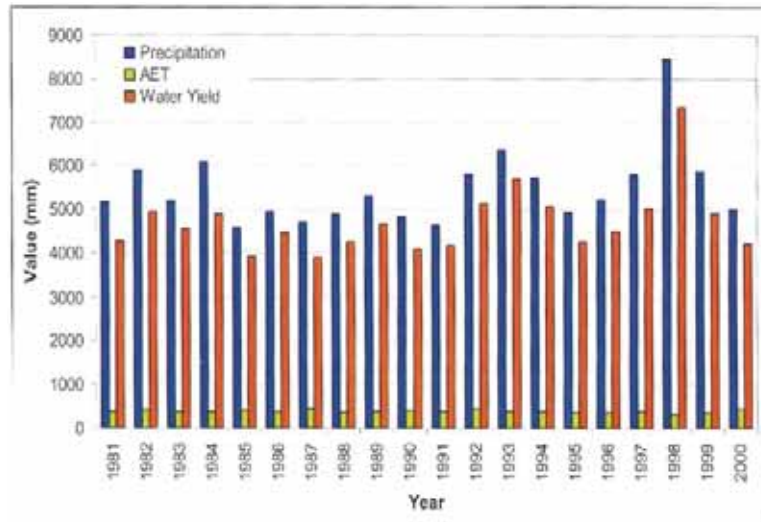


Fig. 1.33 Annual Water Balance Components of Ravi River
 [Source: Water Resources Management for H.P.]

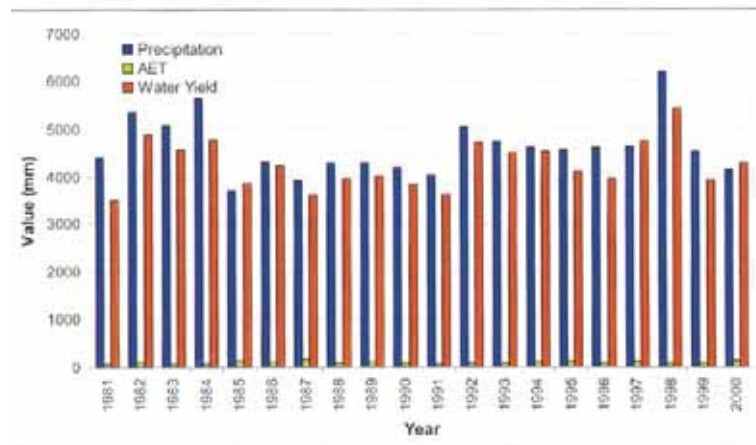


Fig. 1.34 Annual Water Balance Components for Chenab River
 [Source: Water Resources Management for H.P.]

INDUSTRIES AND MINING

Industries and Mining

General:

At the time of its formation, there was virtually no industry in the state of Himachal Pradesh except a few industrial establishments such as Mohan Meakins and Nahan Foundry. Initially industrialization in the state was aimed at developing and up-dating the existing traditional skills and arts in the cottage and tiny sectors through handlooms and handicrafts. The main object in the policy was to use the traditional skills of the local populace and raise their standards of living. Even in the 70s the state had very little modern manufacturing industries.

In early 1980 efforts were initiated to industrialize the state by providing various incentives, facilities and concessions to industry and by developing the basic infrastructure necessary for industry. In recent years the industrial sector has grown significantly and now contributes about 15% of the State Domestic Product.

The efforts of the State Govt. to accelerate the pace of industrialization received further impetus with the notification of special package of incentives to industry for Himachal Pradesh by the Govt. of India on 7.1.2003. As on date 31924 small scale industrial units and about 256 Medium and large scale industrial units with an investment of about Rs. 3664.84 crores and employment of about 1.76 lakh people are already existing in the state.

The state has in recent years emerged as one of the most favourite destinations for industry. A large number of industrial projects have been set up recently by the reputed industrialists of the country in the private sector. The government is encouraging entrepreneurs to set up resource based industries in Himachal Pradesh.

The state was in a disadvantaged position as far as factors of production are concerned, namely, the markets were far away and the state did not have a big base of raw material except limestone. The comparative advantages that industries in the adjoining states are enjoying necessitated the need to create a congenial investment climate for industrial growth in the state. Our state has a good potential for setting up industrial projects where we have competitive advantages such as stable and efficient policy and administration, clean environment, cordial industrial relations, abundant and cheap power. Furthermore, the state has tremendous potential for setting up industries based on horticulture, agriculture, medicinal and other herbal produce. Besides, Himachal is bestowed with plenty of mineral wealth and there is considerable scope for mineral based industries. Above

People Concerns

Because of the coming of industries in the region many of the agriculture lands have been occupied by industrial complexes. It was suggested that no one should be allowed to develop industrial sites on the lands where agriculture production is rich. The industrial complexes should be build either on the non-agriculture lands or on the wastelands.

all, the cool and clean environment of the state is congenial to the growth of electronic and precision engineering industries.

In order to provide additional incentives to industries and to ensure equitable industrial development and employment generation in the state, the State Government has notified a new industrial policy on 30.12.2004. The new policy envisages accelerating industrial development, employment generation and creating an environment to encourage additional investment in the state. The state has now been categorized into three categories depending upon the extent of industrial development in these areas. Prior to this, the Govt. of India, Ministry of Commerce and Industry, Department of Industrial Policy and Promotion had notified the special package of incentives for industrial units located in Himachal Pradesh on 7th January, 2003.

As a result of these policies to encourage industry a large number of projects proposals have been received in the Department of Industries since January 2003. Today 579 investment proposals from entrepreneurs for setting up industry in the medium and large scale sector have been approved after January 2003. These projects envisage an investment of Rs. 8117 crores and will generate employment opportunities for about 80429.

The department has also approved substantial expansion of the 54 existing units in medium-large scale involving an investment of Rs. 380.01 crores and additional employment to about 2199 people. In addition 4771 units in SSI sector including the expansion of 104 SSI units with an investment of 2749.99 crores and employment opportunities for about 99019 people have been notified on a provisional basis with the Department of Industries since 2003.

Thus, since January 2003 until today a total of 5404 units have been registered/approved with a total investment of Rs. 11247 crores and employment potential of 181642 people.

The Baddi-Barotiwala-Nalagarh area of Solan District has emerged as the textile hub of northern India. Out of 5,04,000 spindles installed in the state, 4,26,000 spindles alone have been installed in this area. This area is also emerging as the largest manufacturing hub of pharmaceutical products in the World.

Efforts are being made to encourage industries which do not have an adverse effect on the environment. For hazardous waste management and common effluent treatment plants at Baddi, land measuring 191.08 bighas has been identified at village Majra Tehsil Nalagarh and the case for transfer of land to the name of the Industries Department has been sent to the Divisional Commissioner. Moreover, it is a Govt. of India Scheme which will be implemented by the local Industries Association.

To ensure a non-polluting and eco-friendly environment a few complexes are being devoted exclusively to promoting specific industries like IT, BT and electronic units. It has been decided that to promote their growth, upstream and downstream industries would also be allowed to be set up there. The department would welcome units based on information technology and software

development. The State Government has also developed a Software Technology Park at Shimla with the help of STPI and a B.T. Park in the vicinity is already on the anvil.

Important reserve of limestone in the state is mentioned below:

14.1 Status of Mineral Reserves:

Minerals constitute a fundamental component of the State's material and economic base. Himachal Pradesh through its history has been variously called as an "Apple bowl", "A Hydel State", and is now on the threshold of becoming the "Cement State" of India as good quality limestone, which is one of the most important ingredients in the manufacture of cement, is available in plenty. At present there are three cement plants in the large and medium sector. Besides about 3 mini cement plants functioning in the State. 4 more large scale cement plants have been approved to be set up in the state based on limestone deposits at Sunder Nagar, Alsindi (Mandi district), Boroh-Shind (Chamba) Bagga-Bhalag (Solan District) and based on the reject of the NMDC mine of Arki, District, Solan. One cement plant based on the Gumma limestone deposit (District Shimla) is under consideration.

Commercially exploitable minerals found in various districts of the state at present are given below:

Table 14.172: Commercially Exploitable Minerals Found in Various Districts

Bilaspur	Limestone. dolomitic Limestone. shale, brick earth, minor minerals like sandstone and bajri.
Kangra	Roofing slate. Brick earth and minor minerals, like sandstone and bajri.
Chamba	Limestone, Roofing slate, magnesite and minor minerals like sandstone and bajri.
Kinnaur	Gypsum and minor minerals like sandstone and bajri
Kullu	Roofing slate, quartzite crystal, mineral water. Semi-presious stone and minor minerals like sandstone and bajri.
Lahaul & Spiti	Antimony-ore, gypsum and minor minerals like sandstone and bajri
Solan	Lime stone, diplomatic limestone, shale, building Stone and minor minerals like sandstone and bajri
Una	Silica boulders and minor minerals like sandstone and bajri
Mandi	Limestone, rock salt, and minor minerals like sandstone and bajri
Hamirpur	Silica-sand boulders and minor minerals like sandstone and bajri
Shimla	Limestone, quartzite, slabs slate and minor minerals like sandstone and bajri
Sirmour	Limestone, Barytes, Gypsum, Shale, quartzite and minor minerals like sandstone and bajri

	Reserve in Million Tonne				District	Reserve in Million Tonne		
	Proved	Estimated	Total			Proved	Estimated	
Lease granted and Cement Plants established	550	200	750	Kashlog-Mangu Limestone Deposit	Solan	130	200	Leased out to M/S GACL and Cement Plant is established at Darlaghat
				Gagal Limestone Deposit	Bilaspur	370		Leased out to M/S ACC and Cement plant is established at Barmana
				Manal Limestone Deposit	Sirmour	50		Leased out to M/C CCI and
								Cement Plant is established at Rajban.
Leases Granted/ deposit allotted Applications invited for setting up of Mega Cement Plant	1200	1550 900	2750	Alsindi Limestone deposit	Mandi	275	550	Leased out in favour of M/S Grasim Industries
				Kiron-Sundernagar Deposit	Mandi	225		Leased out in
				Baroh Sindh Limestone deposit	Chamba	400		favour of M/S Harish Chandra
				Bagga-Bhalag	Solan	300	1000	Leased out in favour of M/S Larson & Turbo
				Guma-Rohana Block	Shimla		900	Alloted in favour of M/S J.P. Industries Application Invited
Other	50	1600	1650	Kothi Limestone deposit	Shimla		750	Investigation is in progress
				Sagraithi Limestone deposit	Shimla		350	Investigation is in Progress
				Jamthal Limestone deposit	Bilaspur		500	
				Arki Limestone 40% undersize of steel grades	Solan	50		Leased out in favour of NMDC (40% of total reserve i.e. 120 million tonnes undersize and can be used for manufacturing of Cement

Total production of the minerals during 2002 to 2005 is given below :

Table 14.173: Production of the Mineral During 2002 to 2005

	Production in 000 MT		
Mineral	2002-03	2003-04	2004-05
Limestone	5901	7001	7281
Baryta	1	1	377
Shale	347	508	620
Building stone	627	127	76
Bajri	1407	740	800
Sand	1326	914	1034
Boulders	824	1455	1415
Rock Salt	1	2	3
Slates	7	17	6
Silica sand	13	0.09	1
Quartzite	32	34	19
Total	10486	10799.09	11632

14.2 Impact of Mining Activity:

Impact of mining activity can be classified in to two categories

1. Negative Impact
2. Positive Impact

Negative Impact (Without Mitigation):

- Land degradation
- Effect on flora and fauna
- Effect on air quality
- Noise pollution
- Impact on water regime
- Aesthetic

Positive Impact:

- Socio-economic impact

The following are important impact of mining on land during operation:

- i) Topography and land scene change due to digging of open pits and dumping of overburden rock mass in the form of the heaps.
- ii) The land use pattern undergoes a change due to the use of the land for mining, dumping and other associated activities.
- (iii) The land use in the surrounding areas may be affected due to the impact of mining on water regime.
- (iv) Polluted water from pits affected the characteristics of the topsoil, affecting the end use.
- v) The damage pattern on the surface undergoes a change due to the alterations in the surface topography due to mining and associated activities.

Effect on Flora and Fauna:

- i) Removal of all vegetation (Flora) and thereby fauna from the area required for mining and other purposes.
- ii) Pollution of water in the surrounding water bodies due to flow of debris on the slope affect the aquatic ecology of water bodies.
- iii) Dust in the atmosphere, contributed by the mining and associated activities, when deposited on the leaves of the plants in the surrounding areas may retard their growth.
- iv) Noise and vibrations due to blasting and operation of the machines drive away wild animals and birds from the nearby forest.

Impact on Air Quality:

- (i) Removal of vegetation from the area designated for mining and other purposes produces dust which when air-borne causes an increase in the concentration of SPM in the surrounding areas.
- (ii) Removal, handling, transportation and storage of soils also causes an increase in the concentration of SPM in the atmosphere. The use of diesel equipment in these activities causes an increase in the level of NO_x.
- (iii) Drilling and blasting of overburden and mineral contribute SPM and explosive fumes into the atmosphere.

The equipment used in the mines for various purposes including transportation of the overburden and mineral generate continuous noise. Blasting produces impulsive noise.

Impact on Water Regime:

- i) Deeper excavation on the surface or underground digging, can causes the water table to sink locally, often drastically, resulting in the drying up of wells and springs of the neighbourhood area or their becoming seasonal. In the hilly terrain, the process of excavating and attendant landslides frequently exposed passages of underground water, thus depriving the springs of their contents.
- ii) Exposure of fresh rocks due to mining initiates weathering with the inevitable generation of substances which cause water pollution. The spoil banks, likewise, contains minerals that weather easily so that production of pollutants takes places at a much faster rate. Among the minerals involved are pyrite, maresite, ankerite and siderite. All these substance adversely affect flora and aquatic fauna.
- iii) Mining activities might impact upon the rivers in a way that water quality includes increased short-term turbidity at the mining site from re-suspension of sediment and oil spills or leakage from excavation machinery and transportation vehicles. Mining activities may, therefore, increase suspended solids and chemical contamination in the water at the site and downstream, and this may adversely affect water users and the aquatic ecosystem. The impact is particularly significant if water users downstream of the site arc abstracting water for drinking/domestic use. Suspended solids can also significantly increase water treatment costs.

Aesthetic:

The removal of vegetation from the mining area and the flow of debris on the slope gives it an ugly look.

Positive Impact:

Mining, particularly small scale mining, is playing significant role in economic upliftment of area without

- Non-displacement of people
- No dilution of cultural heritage

And above all giving employment to thousands of people in their vicinity and checking migration in search of job.

Hot Spots:

- Yamuna River in District Sirmour
- Damtal area in District Kangra
- Nalagarh area in District Solan
- Ghanyara area in District Kangra
- River bcds in old Himachal

Yamuna River in District Sirmour:

In Sirmour District the Department used to auction about 11 river beds which also include Yamuna river bed and its adjoining tributaries like Bata, Tons and Giri) an other rivers total 11 rivers. With effect from 13-9-02, the department is not in a position to auction these 11 rivers from 13/9/02 for want of Forest Department NOC. It is also important that another half of Yamuna river bed is in Uttaranchal State where people are free to lift minor minerals and occasionally also trespass in Himachal Pradesh. Yamuna river bed has a vast interstate boundary and illegal extraction of mineral can not be stopped altogether in such a long stretch. There is every likelihood of illegal extraction, if the riverbed within Himachal is not sit at auction.

Damtal area in District Kangra:

Damtal is a border town of Nurpur sub-division of Kangra Distt. on the western extremity of the District. The stone crushing activities started in the vicinity of Damtal area approximately four decades ago. Initially there were approximately 4 stone crushing units. The number, however, kept on increasing and now it has touched the figure of 132 units all along the border. The detail of growth is as under:

Table 14.174 : Number of Stone Crushing Units

Sr. No.	Year	Old Road	Sirat	Mohtili	Dangu Majra	Lodhawan Milwan	Milwan	Total
1.	1965-1970	-	3	1	-	-	-	4
2.	1970-1975	2	-	3	-	-	-	5
3.	1975-1980	-	2	3	1	-	-	6
4.	1980-1983	2	2	3	-	-	-	7
5.	1983-1986	-	-	4	-	-	-	4
6.	1986-1989	2	3	3	9	-	-	17
7.	1989-1992	7	6	3	16	-	2	34
8.	1992-1995	4	3	7	15	-	-	29
9.	1995-1998	5	-	2	4	9	-	6
					Total			132

The State Government tried to grant mineral concessions in the vicinity of Damtal area by putting Chakki Khad on public auction for the collection of minor minerals but the state govt. was restrained from putting the area under reference to auction as per judgement passed on 11-7-1972 by the High Court of H.P. in CWP No. 76 of 1071 entitled Gram Panchayat Surajpur and others V *Is* State of H.P. on the ground that the mineral rights vest with private individuals and state cannot take over the rights without paying compensation. The mineral rights were subsequently acquired by the state govt. under the H.P Vesting of Miner:11 Rights Act, 1983 and Notification for acquisition of minerals rights under the provision of above Act which were issued on 3-5-1997 and 15-7-1998.

Immediately after notification, the process of collection of relevant details of land in question and crushing units and other technical aspects was started. The crusher owners were asked and persuaded to apply for grant of mineral concession. The state govt. did not think proper to stop stone crushers pending grant of mineral concession as a number of people were engaged in this business and their livelihood depended on these stone crusher and other ancillary units/small business which arrived due to stone crushers. Some people came forward but only a few could get mining leases because of the following reasons:

There have been several reasons for the grant of concession to be delayed. Firstly, nearly 95% of the land over which mineral rights have been acquired by notification dated 3-5-1998 and 15-7-1999 is private land, Shamlat Deh Land and land that belongs to the Temple Trust, Damtal. As many as 132 units are installed on the area or 1000-61-34 hectares over which mineral rights have been acquired by the govt. by notification referred above.

Only 5.52% of the area over which the mineral rights have been acquired vest in the state. The surface rights over the remaining area, amounting to 94.1 R% of the total land acquired, belong to private individuals Temple Trust or Shamlat Deh. The consent of the land owners/right holders is required to be obtained before granting mineral concessions over an area of 942-37-45 Hectares i.e. Shamlat Deh or of private individuals/Temple Trust. Such consent is to be obtained by each person before applying for mineral concessions under the H.P. Minor Minerals (Concessions) Revised Rules, 1971. The process of obtaining such consent is time consuming and is primarily delaying the grant of minerals concessions.

- (a) The biggest area of over 110 hectares having maximum partially workable area is still under the possession of one Himachal Bajri Company as per order dated 10-2-2000 passed by Hon'ble Addl. District Judge-II, Dharamsala in CMA 201/2001 in its favour after the expiry of lease on 18-1-2002.
- (b) Another area of 50 hectares is in the possession of Shri Harbhajan Singh. The Temple Trust has won the case in the High Court but the opposite party has obtained an order of status quo from the Supreme Court of India. Though the revenue entries were changed before the stay order of the Supreme Court, the change of possession has to wait until favourable order is given by the Apex Court.
- (c) That another area of approximately 125 Hectares is under the possession of Shri Ashwani Kumar, Narinder Nath, Gagan Singh, Chhaya Devi by virtue of a lease of 50 years w.e.f. 10-9-1985 to 9-9-2035. This portion is 40 hectares in area where systematic mining can be taken up.
- (d) Approximately 23 hectares of land is under the self-possession of the Temple but it does not hold any area suitable for scientific mining of minor minerals.
- (e) The remaining approximately 7 hectares of land is also under the ownership and possession of Temple Trust but it does not hold any area suitable for scientific mining of minor mineral.

Thus, it is clear that the undisputed land with Temple Trust has no workability from the mining point of view. The possession of the workable temple land is either with the parties who have a valid lease until 2035 or with those who have obtained stay orders from the Court of Add. District Judge-II, Dharamsala and the Supreme Court respectively with respect to the land under their possession. Therefore, the Temple is at present not in a position to give consent for a grant of mineral concession in these areas. As per order of Hon'ble High Court dated 1.7.2000 on mineral can be allowed to be lifted from the land in question in the CWP—until further orders. It is also mentioned here that the land in question under suit is the most probable land for mining. Hence department will not be in a position to grant lease in this area.

Thirdly, it was not possible to close down immediately all the stone crushing units especially in view of employment provided and business opportunities afforded by the existing stone crushers. As many as 126 units were installed in the area even prior to acquisition of mineral rights by the govt. 1997/1998. Nearly 5000 people have been given employment by such units. About 500 trucks are directly engaged with the stone crushing units.

As a time gap arrangement until the mineral concession is granted the state government decided to make a workable arrangement and give implied consent vide its letter dated 20/7/2000 by charging royalty @ Rs. 4000/- per month per unit for first six months and after that as per capacity of the stone crusher. Since the crusher owners were not paying royalty as per conditions laid down in the letter dated 20/7/2000, the state government withdrew the consent vide its letter dated 14/7/2003 so that action could be taken against those who work against the provision of Mines and Mineral (Development & Regulation) Act, 1957 and the Himachal Pradesh Minor Mineral (Concession) Revised Rules, 1971. Until now only 15 stone crusher owners have been given valid mining leases.

The other modalities for grant of lease are under consideration.

Nalagarh Area in District Solan:

Being a border area there is always pressure on the river beds of the Nalagarh area in District Solan for the supply of minor mineral, because the area lies in the centre of the economic development zone. With the coming of many industries in the Nalagarh area again the demand of grit is increased many fold. This is causing concern to the environmentalist that river beds are being mined more than its capacity.

The last auction of river bed in the Nalagarh area was conducted on 22/9/2000. The 18 No. of minor mineral quarries were again notified for auction on 22/5/2001, but due to public objections and to avoid over exploitation of river bed the auction of quarries of Nalagarh area was postponed and no auction was conducted after that.

It is submitted that Vide notification dated 28/2/2004, the Government has formulated a river/stream bed mining policy guidelines and as per this policy it was decided that the first instance and in the interest of systematic/scientific mining and to reduce pressure on river/stream beds, no auction shall be done in border areas, like Nalagarh sub-division and Kasauli Tehsil of District

Solan. where there are chances of over exploitation of river/stream beds and chances of illegal transportation of mineral outside the state. Other border areas will also be included on the basis of study to be conducted.

Because of high demand of grit in the area there is every likelihood of illegal extraction there.

Ghanyara Area in District Kangra:

The history of slate mining in Ghanyara is more than 100 year old and about 200 slate pits were also situated in the Khanyara area of Kangra District under the control of the panchayat, vide Notification dated 1/5/1997 under section 3 of Himachal Pradesh.

Mineral (Vesting of Rights) Act 1983, the government acquired the mineral rights of these Slate quarries. Since the land area under reference fell within the definition of forest land, therefore attracting the provisions of ITA of FCA, 1980, the Department of Industries moved a case for clearance of 25 hectare of land, to M.O.E.F. Govt. of India for diversion of this forest land where scientific mining could be carried out. Clearance from the Ministry of Environment and Forest (M.O.E.F.), Government of India was obtained on 27/9/2000 with certain stipulations particularly with reference to preparation of local Environment Management Plan. This plan was prepared through National Council for Cement and Building Material (N.C.B.M), New Delhi. After approval of this plan by M.O.E.F., the local people were asked to apply for mineral concessions. About sixteen applications have been received and the process is on to grant mineral concession.

The area is prone to illegal mining

River Beds in Old Himachal:

Prior to 9/9/03, the Department used to auction (other than that which is not granted on lease) the following numbers of quarries in various districts.

Table 14.175: Number of Quarries

Sr. No	District	No of River/Khads/Part of River/ Khads
1	Solan	18
2	Mandi	50
3	Kullu	44
4	Shimla	23
5	Sirrnour	11
6	Kangra	33
7	Hamirpur	24
8	Bilaspur	30
9	Chamba	17
10	Una	54
Total		304

In the Year 1952 Forest Department issued two notifications under the provision of Section 29 of Indian Forest Act (X VI of 1967) as applied to Himachal Pradesh. These notifications were:

- Notification No Ft (a) -1/52 dated 15-1-52 vide which the provision of Chapter IV of the Act was made applicable to all such government lands in Bilaspur State which in the Second Land Revenue Settlement have been recorded as the property of the govt. or over which the Govt. has proprietary right.
- Notification No Ft 29-245 -813/49, dated 25/2/52 applicable to all forest land or waste lands in Himachal Pradesh which are property of the govt. or over which the govt. has proprietary right.

The Supreme Court of India in its orders dated 12/12/89 issued interim directions in the writ petition No 202 of 1995 on titled T.N. Godaverman Tirumulkpad versus Union of India and others. Apart from other directions it directed that all the ongoing activity within any forest in any state throughout the country without prior approval of Central Government must cease forthwith. With the applicability of Forest Department, notification dated 25/2/1952 and 15/1/1952 wherein all the waste land in the ownership of govt. has been declared forest land and thus attracting the provision of FCA, 1980. For this reason, department is unable to auction the minor mineral quarries in various part of the Himachal Pradesh Forest Department vide Notification No. FFE-B(F)-8-76/96-loose dated 24th August, 1998, clarified that areas classified as “Gair Mumkin” and “Charagah Bila Drakthan” in revenue records are not included in “Waste Land” for the purpose of Notification dated 25/2/1952 vide Notification No. FFE-B(F)-8-76/96-loose dated 5th December, 1998, the Forest Department further clarified that areas classified as “Nakabil Charand” in the revenue records of Sirmour District are not included in “Waste Land” for the purpose of Notification dated 25/2/1952.

Based on these notifications the department was conducting auctions in Himachal Pradesh (Except Bilaspur District).

The Forest Department vide notification dated 9-9-03 has rescinded its earlier notification 24-X-9X and 5-12-9R wherein lands classified as “Gair Mumkin” ‘Charagah Bila Drakhtan and ‘Nakabil Charand’ have been taken out of the preview of 1952 notification.

Hence at present the department is in a position to auction in only those areas (In the states which were not part of the Himachal Pradesh during 1952, Because of regular demand of sand, stone and bajri for the development activities in the area, the whole area is prone to illegal mining.

Available Reclamation Technology:

Even prior to the amendment of Mineral Conservation and Development Rule, 1988 and National Mineral Policy, 1993, when the concept of scientific mining and environment protection was introduced in mining, Geological Wing of Himachal Pradesh rose to the occasion in 1986 and started thinking about the concept of scientific mining and environmental protection by small scale mining, which was emerging as the lead sector in the economic development. Particularly in

developing countries and in remote areas. In general small sector mining was:

- Unorganized
- Mostly unsupervised
- Lacking technical know how finances
- Poor infrastructure
- Accessibility problem
- Adverse weather and tough climate
- Non-availability of local skilled manpower
- Unstable market
- Non-uniform deposit

But playing a significant role in economic upliftment of area without :

- Non-displacement of people
- No dilatation of cultural heritage
- No law and order problem
- And above all giving employment to thousands of people in their vicinity and checking migration in search of jobs.

Hence an attempt was made in 1986 to make this sector environmentally aware and shift from “No Environment” prior to 1986 to “Know environment”.

Responses:

To achieve this in a phased manner, the following actions were taken :

First Phase:

Although the concept of mining planning came through the amendment in Mineral Conservation and Development Rules on 24/10/1988; it was in June 1986 when the concept of geological working plan was introduced by stopping mid slope mining and starting detail mapping of the limestone mine of Messers Hari Singh Thakur and Sons, District Sirmour and the lessee was directed to :

- Lifting of undersize material/scree lying along slopes and over approach roads and benches
- To dress the benches properly
- To erect retaining walls at the suggested sites
- To spread the top soil in the mined out areas for plantation
- To start mining from the top
- To improve the gradient of the road and to raise the plantation all along the mine road

The mining scenario was completely changed after this as evident from the photographs shown below. The silent features were as:

- Rehabilitation of two benches has been completed.
- Waste material has been dumped at proper place.
- About 25 check dams varying in length from 15 feet to 35 feet, had been raised at all vulnerable points to arrest the flow of debris to retaining walls, one of 187 ft long and another 80-ft have also been raised to channelise rainwater.
- Afforestation work was done in the mined out bench, a total of 19835 plants were planted.

Simultaneously more than 30 geological and mining plans were prepared on cost-to-cost basis and got approved from IBM. The similar action was also taken in other leases.

Second Phase:

A detailed study was conducted by MoEF through CMRI, assisted by Geological Wing, Department of Industries & I.T. Himachal Pradesh, entitled as “Sustainable development planning including limestone mining for Sirmour Region, Himachal Pradesh.

Third Phase (NORAD Project):

Setting up of demonstration site, with an objective to convert the degraded and disfigured slopes of already mined out areas to a safe and stable condition and restore it as closely as possible to pre mining condition, by depicting various techniques of rehabilitation at:

Khajjiar Khalla, district Sirmour under NORAD CO- OPERATION SCHEME.

First demonstration site was established in 1997 at Khajjiar Khalla with the object of converting the degraded and disfigured slopes of already mined out areas to a safe and stable condition and to restore it as closely as possible to pre- mining condition.

The area of about 3 hectare in an operative mine since 1980 was selected because most of the mines are located nearby it.

Silent Features:

Eco restoration plan on the scale of I: 500 land leveling, scaping and fencing.

Total length of breast wall & crate wire wall etc. for Stabilizing -appox 1000 mts.

More than 600 species of trees and many bushes were planted.

Results:

Bakumbar a limestone laying bush survived well in first year.

After area is stabilized Eucalyptus, Gold Mohr, Bamboo started coming well.

Area attained almost pre mining condition in three years.

Photo showing the comparison of area before rehabilitation and after the plantation.

Forth Phase (Aus -Aid Project):

Initially 3 sites in Sirmour District and 3 Sites in Chamba District having different type of problem as well as in another area of H.P. were selected for different simple and low cost lessees, under Aus-Aid Project. The India-Australia Training and Capacity Building Project (IATCBP).

The department successfully established all the above sites in this project :-

- All stakeholders were involved in the rehabilitation programme.

Fifth Phase:

A composite plane was made for Bagan Dhar catchment area because initially the programme was focused in individual lease areas only. Under Environmental Management Capacity Building Technical Assistance Project. Activity 11- C: Demonstration Project (World Bank funded MOEF Project). Bagan Dhar has been selected as it is a ridge acting as a drainage divide where six mines are situated in the catchment. The ill effected slope below the mines of Messrs Satya Tomer and Messrs Sohan Singh and Meet Singh was rehabilitated and now the slope is completely stable with a growth of local bushes on it.

* * * * *

APPENDIX

Environmental Legislations in India

I. Introduction:

The genesis of environmental movement in India in recent times could be traced from the early 1970s. The watershed event in the environmental movement was the participation of the then Prime Minister, Smt. Indira Gandhi, at the Stockholm conference on Human Environment in June 1972. The conference made it evident to all attendees that each nation needed to adopt comprehensive legislation addressing health and safety issues for people, flora and fauna. The Stockholm conference served as the beginning for a series of environmental measures subsequently adopted by the Government of India. India employs a range of regulatory instruments to preserve and protect its natural resources. The Indian judiciary has assumed the active role in matters concerning the protection of the environment. The development of environmental law is largely the story of India's judiciary responding to the complaints of its citizens against environmental degradation and administrative sloth.¹

II. Development of Environmental Legislations in India:

The Constitution of India permits water-related issues to be controlled by the states, so prior regulatory efforts had been considered the domain of the states. In fact, during the 1950s and early 1960s, several states had taken steps about water protection. Laws passed included *The Orissa River Pollution Act of 1953*, *The Punjab State Tubewell Act of 1954*, *West Bengal Notification No. 7 Regulation - Control of Water Pollution Act of 1957*, *Jammu and Kashmir State Canal and Drainage Act of 1963* and the *Maharashtra Water Pollution Prevention Act of 1969*. During the intervening years, other laws have been also passed to address specific issues, including *The Wild Life Protection Act of 1972*,² and *The Atomic Energy Act, 1962*.³ After the amendment in 1987 *the Factories Act of 1948*, empowers the state to appoint site appraisal committees to advise on the initial location of factories that use hazardous processes. In addition to these legislations, the government of India, for the protection of the environment, adopted several other important Acts.⁴

As early as 1962 the Ministry of Health had begun to address water pollution issues by appointing a study committee. The committee made recommendations for both central and state levels action.

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¹ S. Divan & A. Rosencranz, *Environment Law and Policy in India: Cases, Materials and Statutes* (Oxford University Press, New Delhi, 2002), (ed.2nd).

² The Wild Life Act provides for state wildlife advisory boards, regulations for hunting wild animals and birds, establishment of sanctuaries and national parks, regulations for trade in wild animals, animal products and trophies, and judicially imposed penalties for violating the Act.

³ The Atomic Energy Act of 1962, and the Radiation Protection Rules of 1971 govern the regulation of nuclear energy and radioactive substances in India.

⁴ The Mines and Minerals (Regulation and Development) Act of 1957; The Indian Forest Act of 1927; The Insecticides Act of 1968; The Water (Prevention and Control of Pollution) Cess Act of 1977 and the Forest (Conservation) Act of 1980.

Jurisdictional questions remain unsolved between the states and central government, but by 1965 a draft bill was finally being circulated which allowed the states to pass resolutions authorizing parliament to enact legislation on their behalf. By 1969, a bill, the Prevention of Water Pollution, had been introduced, which led to the adoption of a modified version of the *Water (Prevention and Control of Pollution) Act, in 1974*. Institutionalizing a regulatory agency for controlling water pollution marked the first true commitment by the Indian Parliament for the protection of the environment. The Water Act also established the Pollution Control Boards at central and state levels. The Department of Environment (DOE) was created in 1980 to look into matters related to the environment. DOE performed an oversight role for the central government. DOE did environmental appraisals of development projects, monitored air and water quality, established an environmental information system, promoted research, and coordinated activities between federal, state and local governments. Finally, an independent ministry, Ministry of Environment and Forests (MoEF)⁵ was created by the Prime Minister Shri Rajiv Gandhi, in 1985.

In 1981, the *Air (Prevention and Control of Pollution) Act* was passed and, in 1986, Parliament passed the *Environment Protection Act (EPA)*, EPA designed to act as umbrella legislation on the environment. *The Public Liability Insurance Act of 1991*, this Act was enacted to provide immediate relief to the victims of an accident involving a hazardous substance. The Act was amended in 1992 to introduce provisions relating to the relief fund. The *National Environmental Tribunal Act of 1995*, this Act extends the principle of ‘no-fault’ liability, which first received statutory recognition under the *Public Liability Insurance Act*. The *National Environmental Tribunal Act* applies in cases where death or injury to any person or damage to any property is caused by an accident during the handling of any hazardous substance. Both Acts adopted the same definition for the expressions ‘accident’ and ‘handling’. The *National Environmental Appellate Authority Act of 1997*, this statute established a national environmental appellate authority for hearing appeals against orders granting environmental clearance in areas where restrictions are imposed on setting up any industry carrying on any operation or process.

III. Environment Protection under the Indian Penal Code:

Chapter XIV of The Indian Penal Code deals with offences affecting Public Health, Safety, Convenience. Sec. 268 provides that “a person is guilty of a public nuisance who does any act or is guilty of an illegal omission which causes any common injury, danger or annoyance to the public or to the people in general who dwell or occupy property in the vicinity, or which must necessarily cause injury, obstruction, danger, or annoyance to persons who may have occasion to use any public right”. The section further explains that a common nuisance is not excusable on the ground that it causes some convenience or advantage. Other concerned provisions are: a “negligent act likely to spread infection or disease dangerous to life” (Sec. 269 I.P.C.), a “malignant act likely to spread infection or disease dangerous to life” (Sec. 270 I.P.C.), “making atmosphere noxious to health” (Sec. 278 I.P.C.).

⁵ MoEF was more comprehensive and institutionalized, and had a Union Minister and Minister of State, two political positions answering directly to the Prime Minister.

But the essential requirement of the provision to punish a man is the guilty intention of the accused, i.e. either the act of the accused should be negligent, malignant or voluntary, which vitiates the atmosphere. In case of public nuisance, the Penal Code provides for fines up to Rs.200/- by way of punishment (Sec.290I.P.C.) and for making the atmosphere noxious to health Rs.500/- only (Sec.78 I.P.C.). The punishments are too little to meet the objectives. With these inadequate penal provisions, it is not possible to check environmental pollution.

IV. Protection of Environment under the Indian Constitution:

The Indian Constitution is amongst the few in the world that contains specific provisions on environmental protection. The 42nd Amendment to the Constitution, passed in 1976, highlighted this new focus. This amendment included Part IV A under the Indian Constitution, which talks about the fundamental duties of citizens. By 42nd amendment Article 48-A was added under the Directive Principles of state Policy, which highlights the State's responsibility with regard to environmental protection.⁶ It also provided under Article 51(A)(g) for the fundamental duties of citizens and the state to protect and improve the environment.⁷ The Directive Principles of State Policy and the fundamental duties chapters explicitly enunciate the national commitment to protect and improve the environment. In addition to these provisions, the Indian judiciary has widened the horizon of Article 21 of the Indian Constitution and established by various judgments that there is a close relationship between the right to life and to the right to clean environment. Article 21 of the Constitution is a fundamental right, which reads as follows, "no person shall be deprived of his life or personal liberty except according to procedure established by law". Though this Article does not explicitly mention the environment, the Supreme Court and the various High Courts of the country have given a wider interpretation to the word "life" in this Article. According to the courts, the right to life includes the right to a living environment congenial to human existence. Unlike Fundamental Rights, violation of the Directive Principles of State policy or the Fundamental Duties cannot be questioned in a Court.

The subjects related to environment between the State and Centre is mentioned under the Seventh Schedule of the Constitution.⁸ According to Article 246(1), while the Union is supreme to make

⁶ Article 48 (A) states that , "the State shall endeavour to protect and improve the environment and to safeguard the forests and wild life of the country".

⁷ Article 51A(g) imposes duties on every citizen "to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures".

⁸ Union List Entries

52. - Industries

53. - Regulation and development of oil fields and mineral oil resources

54. - Regulation of mines and mineral development

56. - Regulation and development of inter-State rivers and river valleys

57. - Fishing and fisheries beyond territorial waters.

State List Entries

6. - Public health and sanitation

14. - Agriculture, protection against pest and prevention of plant diseases.

18. - Land, colonisation, etc.

21. - Fisheries

23. - Regulation of mines and mineral development subject to the provisions of List-I

24. - Industries subject to the provisions of List-I.

any law over the subjects enumerated in List I, the States, under Article 246 (3), enjoy competence to legislate on the entries contained in List II, and both the Union and the States under Article 246(2) have concurrent jurisdiction on entries contained in List III. In the event of a clash, the Union enjoys a primacy over states in that its legislation in the Union and the Concurrent List prevails over state legislations. According to Article 248 of the Indian Constitution Parliament has residuary powers to legislate on any matter not covered in the three Lists.

In India there are more than 200 central and state statutes that have some bearing on environmental protection.⁹ Because environmental protection ultimately stems from the right to life, the Indian Constitution is the primary reference for all other environmental regulations in the country. The Indian Constitution protects the right to life¹⁰, obligates the state to secure the health of its citizens,¹¹ and defines the need of the State to protect and improve the environment.¹² The Indian Constitution contains specific provisions for environmental protection. These provisions have guided the interpretation of many environmental public interest cases and have been cited by the Supreme Court as the justification for its activism.

V. Environmental Impact Assessment:

In order to predict the impact on the environment of development activity and to provide an opportunity to mitigate negative impact and enhance positive impact, the *Environmental Impact Assessment* (EIA) procedure was developed in the 1970s. An EIA may be defined as a formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and to augment the positive. In India, the Ministry of Environment and Forests introduced the EIA law through a gazette notification passed on 27 January 1994, for obtaining “environmental clearance” for certain types of projects. To make it more participatory the provision of “public hearing” was added, which was definitely a step forward. The main EIA notification has been amended seven times in the past eight years. A recent amendment to the EIA requirements that was notified on 13 June 2002 exempting pipeline projects from preparation of EIA reports. However, the latest amendment reconstitutes the requirement that EIA reports must be made available to the public *prior* to the Public Hearings, a requirement that was done away with earlier. This amendment was also made without issuing notice to the public asking for their opinions and comments stating that it was in the “public interest

Concurrent List Entries

- 17A. - Forests
- 17B. - Protection of wild animals and birds
- 20. - Economic and social planning
- 20A. - Population control and family planning

⁹ Report of the Tiwari Committee for Recommending Legislative Measures and Administrative Machinery for Ensuring Environment Protection (1980), Department of Science and Technology, Government of India.

¹⁰ Article 21 states that “No person shall be deprived of his life or personal liberty except according to procedure established by law.”

¹¹ Article 39(e) “that the health and strength of workers, men and women, and the tender age of children are not abused . . .”.

¹² Article 47 “the State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties . . .”

not to do so”. Section 3 of the Environment Protection Act, 1986 (EPA) under which the EIA notification has been issued, authorizes the Central Government to take measures for, “protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.” Naturally, it follows that anything derived under Section 3 of the EPA should be for the purpose of preserving the environment and controlling pollution.

The EIA notification of 1994 made it mandatory for the Impact Assessment Agency (IAA), i.e. the Ministry of Environment and Forests, to consult a committee of experts before granting environmental clearance to a particular project. In its present amended form the notification states that the IAA *may* consult the committee of experts if deemed necessary. The 1994 notification made it mandatory for half-yearly compliance reports prepared by the project authorities to be made publicly available. The notification now leaves it to the discretion of the IAA to make complaint reports publicly available, “subject to public interest”.

VI. Air and Water Acts:

The Water Act of 1974 represents one of India’s first attempts to deal comprehensively with environmental issues. Parliament has adopted minor amendments to the Act in 1978 and revised the Act in 1988 to conform more closely to the provisions of the EPA. The Water Act is comprehensive in its coverage, applying to streams, inland waters, subterranean waters, and sea or tidal waters. The Act provides for a permit system or ‘consent’ procedure to prevent and control water pollution. Sections 41 to 45 of the Water Act deal with civil and criminal penalties for the violation of its provisions.

Unlike the Water Act, which was enacted by Parliament under Article 252(1) of the Constitution after securing enabling resolutions from 12 states, the Air Act was enacted by invoking the Central Government’s power under Article 253 to make laws implementing decisions taken at international conferences. The Air Act of 1981, as amended in 1987, contains several interesting features. According to Section 19 the Act grants discretion to each state government to designate particular areas as ‘air pollution control areas’. Section 22 A of the Act enables a magistrate to restrain an air polluter from discharging emissions, and Section 31 A empowers both the Central and State boards to give directions to industries which, if not followed, can be enforced by the board’s closing down the industry or withdrawing its supply of power and water.

To fulfill its obligation to protect the environment, the government established pollution control enforcement structures through the passage of the Water (Prevention and Control) Act of 1974 and Air (Prevention and Control) Act of 1981. These acts established the Pollution Control Boards (PCBs) under the Department of Environment at both state and the national levels to develop and enforce emission standards on polluting industries. Since their inception, the Boards have relied upon the Courts to assist them in closing industries that refused to comply with existing environmental regulations.¹³ However, due to a chronic lack of funding, the Boards have been less effective in the enforcement of environmental regulations.

¹³ Article 22 A of the Air (Prevention and Control of Pollution) Act.

The PCBs have a two-tier administrative structure composed of the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) for each state. The CPCB meets only once every three months and is responsible for setting up emission standards, coordinating the actions of the SPCBs, and taking other necessary administrative action. The SPCBs implement the policies set forth by the CPCB, mainly through monitoring pollution levels of various industries. Furthermore, each SPCB is encouraged to create and enforce its own emissions standards, provided these restrictions are more stringent than those set by the CPCB. Although the SPCBs were originally rather ineffective, the amendments to the Air Act in 1987 sought to increase industrial compliance by giving the SPCBs the power to cut off the water and electricity supply to industries that violated the emission standards set forth by the PCBs, effectively forcing industries to comply with environmental regulations.¹⁴ In practice, there are great variations among the SPCBs. The staff size in each office varies widely; some offices have twice the staff of others. The SPCBs also differ greatly in the number of cases brought against polluting industries. Notwithstanding the disparities and inefficiencies in India's pollution control machinery, the courts have been a recourse for those interested in compliance with and enforcement of environmental regulations.

VII. The Environment (Protection) Act, 1986:

The Environment Protection Act (EPA), 1986, was designed to act as an umbrella legislation on the environment. The EPA became the omnibus legislation regulating air, water and land from environmental pollution and mismanagement. The EPA was adopted in the background of the 1984 gas disaster of Bhopal. The EPA, being a child of this horrific tragedy, gave citizens the right to file cases against industry. It legitimized the role of citizens in managing the environment. The responsibility entrusted to administer the new legislation also fell to the central and state pollution control boards. The landmark bills, mentioned above, are not the only remedies for pollution control boards through which to enforce their environmental powers. Due to deficiencies in the Water Act, some state boards have been successful in persuading Magistrates to use sections of the Criminal Procedure Code to control water pollution. The code vests powers in the Magistracy for the removal of a "public nuisance".

Section 3(1) of the Act empowers the centre to take all such measures as it deems necessary or expedient for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution. The Central Government is empowered by this Act to set new national standards for the quality of the environment as well as standards for controlling emissions and effluent discharges; to regulate industrial locations; to prescribe procedure for managing hazardous substances; to establish safeguards for preventing accidents; and to collect and disseminate information regarding environment pollution. Section 23 of the Act empowers the centre to delegate its powers and functions to any officer, state government or any authority. According to section 15, any case of non-compliance or contravening any of the provisions of this Act, or the rules made or orders or directions issued thereunder, will be punishable with

¹⁴ Article 31 of the Air (Prevention and Control of Pollution) Act.

imprisonment for a term which may extend to five years or with fine which may extend to one lakh rupees, or with both, and in case the failure or contravention continues, with an additional fine which may extend to five thousand rupees for every day during which such failure or contravention continues after the conviction for the first such failure or contravention. If the failure or contravention referred to in sub-section 15 (1) continues beyond a period of one year after the date of conviction, the offender shall be punishable with imprisonment for a term, which may extend to seven years.

VIII. Protection of Environment in Himachal Pradesh:

The State of Himachal Pradesh falls in the Himalayan region which is ecologically one of the most fragile areas on earth. In order to protect the environment and control all types of pollution, EPA 1986 provides various rules under the Act. According to these rules the Deputy Commissioner/ District Collectors have been declared “Prescribed Authority” for enforcement of these rules in the state. The rules framed under EPA are as follows:

1. The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989
2. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules 1996
3. Recycled Plastics (Manufacture and Usage) Rule, 1999
4. Noise Pollution (Regulation and Control) Rules, 2000
5. Municipal Solid Waste (Management and Handling) Rules, 2000

The Deputy Commissioners/ District Collectors in the state are empowered to implement the above-mentioned rules in their respective territorial jurisdictions. It goes further and stipulates that any lapse in this regard shall render the Prescribed Authority responsible for negligence in his duties.

A. Efforts by the Himachal Pradesh Government:

- (i) *Disturbance to natural drainage and thereby increasing threats to Environment and existence* : The Himachal Pradesh Town & Country Planning Act, 1977, Rules 1978 and Development Plans prepared thereunder emphasize upon eco-friendly development in accordance with natural imperatives including drainage. The natural drainage lines are of vital concern for human and animal lives. On part of the Himachal Government all out efforts have been made to enforce effectively provisions of Act, Rules and Development Plans/ Sectoral Plans, so that precious human and animal lives as well as property are safeguarded from potential hazards.
- (ii) *Implementation of ban on Polythene Bags of Certain Dimensions w.e.f 14 June 2004:* The Government of Himachal Pradesh has prohibited the use of polythene (and other similar

¹⁵ This ban has been imposed by Notification No. STE-A(3)-4/2003 dated 4 June 2004.

material)¹⁵ carry bags by stockiest, traders, retailers and venders of all kinds of commodities within the State of Himachal Pradesh, if size and thickness of bags are less than 18” x 12” and 70 microns respectively.

- (iii) *Segregation of Non-bio Degradable Waste* : According to Section 4 of the Himachal Pradesh Non-Biodegradable Garbage (Control) Act, 1995 (i.e. Municipal Corporation, Municipal Councils and Nagar Panchayat) local authorities are legally responsible for providing receptacles or places for deposit of non-biodegradable garbage. The owners and occupiers of lands and buildings are also expected to segregate the non-biodegradable garbage at the source level only. Non-compliance with the statutory functions is an offence under the Act.

It is clear from the above discussion that the State Council for Science, Technology & Environment, State of Himachal Pradesh, has been taking note of the development taking place in the protection of environment nationally and internationally. The state government is conscious of its obligations under the EPA, 1986 and other relevant instruments for protection of the environment and its enforcement at the state level.

IX. Role of the Judiciary in Developing Environmental Jurisprudence in India:

The judge’s responsibility for delivering justice is no longer largely confined to presiding over a trial and acting as arbiter between the conflicting positions of the claimant and the defendant or the prosecution and the defence. The role of the judiciary, individually and collectively, is to be proactive in the delivery of justice. To take on new responsibilities, so as to contribute to the quality of justice. At the forefront of these new responsibilities is achieving access to justice for those within the judge’s jurisdiction. One of the fundamental pillars of governance is access to justice. The notions of governance and the rule of law are intrinsically intertwined and that the judiciary—as the final arbiter in human affairs—has both the responsibility and the duty to dispense justice with regard to both the rule of law and the rules of good governance.

Environmental jurisprudence in India, especially over the past two decades, provides illuminating evidence of the rise of proactive judicial engagement in resolving disputes that require delicate balancing of competing and compelling interests. For example, judges have attempted to balance promoting the wellbeing of people and alleviating poverty and preserving the integrity of the environment and advancing the imperatives of economic development. Environmental law is a comparatively new branch of law; the judiciary is positioned to actively influence the law’s normative development.

In the last thirty years following the emergency period, the Supreme Court has continued to reinvent itself. Taking on the role of “the last resort of the oppressed and bewildered,”¹⁶ the Court initiated a period of judicial activism in a wide range of legal areas. One of the most important judicial

¹⁶ *State of Rajasthan v. Union of India*, (1977) 3 S.C.C. 592.

reforms came with the establishment of Public Interest Litigation (PIL), which enables any citizen to bypass ordinary legal proceedings and appeal directly to the Supreme Court to protect his/her fundamental rights. The Supreme Court, in its interpretation of Article 21, has facilitated the emergence of environmental jurisprudence in India, while also strengthening human rights jurisprudence. There are numerous decisions wherein the right to a clean environment, drinking water, a pollution-free atmosphere have been given the status of inalienable human rights and, therefore, fundamental rights of Indian citizens.

A. Municipal Council Ratlam vs Vardhichand and ors.

In *Municipal Council Ratlam vs Vardhichand and ors*¹⁷, the residents of a locality within the limits of Ratlam Municipality, tormented by stench and stink from open drains and public excretions of nearby slum dwellers. Petitioner moved the Sub-Divisional Magistrate under Sec. 133 Cr.P.C. Section 133 give power to magistrate to take action in case of public nuisance. The Sub- Divisional Magistrate, Ratlam, was moved to take action under S.133 of Cr.P.C. to abate the nuisance by ordering the municipality to construct drainpipes with the flow of water to wash the filth and stop the stench flowing towards the members of the public. The Municipality pleaded paucity of funds as the chief cause of disability to carry out its duties. The Magistrate gave directions to the Municipality to draft a plan within six months for removing the nuisance. The High Court approved the order of the Magistrate, to which the Municipality further appealed to the Supreme Court. An act of negligence may also constitute a nuisance if it unlawfully interferes with the enjoyment of another's right in the land. Similarly, it may also amount to a breach of the rule of strict liability in *Rylands vs Fletcher*,¹⁸ if the negligent act allows the escape of anything dangerous, which the defendant has brought on the land.

The issue was whether a Court could compel a statutory body to carry out its duties to the community by constructing sanitation facilities. The Supreme Court upheld the order of the High Court and directed the Municipality to take immediate action within its statutory powers to construct a sufficient number of public latrines, provide a water supply and scavenging services, to construct drains, cesspools and to provide basic amenities to the public. The Court also accepted the use of Sec. 133 Cr.P.C for the removal of public nuisance. A responsible municipal council constituted for the precise purpose of preserving public health and providing better finances cannot run away from its principal duty by pleading financial inability.

B. Subhash Kumar vs State of Bihar:

In *Subhash Kumar vs State of Bihar*,¹⁹ the petitioner filed a public interest petition under Article 32 of the Constitution, pleading infringement of the right to life guaranteed by Article 21 of the Constitution, arising from the pollution of the Bokaro river by the sludge/slurry discharged from the washeries of the Tata Iron and Steel Company Ltd. (TISCO). It was alleged that as a result of the release of effluent into the river, its water was not fit for drinking purposes or for irrigation.

¹⁷ *Municipal Council Ratlam v Vardhichand and ors*, AIR 1980 SC 1622

¹⁸ (1868)LR 3 HL 330.

¹⁹ *Subhash Kumar v. State of Bihar*, AIR 1991 SC 420

The respondents on their part established that TISCO and the State Pollution Control Board had complied with statutory requirement and that the petitioner was motivated by self-interest. The Court observed that Article 32 is designed for the enforcement of fundamental rights. The right to life enshrined in Article 21 includes the right to enjoyment of pollution-free water and air for the full enjoyment of life. If anything endangers or impairs the quality of life, an affected person or a person genuinely interested in the protection of society would have recourse to Article 32. PIL envisages legal proceedings for vindication or enforcement of the fundamental rights of a group of persons or community, which are not able to enforce their fundamental rights on account of their capacity, poverty or ignorance of law. However, PIL litigation cannot be resorted to satisfy a personal grudge or enmity. Personal interest cannot be enforced through the process of court under Article 32 in the grab of PIL. Since the instant case was motivated by self-interest, it was accordingly dismissed with a warning to all such people who would approach the court for fulfilling personal goals.

C. M. C Mehta vs State of Orissa²⁰

A writ petition was filed to protect the health of thousands of innocent people living in Cuttack and adjacent areas who were suffering from pollution from sewage being caused by the Municipal Committee, Cuttack and the SCB Medical College Hospital, Cuttack. The main contention of the petitioner was that the dumping of untreated waste water of the hospital and some other parts of the city in the Taladanda canal was creating health problems in the city. The state, on the other hand contended that a central sewerage system had been installed in the hospital and that there is no sewage flow into the Taladanda canal as alleged. Furthermore, it was asserted that the State had not received any information relating to either pollution or of an epidemic of water borne diseases caused by contamination of the canal. Also, the health department shrugged off the responsibility for supplies of drinking water and passed the responsibility to the Municipality, which refuted the contentions of carelessness and callousness.

The Court reprimanded the authorities and directed the government to immediately act on the matter. Also, the court recommended the setting up of a committee to take steps to prevent and control water pollution and to maintain the wholesomeness of water meant for human consumption amongst other things. Responsible Municipal Council is constituted for the precise purpose of preserving public health. Provision of proper drainage system in working conditions cannot be avoided by pleading financial inability.

The Ratlam Municipality case emphasizes the substantive law and, equally importantly, the procedural law bearing upon environmental and ecological conservation and the defence against pollution. *Rural Litigation and Entitlement Kendra vs State of Uttar Pradesh*,²¹ is significant as the first case requiring the Supreme Court to balance environmental and ecological integrity against industrial demand for forest resources. The case arose from haphazard and dangerous limestone quarrying practices in the Mussoorie Hill range of the Himalayas. The Supreme Court

²⁰ *M. C Mehta v State of Orissa* , AIR 1992 Ori 225

²¹ *Rural Litigation and Entitlement Kendra v. State of Uttar Pradesh*, AIR 1985 SC 652.

played an activist role in this litigation, essentially conducting a comprehensive environmental review and analysis of the national need for mining operations located in the Dehradun valley. In addition, the Court provided for the funding and administrative oversight of reforestation of the region. The Court also passed five comprehensive interim orders on the judicial understanding that environmental rights were to be implied into the scope of Article 21.

The Indian courts have successfully adopted specific environmental law principles from international environmental law jurisprudence and have combined a liberal view towards ensuring social justice and the protection of human rights. These principles have been incorporated in the Indian environmental jurisprudence and play a key role in decisions of judges even when not explicitly mentioned in the concerned statute.

D. Precautionary Principle:

A new principle for guiding human activities, to prevent harm to the environment and to human health, has been emerging during the last 10 years. First time, in India, in *Vellore Citizens' Welfare Forum vs Union of India*,²² the Supreme Court explicitly recognized the precautionary principle as a principle of Indian environmental law. In *S Jagannath vs Union of India (Shrimp Culture Case)*,²³ Justice Kuldeep Singh observed that the authority to deal with the situation created by the shrimp industry and issue remedial directions consistent with the precautionary and polluter pays principles. The Court drew out the development of the precautionary principle in clear terms in *A.P. Pollution Control Board vs Prof M.V. Nayudu*²⁴. In the *Narmada Bachao Andolan vs Union of India*²⁵, the Court explained that, “when there is a state of uncertainty due to the lack of data or material about the extent of damage or pollution likely to be caused, then, in order to maintain the ecology balance, the burden of proof that the said balance will be maintained must necessarily be on the industry or the unit which is likely to cause pollution”. Refusing to apply the “precautionary principle” used in cases dealing with inherently polluting activities such as heavy industries, the Court accepted the contention of the respondents that the project would have a positive impact by arresting the ecological degradation at present taking place in the drought-prone areas of Gujarat and Rajasthan, leading to sustainable agriculture and the spread of green cover. The generation of hydropower would avoid the air pollution that would otherwise take place by thermal generation. The movement towards adopting the precautionary principle has definitely widened the scope of corporate accountability but the interpretation taken by the court mitigates the relevance and incorporation of this principle in Indian Jurisprudence.

E. The “Polluter Pays” Principle:

The Supreme Court has come to sustain a position where it calculates environmental damages not on the basis of a claim put forward by either party, but through an examination of the situation

²² *Vellore Citizens' Welfare Forum v. Union of Indi*, AIR 1996SC 2715

²³ *S Jagannath v Union of India*, AIR 1997SC 811

²⁴ *A.P. Pollution Control Board v Prof M.V. Nayudu* , AIR 1999 SC 812

²⁵ *Narmada Bachao Andolan v Union of India*, AIR 2000SC 3751

by the Court, keeping in mind factors such as the deterrent nature of the award. The Supreme Court with the introduction of the principle of absolute liability in *M.C Mehta v Union of India*²⁶ calculates environmental cost keeping in mind factors such as the deterrent nature of the award. The polluter pay principle has been held to be a sound principle by the Supreme Court in *Indian Council for Enviro-Legal action vs Union of India*.²⁷ In *Vellore Citizen's Welfare Forum vs Union of India*,²⁸ the Court observed that any principle evolved on behalf of this should be simple, practical and suited to the conditions obtaining in this country. The Court ruled that "once the activity carries on is hazardous and inherently dangerous the person carrying such activity is liable to make good the loss caused to any other person by his activity irrespective of the fact whether he took reasonable care while carrying on his activity". In *Narmada Bachao Andolan vs Union of India*²⁹ it was observed that: "Sustainable development means what type or extent of development can take place, which can be sustained by nature/ecology with or without mitigation". In *Vellore Citizen's Welfare forum vs Union of India*³⁰, the traditional concept that development and ecology were opposed to each other was rejected and sustainable development was adopted. In *State of Himachal Pradesh vs Ganesh Wood Products*³¹, the Supreme Court recognized the significance of inter-generational equity and held a government department's approval to establish forest based industry to be because it is contrary to public interest involved in preserving forest wealth, maintenance of environment and ecology and considerations of sustainable growth and inter-generational equity.

X. Conclusion:

The Supreme Court, in its interpretation of Article 21, has facilitated the emergence of an environmental jurisprudence in India, while also strengthening human rights jurisprudence. There are numerous decisions wherein the right to a clean environment, drinking water, a pollution-free atmosphere have been given the status of inalienable human rights and, therefore, fundamental rights of Indian citizens.

Jurisprudence developed by the Courts in India demonstrates that there is an increasing willingness among judges to carry out their functions in a proactive manner within the constitutional limitations of the separation of powers. In doing so, they seek to reconcile the series of compelling and conflicting interests in order to achieve a perceptive and sensitive equilibrium. These decisions will balance the wider social, economic, and environmental interests that deliver justice within the framework of the rule of law. By providing judicial recognition to the set of emerging concepts, norms, and principles that comprise environmental law, judiciary is playing a primary role in strengthening environmental governance.

²⁶ *M.C Mehta v Union of India*, AIR 1987 SC 965

²⁷ *Enviro-Legal action v Union of India*, AIR 1996 SC 1446

²⁸ *Vellore Citizen's Welfare Forum v Union of India*, AIR 1996SC 215

²⁹ *Narmada Bachao Andolan v Union of India*, AIR 2000SC 3751.

³⁰ *Vellore Citizen's Welfare Forum v Union of India*, AIR 1996 SC 2715

³¹ *State of Himachal Pradesh v. Ganesh Wood Products* AIR 1996 SC 149

Environmental Accounting

Background:

Natural resources are valuable commodities provided to us by Mother Nature. Since human beings are not involved in their production, it must thus be accepted that these resources are nothing but nature's precious gift to us. The very definition of *natural resources*, therefore, burdens us with the responsibility of not acting in a way to humiliate nature. Unfortunately this has not often been the case and human greed is resulting into resource use patterns that are reflecting adversely on the status of natural resources. The socio-economic and ecological view of natural resource use, which emphasizes the need for sustainable use these resources over generations, is gaining grounds. Declining status of natural resources has been of concern to the planners because of their pivotal role as factors of production. These resources are the important components of natural environment and sustainability of the socio-economically desired activities depends upon the sustainability of each of these resources.

Environmental awareness was heightened in some sections of industrialized society during the 1960s as a result of widespread environmental pollution. The most mainstream economists, however, believed that economic growth was sustainable. It was felt that the depletion effect of resources would be countered by technical change, recycling and substitution. The level of economic activities influences the status and quality of natural resources and the environment, and this in turn also influences the path and level of future economic activities. The 1992 World Development Report on development and environment stressed that there can be no differences between the goals of development policy and environmental sustainability. Without adequate environmental protection, development is undermined and "without development, capital will be inadequate for needed investments, and environmental protection will fail". The efforts to address this paradoxical situation lead to the thinking on need to consider the true value and contribution of the environmental resources in national income accounting.

Traditionally, national income is defined as "a certain net aggregate of commodities, material and immaterial, including services of all kinds, and the net income due on foreign account," produced annually by the labour and capital of a country acting on its natural resources. Here, emphasis is on the measure of economic activities in a given year. This system of national accounts, however, does not take into account the impact of various economic activities on the natural environment of the country. In a sense, the system seems to assume that the stock of natural resources and the environment are given and non-deteriorating. This view need modification, and fortunately is changing fast even at the lower level of income accounting.

System of National Income Accounting:

As far as income accounting is concerned, Hicks (1940, 1948) provided the basic principle to define income as a welfare indicator. He advocated that all current consumption that does not impoverish future consumption should be included in the income measure. Obviously, expenditure

on private and public consumption are part of this welfare indicator. Such welfare benefits emerge out of the use of resources of the economy; examples are labour, land, manmade capital, material produced by various production processes and so on. However, manmade capital, as a stock is part of the national wealth and is used as an input in the production of commodities and services. This production may lead to depreciation of the capital used. If this depreciation is not accounted as a cost in the current income accounts, the current state of the economy is made to look better, whereas in reality there remain a smaller stock of capital for future use. This leads to lower level of production and reduced welfare in the future at the cost of an inflated welfare shown in the current accounts. The Hicksian solution is to account for all such depreciation as costs in current income accounting. This is how a concept of net domestic product evolved.

In most countries, national income accounts have a way to adjust the net contribution by manmade capital. One can get a reasonably perfect natural resource accounting if the same is attempted for natural resource as well. For any accounting year, some further adjustments such as adjusting for change in the stock of goods (which have neither been consumed or invested, nor exported) may become necessary. The method of system of national account (SNA) is basically mathematical treatment of all flows of income or goods and services in the economy in an accounting year.

Sustainable Accounting:

Natural resources such as soil, water, forests, minerals, wildlife, contribute towards national income. In an economic sense these can thus be termed as natural capital. Not considering this natural capital in income accounting would result into either an underestimation or overestimation of the income. As for example, any regeneration or deforestation of forests changes their potential to contribute to income. Sustainable accounting allows better understanding of linkages between environment and development. The SNA has one basic deficiency that it does not take note of such production and consumption processes for which there does not exist a market price. Improvement in the methodology of SNA were debated in early 1990s at the United Nations Conference on Environment and Development (Rio de Janeiro, 1992), which recommended that all nations develop a system of integrated environmental and economic accounting (IEEA). The main objective of IEEA is to integrate environment and social dimensions in the accounting framework to arrive at Green-GNP. The statistical division of the United Nations, in 1993, came up with a revised SNA describing the method of this system of environmental and economic accounting. Some of the major steps for such an accounting system are:

- Identification of environmentally related economic activities
- Physical accounts of these sectors/activities: stocks, flow and changes in stocks, factors affecting the changes in stocks
- Valuation of the changes in stocks and flows
- Aggregation of values

These and various other efforts show the global concerns for development without natural environmental destruction. As noted above, some nations have already started modifying their

systems of national accounts to consider environmental *pluses* and *minuses*. It is now a well-accepted fact that the sustainability of economic activities and thus that of economic growth is dependent on sustainability of our natural resources and on the quality of natural environment. The emphasis on satellite environmental and economic accounting (SEEA) also reflects the gravity of these concerns. This shows that our faith in traditional indicators of economic growth, as sole indicators of economic growth and social welfare is shaking for good, as we feel more and more concerned about quality and sustainability of natural environment.

Types of Environmental Accounting:

Environmental accounting, as noted, is becoming increasingly relevant and necessary. Environmental accounting, however, does not make the traditional system of accounting obsolete. In fact, it charges the planners and policymakers with the responsibility of considering environment in all planning processes as well and to enlighten people to better appreciate environment. At the same time, it requires of them a better understanding of the economic and social implications of deteriorating natural environment. Merely modifying the components of GDP would not matter unless there is a larger acceptance of the need to do so. Since the micro-level actions of the firms/producers or administrative units contribute towards environmental changes at a larger level, it is important that environmental accounting becomes a part of the management system at the firm/producer's level as well. The US environmental protection agency (EPA, 1995) describes the following three types of environmental accounting.

Type of Environmental Accounting	Focus	Audience
1. National income accounting	Nation	External
2. Financial accounting	Firm	External
3. Managerial accounting	Firm, facility, a system, or a product line.	Internal

As pointed out above, the national income accounting is a macro-economic measure. Gross Domestic Product (GDP) is the sum of goods and services produced in a country in a year. The 'higher the better' principle of looking at traditional national income accounts often ignored the costs of environment. Environmental accounting takes note of these costs and reflects a long-term view of development without destruction. Considering defensive expenditure made on environmental protection activities, user cost in resource extraction and environmental services and damages, adjustments in GDP are now being made in many countries. The first approach is based on the idea that ecological and economic concerns are interdependent. It considers the expenditures made on environmental protection to safeguard people against the ill effects of pollution, as well as for maintaining the usability of natural resources. The environmental resources are scarce goods with positive shadow prices and this needs to be reflected in our accounting procedure as well to promote their judicious use. The user cost approach to adjustments in GDP considers the problem of resource depletion. User cost is the value of the satisfaction foregone by the user for not using the resource. El Serafy (1989) proposed a methodology to take user-

cost into consideration while estimating national income. Similarly, Peskin proposed a methodology to make adjustments in GDP by considering environmental services and environmental damages to arrive at the figure of adjusted GDP {adjusted GDP = GDP + (environmental services – environmental damage)}.

The natural capital which, in general, is taken to include stocks of natural resources, land and ecosystem provide many services. The services provided by the natural environment can be grouped as (i) provision of raw material and other input for economic activities, (ii) amenity and living space, (iii) the context within which we all live and (iv) ecosystem functions, particularly assimilative capacity like landfills and carbon sinks. Human consumption inevitably creates wastes, in the air, in water, and on land. We need the physical environment to decompose and render safe the by-products of our economic activities. Sometimes this process is slow and takes centuries and on occasions it does not seem to have happened at all. The first law of thermodynamics states that matter and energy cannot be created or destroyed. Thus the total materials and energy used in economic processes must emerge eventually as residuals from it. These residuals, sometimes deliberately placed at a given site (dumping grounds, sewage in the streams, air in atmosphere), are often the source of environmental problems. The implication of all this, in general, is that as the scale of economy grows the burden placed on the environment also increases. Finally, there are still other types of goods/services, some of which are intangible. These include clear air and water, bio-diversity, aesthetically important open space and sites. These amenity functions are becoming increasingly important at the present time and are at the core of environmental accounting.

The other type of environmental accounting, though not very common at macro level, relates to financial accounting at the firm's level. Macro aggregates are derived from these micro level realities. Hence accounting at micro level gains importance not only from the point of view of accounting entry but also from the point of view of authenticity of national (green) income estimates. The managerial accounting relates to the “processes of identifying, collecting and analyzing information, primarily for internal purposes”. This exercise helps in better planning and directing management to make informed decisions about the products and services for selecting environmentally safe production processes. Management accounting has thus been defined as the “the process of identification, measurement, accumulation, analysis, preparation, interpretation, and communication of financial information used by the management to plan, evaluate, and control within an organization and to assure appropriate use of and accountability of its resources.

In the capital approach the national income can be defined as the amount that a nation can collectively spend during a period without depleting the capital base upon which it relies to generate this income. Economists also emphasize the role of human and social capital along with the natural capital. Another approach to sustainable development refers to economic, social and environment needs, which must also be simultaneously sustainable.

Valuation of Environmental/ Natural Resources:

Value of a resource lies in its use or potential use as perceived by the consumers. Conceptually, therefore, the *total economic value* (TEV) of a natural resource consists of its (i) use value (UV) and (ii) non-use value (NUV). Use value consists of direct use value (DUV) and the indirect use value (IUV) and the option or potential use value (OV). In estimating the total economic value of a resource a care has to be taken not to double count both the value indirect supporting functions and the value of the resulting direct use. The non-use value consists of existence (EV) and bequest values (BV). These relationships are summarized as under.

$$\begin{aligned}
 TEV &= UV + NUV \\
 \text{Or, } TEV &= (DUV + IUV + OV) + (NUV) \\
 \text{Or, } TEV &= (DUV + IUV + OV) + (EV + BV)
 \end{aligned}$$

Munasinghe (1993) provides the following description of the concepts used in environmental valuation.

- Direct use value is determined by the contribution that environmental assets make to current production or consumption.
- Indirect use value includes the benefits that the environment provides to support current production functions like natural filtration of polluted water or recycling of nutrients.
- Option value is basically the premium that consumers are willing to pay for an unutilized asset, simply to avoid the risk of not having it available in the future, and
- Existence value arises from the satisfaction of merely knowing that the asset exists, although the person assigning the value may not have any intention of using it in the near future.

Causes and Characteristics of Environmental Damage:

Any attempt to remedy environmental damages requires the full perception of the causes as well as the characteristics of these damages. An early approach to illuminate this issue was the *I = PAT* formula (Ehrlich and Holdren 1971; Holdren *et al.* 1995) where, I is environmental impact, P is population, A is consumption per person (affluence) and T represents the technology or the impact per consumption. The pressure points on the natural environment are evident from the relation, which implies the role of the size of population, consumption pattern and the state of technology in use. By considering some disaggregation of the components of this relation, the damage is thus estimated as follows.

$ \begin{aligned} \text{Damage} = & \text{Population} \times \text{economic activity per person (affluence)} \times \text{resource} \\ & \text{use per economic activity (resources)} \times \text{stress on the environment} \\ & \text{per resource use (technology)} \times \text{damage per stress (susceptibility)} \end{aligned} $

All these efforts are aimed at optimal use of natural resources for sustainable development which has also been defined as “a relationship between dynamic human economic systems and larger dynamic, but normally slower-changing *ecological systems*; in which (a) human life can continue indefinitely, (b) human individual can flourish, (c) human culture can develop, but (d) in which effects of human activities remain within bounds, so as not to destroy the diversity, complexity, and function of *ecological life support system*” (Costanza, 1991). Therefore, adjustments in national income are important to convert the pure economic growth indicators to that of welfare indicators.

Market Valuation:

Valuation of resources for which a market exists is relatively straightforward. For example, stocks of non-produced fixed assets, such as land, could be valued by applying the market prices observed in market surveys. If these assets are not marketed, the market price of similar assets could be used. The flow of services of marketed, but non-produced fixed assets can be estimated by using data on rents or leases that were actually paid for the permission to use these or similar assets. Stocks of depletable natural assets such as subsoil assets or wild biota usually do not have a market price, as they are rarely sold/bought in total. A number of methods to estimate the market price/value of the stocks of scarce and depletable natural resources and by implication, changes in the value of stock (between the beginning and at the end of the accounting period) have been proposed and also are in use. Major approaches for valuing exhaustible resources are briefly explained hereunder.

Considering Time in Valuation:

Net market value of the output of goods and services of exhaustible resources can be calculated by the prices of these goods and services, appropriately adjusted for the exploitation cost. In general, exploitation of these resources is spread over a long period and thus the flow of future net returns is estimated by discounting using an appropriate discount rate, as follows.

$$V_0 = \sum_{t=0}^T \frac{N_t Q_t}{(1+r)^t}$$

Here, V_0 is the present value of the resource, which is expected to generate returns over its lifespan ‘ T ’ and ‘ r ’ is the accepted rate of discount. N_t is the total unit value of the resource, less the costs of extraction and development and Q_t is the quantity exploited over the period ‘ t ’.

Net Price Method:

In this method, the concept of Hotelling rent is used. The net price of the resource is the rental on the stock of natural capital, which is equal to the difference in market value of the resource and the unit cost of extraction, exploration and development, i.e. $V_t = (p_t - c_t) R_t = N_t R_t$ where; V_t is the value of the resource at the beginning of period t , while R_t (or $\sum Q_t$, the sum of period -

wise quantity extracted over the lifetime of the resource) is the volume of proven reserve multiplied with the difference, N_{t_0} , between the average market value per unit of the resource, p_t , and the per unit cost, c_t , of extraction, development and exploration of the resource.

The following steps are involved in assessment of the net price of the resource.

- a) Establishment of the physical asset account, which, according to SEEA, can be described in simplified terms as:
 - Opening stocks
 - Depletion
 - Degradation of land
 - Discharge (and treatment) of residuals
 - Other volume changes
 - Closing stocks

These physical accounts are important database, either for the direct or for the indirect management of particular natural assets or as data input into physical models of environment-economy interaction, as for example, in input-output analysis.

- b) Determination of the net price of the resources, consisting of following steps:
 - i) Determining the market price of different resource categories.
 - ii) Assessing the total factor cost, including a normal return to capital, of producing one unit of these resource categories
 - iii) Calculating the net price as the difference between (i) and (ii).

User Cost Method:

It is generally difficult to estimate the stock of natural resources. The precision of these estimates is important for the valuation of natural resources by using market valuation. In order to deal with this problem, El Serafy (1989) suggested that instead of making the stock of natural resources as the starting point, it is important to follow the changes in the flow (or extractions) which are relevant for defining sustainable use patterns. He considers the rental on a stock of natural capital as consisting of two components namely; a 'true' cost or value and another as 'user' cost. The true value itself is a measure of the net worth of the resource (for both the present and future generations). The user cost is the value enjoyed by the present generation at the cost of the future generation or future users of the resource. Therefore, this user cost is a capital consumption charge and is considered the relevant indicator of depreciation or depletion.

Non-Market Valuation:

The natural environmental products are either used or sold. Products that are sold, e.g. fuelwood, fodder, minerals and fish, can be valued at the going market price. But those products which are

used for subsistence and do not enter the market are more difficult to value, for example, the valuation of wetland services like flood control, habitat for flora and fauna, recreational values, waste treatment, water storage and supply involve non-market valuation. This valuation is important because due to market failure a non-sustainable use of these resources gets encouraged and these resources are often undervalued. In order to promote rational use of these resources their true valuation becomes important.

The methods for valuing environmental or non-market goods have been classified as:

- **Those based on direct and indirect market information, such as property values, wage rates; expenditure on related goods**
- **Those based on status performances in the absence of markets, as expressed through questionnaires or through public or charitable contributions**
- **Those based on dose response data linking environmental changes to pollutants**

In all cases, the purpose is to get individual values as expressed in terms of willingness-to-pay (WTP) for an environmental improvement, or willingness-to-accept (WTA) compensation for an environmental deterioration.

Important non-market valuation methods are:

1. Contingent valuation method (CVM)
2. Travel cost method (TCM)
3. Hedonic pricing method
4. Cost based methods:
 - a. Damage cost avoidance
 - b. Replacement cost
 - c. Substitute cost
5. Human capital method
6. Preventive expenditure method

The following discusses the two most important and widely used methods of valuing non-marketed goods and services.

Contingent Valuation:

The contingent valuation method tries to obtain information on consumers' preferences by posing direct questions about their willingness to pay. It basically asks people what would they be willing to pay for the continuation of benefits accruing from the non-marketed goods and services. The method also can be used to ascertain as to what people are willing to accept by way of

compensation to tolerate an environmental cost or what is generally termed as negative environmental externality. The method involves the use of a specifically prepared survey questionnaire or schedule, or by experimental techniques in which people respond to various stimuli in simulated conditions. Here we seek personal valuations of the respondents for increase or decrease in the quantity/quality of some environmental good or service, contingent upon a hypothetical market. People's willingness-to-pay for environmental services is constrained by their incomes. On the other hand, their willingness-to-accept payment for a loss in environmental quality, may not be so constrained. Estimates of willingness to accept often tend to be several times higher than willingness-to-pay estimates. The contingent valuation method rests on the three important assumptions:

1. That the user (sample) population has a sufficiently well developed sense of the utility of the resource in question, and thus is in a position to subjectively assign monetary value to the (say) non-marketed recreational experience.
2. Appropriate representation, and comparable samples of the user population, which is a must for the authenticity of the CVM estimates.
3. That interviews and questionnaire methods used in the on-site survey can objectively elicit values from the visitors, without bias or distortion.

Using CVM:

In an application of this method, Hammack and Brown (1974) used a mailed questionnaire to determine the average value of a season of waterfowl hunting. The two critical questions asked of more than two thousand respondents were (i) the level of the smallest amount one would take to give up his/her right to hunt waterfowl for a season, and (ii) about how much high the costs would have to be before they decide not to go hunting at all during that season? The first question really asked how much a user would be willing to receive to sell his or her right to hunt and thus not hunt at all for a season. The second aimed at getting their perception of how high the price (cost) would rise before the rights holder would discontinue hunting. The results of this study, on an average, gave a willingness-to-pay of \$247 per season and a willingness-to-sell of \$1,044 per season.

Another example of the use of valuation technique in a developing country is that of estimation of the value of the Safaris in Kenya (Munasinghe, 1993). The value of viewing elephants in Safaris in Kenya was estimated by using TCM, considering 80 percent of European and North American tourists who came to Kenya. A weighted average consumers' surplus of \$ 218 million per annum was estimated depending on the assumed level of visitation. To identify the contribution that elephants make to the value of the safari, tourists were asked to allocate the pleasure and enjoyment of their trip over various categories of experience. Elephant represented 12.6 per cent of the total enjoyment. Therefore, the estimated economic value of a safari yields a viewing value for elephant of US\$ 23 to 27 million per year. In order to assess consumers' willingness to pay to maintain the elephant population at current levels through increased enforcement activity, the study used the contingent valuation approach. The average value was 89 dollars while the median

was 100 dollars. This yielded as annual viewing value of US\$ 25 to 30 million based on an estimate of about 250 to 300 thousand adult safaris per year.

In still another application of indirect valuation methods (Kumar, 2002) estimated the total economic value of Pong dam wetland ecosystem, in Himachal Pradesh, India (Table 1,2). The study is based on responses from 140 respondents comprising visitors, non-users and farmers of the area. The ecosystem value has been estimated by using different valuation techniques like the individual travel cost method, indirect substitute cost method, contingent valuation and market value methods. Willingness-to-pay of more than 80 percent visitors, for use value of the ecosystem, ranged from Rs.75 to Rs.125 per annum. Similarly, more than 62 per cent of the visitors were willing to pay in the range of Rs. 25 to Rs. 75 as option value. Some 30 per cent of visitors were not inclined to pay anything for maintaining the Pong Dam ecosystem.

Table 1: Estimates of Imputed Values of Fodder through Opportunity Cost Method in the Pong dam Wetland Area in Himachal Pradesh

Particulars	Units	Total
• Average time required to collect the fodder from the wetland	Kg/hour	20.00
• Opportunities cost of time of the labour at wetland	Rs./day	50.00
• Fodder supplied by the wetland to the exclusively dependent livestock for six months	Lakh Tonnes	77.25
• Opportunity cost saved in wetland	Rs. (Lakh)	241.41

Table 2: Estimates of Annual Economic Value of Selected Ecological Functions of the Pong dam Wetland, in Himachal Pradesh

Ecological function	Benefits	Beneficiaries	Valuation method used	Value (Rs. Lakh)
Biological productivity				
i) Fish breeding and dry fish	Fish production and state govt.	Local people value	Market	24.54
ii) Sustenance to the grass ecosystem	i) Fodder production	Local people substitute cost method	Indirect	656.63
	ii) Thatching grass production	Local people and paper mills	Market value	38.25
iii) Agriculture	Wheat production	Local people	Market value	127.25
Wildlife habitat and recreations				
	i) Recreational ii) Option and iii) Existence values	Local and general public	Contingent valuation method	60.51
Total value				907.18

In a detailed study of estimating willingness-to-pay for different tourism related activities, Bhalla (2003) found that even the people with relatively low incomes are willing to pay for checking environmental degradation and for improvements in civic amenities in their vicinity (Table 3, 4). The study showed that more than one-fourth of the total respondents were willing to pay upto fifty rupees a month for checking environmental degradation in Manali town of Himachal Pradesh. Manali is an important tourist destination for both domestic and foreign tourists and local people's livelihoods are linked to the continuance of this status of the town. The proportion of people willing to share the costs of improvements in civic amenities is also high and this includes people from lower income strata as well. Willingness-to-pay was noted to increase with income levels of the respondents.

Table 3: Respondents' Willingness-to-pay for Checking Environmental Degradation in Manali Town of Himachal Pradesh

Income class (Rs. Lakh)	WTP (Rs./month)				Total (%)
	Nil	>50	50-100	>100	
> 1	51.17 (71.31)	25.00 (28.69)	–	–	100.00
1-2	35.88 (55.96)	30.71 (39.44)	9.25 (4.60)	–	100.00
2-3	8.23 (19.44)	27.84 (54.16)	31.48 (23.61)	9.09 (2.79)	100.00
> 3	4.72 (9.63)	16.45 (27.71)	59.27 (38.55)	90.91 24.11	100.00
Total (%)	100.00	100.00	100.00	100.00	-

Figures in parentheses show row-wise percentages

Table 4: Respondents' Willingness-to-pay for Improvements in Civic Amenities in Manali Town of Himachal Pradesh

Income class (Rs. Lakh)	WTP (Rs./month)				Total (%)
	Nil	>50	50-100	>100	
>1	52.89 (59.83)	32.45 (40.17)	–	–	100.00
1-2	36.95 (39.84)	33.12 (39.06)	14.03 (21.10)	–	100.00
2-3	7.24 (13.88)	22.51 (47.22)	35.08 (27.77)	20.0 (11.13)	100.00
> 3	2.92 (4.81)	11.92 (21.68)	50.89 (34.94)	80.00 38.57	100.00
Total (%)	100.00	100.00	100.00	100.00	-

The method of CVM has many shortcomings and complexities, including the problem of designing, implementing and interpreting questionnaires. Theoretically, while the applicability of the method may be limited, there is now a great deal of interest in using this technique to estimate people's willingness to participate in environmental conservation and in the conservation of endangered species. However, before one decides to use CVM, it is important to ascertain that the targeted people really understand the issue under consideration and also that they are interested in it.

Travel Cost Method:

Harold Hotelling (1949) first suggested the use of the travel cost method and later (1950) others (Trice and Wood, for example) also used it to measure the benefits of recreation. However, it was with the works of Clawson that the method claimed the real attention. Clawson's works on measuring demand and value of outdoors recreation also build on the basic idea propagated in Hotelling's approach. In this method, the value of particular goods or services is inferred from the opportunity cost of time plus other direct and indirect costs incurred in visiting the recreation site by the interested person. In fact, the method uses the economic concept of revealed preference. When an individual decides to visit a particular site, in preference to other sites, he/she reveals a preference for that site.

Travel cost method is an oldest method to estimate values of recreational sites, first used to estimate recreational values of national parks in the USA. In a typical Marshallian demand curve we deal with tangible goods, which are marketable. The negatively sloped demand curve reflects diminishing marginal utility of consumption. In case of demand for recreation, the good is the site or the services of the site that cannot be consumed in the traditional sense. Therefore, to use the demand analysis for estimating the site value requires making some assumptions. These assumptions, among others, include the important assumptions of (i) visitor's willingness to incur costs to visit the site, (ii) that site visiting is the sole purpose of the visitor, (iii) that he/she visits only one site at a time, (iv) diminishing marginal utility is accurately reflected in demand curve used in this case and (v) that people who value the particular thing have almost similar preferences. Thus by looking at how the number of trips made to a site varies with the cost of trip, the demand for the site can be estimated.

Estimating Demand by TCM:

The idea that the "consumers would react in the same way to a change in admission fee at the gate as they would to a change in travel cost to the site" has been used to a demand schedule for recreation type outputs. The basic model envisions an individual located at a given place and contemplating consumption of a recreational outputs (Davis and Johnson, 1987). The individual is assumed to have a normal demand curve for recreational benefits and considers all travel related costs, including the opportunity cost of the trip in terms of the income/earnings foregone for the day of the visit. With this information available for a large number of visitors to the site, a demand curve can be estimated. This can then be used to find out the estimated benefits of the site through the measurement of consumer's surplus. If there are high variations in socio-economic or even

in location related characteristics of the visitors, then separate demand curves are fitted and the total benefits of the site can be estimated by adding up the consumer surpluses.

In a 1980 study of estimating the value of a Thai national park, TCM and contingent valuation methods were used to estimate the economic value of Lumpinee Park to Bangkok residents. Although the urban setting is not usually considered suitable for a travel cost approach, because of short time and low costs of visits, the analysis still confirmed the expected inverse relationship between travel cost and number of visits to the park. In this case also the standard form of the demand function, considering the visitation rates as the function of total travel cost, availability of substitute sites, and income, was used. The total travel costs included both out-of-pocket travel costs plus the monetary value of the time spent in traveling, using the going wage rates. 187 people, from 17 zones of origin within Bangkok, were interviewed and a demand curve for public use of the park was derived. Using the consumer surplus approach, the visitation value of the park was estimated to be 13.2 million Bhat per year (Munasinghe, 1993).

Verma (2000) (Table-5) and Chopra and Kadekodi (1997) have also estimated values of forest stock for Himachal Pradesh using various non-market valuation techniques. In line with the works of other researchers, the study by Verma considers many direct and indirect use values of state forests. Notable among these are the direct consumptive values such as fodder, timber, fodder, and fuelwood and indirect benefits like carbon sink functions of the forests, microclimate and watershed functions. Non-consumptive benefits like ecotourism have also been considered. The ecotourism value has been estimated at Rs. 46000 per hectare of forest area. Similarly, watershed benefits of the entire forest area have been estimated at Rs. 5.16 lakh per annum, using all India averages based on selected studies. The carbon sink function value of the forests has been estimated at Rs. 1.23 lakh per hectare per annum. Total economic value of the state forests has been estimated to be Rs. 7.43 lakh per hectare per annum. However, it has to be borne in mind that these estimates are based on the results of various studies, micro and macro level, and on some convenient assumptions for data on production and prices. Nevertheless, the study provides important indicators of the true value of state forests as well as the utility of the use of various methods to value indirect-use values of different resources.

Table 5: Some Valuation Components of Forest Stock of Himachal Pradesh

Stocks and flows from forests	Physical units	Value (Rs./ha)
Total growing stock	10.25 crore m ³	2.85 Lakh
Salvage	3.50 lakh m ³	0.22 thousand
Timber for rights holders	1.06 lakh m ³	0.42 thousand
Fuel wood	27.60 lakh tones	1.92 thousand
Fodder	92 lakh tones	4.81 thousand
Minor forest produce	1,161.56 tonnes	0.17 thousand
Total direct consumptive uses		7.0 thousand
Direct non-consumptive uses		
Eco-tourism	66.56 lakh tourists	46.0 thousand
Total Direct Benefits		53.0 thousand
Indirect Uses		
Watershed	6.77 crore m ³ (growing stock in river basin forest circle) and 36.986 km ² (entire forests area)	5.16 lakh
Micro-climatic functions	9,69,018 households	1.0 thousand
Carbon sink	12,521 km ² (area under tree cover and scrub forest)	1.23 lakh
Biodiversity/endangered species	8,966 (total no. of species in HP) and 125 (endangered species)	20 thousand
Employment generation	48.4 mandays	1.7 thousand
Total Indirect Benefits		6.90 lakh
Total Economic Value		7.43 lakh

Marothia (2001) also estimated the day-use recreation value of the Vivekanand Lake in Raipur, Chattisgarh using indirect methods. Contingent valuation and zonal travel cost and individual travel cost methods were used for the indirect valuation to capture the recreation value and to estimate demand functions. Different strata of local population, including scientists, environmental conscious citizens and other local people were considered for getting their responses for the purpose of this study. Model specification in the study, as presented below, gives an idea of this methodology and also the factors or variables that can be considered in indirect valuation of natural resources. Variables can be direct physical quantities, number, or proxy variables for some qualitative factors such as extent of interest in conservation of resources, Marothia's specification of travel cost model used and the variables considered was as follows:

$$V = f(\text{DIST, LC, REA, INC, OCT, EDU, VH, CON, MAG})$$

Where;

- V = Number of visits made by each visitor per period
- DIST = Distance from residence to Lake Vivekanand
- LC = Local cost incurred on parking, boating and eating

TC	=	Total travel cost from place of residence
REA	=	Reason for visiting the lake viz. combination of water and park recreation, educational interest, presence of the Lake)
INC	=	Household income (Rs. per family)
OCT	=	Per capita household income (opportunity cost of time)
EDU	=	Education of the respondent
VH	=	Time spent at the Lake (hours) per visit
CON	=	Dummy variable for concern for upkeep of lake
MAG	=	dummy variable for lake management

Similarly, the specification of the willingness-to-pay function and variables used for contingent valuation was as follows :

$$W = f (V, REA, INC, OCT, EDU, VH, CON, MAG, DIST, ENT)$$

Where, ENT is the proposed entrance fee (Rs.) and other variables are the same as in case of the travel cost model. The results of the study revealed that distance from residence to the lake, total travel cost (on per capita basis) from place of residence and expenses of parking, boating and eating within the surrounding of the lake, reason for visiting the lake are important factors that influence the visitation rate.

Table 6: Demand Function for Lake Vivekanand Visitation Rate (Total Travel Cost)

Independent variable	Model	
	Linear	Semi-log
DIST	-21.469 **	-0.087 **
TC	-1.799 *	-0.004 **
REA	-30.696*	-0.118 **
INC	-0.003	-0.000
OC	0.655	0.005
EDU	18.677	0.081
VH	24.785*	0.147
CON	-24.095	0.046
MAG	71.705	0.200
Constant	154.87	1.77
R ²	0.4282	0.4291

*, ** Show significance at 1&5 per cent level of significance respectively.

Synthesis:

The use of formal environmental accounting is still in its infancy in the state. Increased biotic and abiotic pressures on natural resources call for a focused approach on environmental accounting. For a long time natural environment and many natural resources were considered as free goods and their contribution was thus not duly accounted for in incomes. Increasing pressures from agriculture and industrial sectors have brought into focus the deteriorating state of the environment and its ill impact on the economy of the state. Sustainability of economic growth in this hill state in particular and in the region in general is contingent upon sustainability of natural resources and natural environment. It thus is heartening to note that an increased emphasis is being placed on the policies and programmes that aim at sustainable use of natural resources and on conservation of natural environment. In order to understand and plan for environmental conservation, **Pressure, State, Impact and Response (PSIR)** method often is helpful in planning for the development without environmental degradation. The PSIR matrix, given below, summarizes these issues in the context of environmental accounting in the state :

PSIR Matrix for Environmental Accounting:

Pressures	State
Declining forest cover and productivity of forests and support lands	No formal procedure in place for environmental accounting
Reduced water holding capacity of forests and other lands	Some initiation at project/ firm level (e.g. HP Forestry Sector Reforms Project, Power projects, etc.)
Increase in human and livestock population	Biodiversity and environmental conservation, and pollution control a part of course curricula at school and university levels
- Increased market orientation - Extension of agricultural land - Pressures of urbanization and industrialization - Increased health hazards and additional expenditure on health care	Emphasis on eco-tourism implies acceptance of indirect values of the natural sites/environments
Impact	Responses
Shift in land use and agricultural production patterns	Increased emphasis on environmental awareness creation
More emphasis on mechanization and use of chemicals in farming	Greater and explicit recognition of the field of environmental economics
Increased water run-off and loss of fertile soil	Greater acceptance of the input from general public in policy making and programme implementation (like the role of NGOs)
Low per capita availability of forests and other natural resources	Increased activism of the judiciary for environment protection

Impact	Responses
• Low per capita availability of safe drinking water	• Increased collaborative action in the field of environmental conservation and management
• Increase in time for collection of natural resources	• Emphasis on recycling and re-use to protect the environment
• Increased siltation of lakes, rivers and hydroelectric power generation dams	• Emphasis on intensive agriculture and livestock improvement programmes
• Depleted natural flora and fauna	• Ban on <i>green</i> felling and increased afforestation and reforestation drives
• Congestion at natural outdoor recreational sites	• Emphasis on biodiversity conservation and eco-tourism

* * * * *

જન્ન વિચાર

‘कैसे बचेगी जलती वन सम्पदा और वन्य जीव’

हमारे मानवीय जीवन की उत्पत्ति और उसके आरंभिक विकास पर दृष्टिपात यदि करें तो पता चलता है कि यह जीवन कन्दराओं और वनों में ही उत्पन्न हुआ है। इन्हीं कन्दराओं और वनों से होकर ही हम आधुनिक सभ्यता के उन्नत कहे जाने वाले वर्तमान पड़ाव पर पहुंचे हैं। परन्तु आश्चर्य की बात है कि जिन वनों ने हमारा विकास किया, जो हमारे जीवन के अस्तित्व के लिए आज भी उतने ही महत्वपूर्ण हैं जितने हजारों साल पहले थे, उन्हीं वनों तथा पेड़ों को अपनी व्यक्तिगत समृद्धि के लिए हम नष्ट करने में लगे हैं।

हिमाचल प्रदेश में वनों के अधीन प्रदेश के कुल भौगोलिक क्षेत्र का लगभग ६६.५ प्रतिशत भाग आता है। इस भाग का क्षेत्रफल लगभग ३३०७७ वर्ग किलोमीटर बनता है। जबकि प्रदेश का कुल क्षेत्रफल ५५६७३ वर्ग कि०मी० है। यह निश्चित नहीं कि वनों के अधीन सारी की सारी भूमि घने पेड़ों से ढकी हो। इन वनों में कई प्रकार के पेड़ पाए जाते हैं जो इस शीतल शान्त प्रदेश की शोभा को भी बढ़ाते हैं। प्रदेश की ऊंची नीची ढलानदार पर्वतीय भूमि पर फैले इन वनों में देवदार, चीड़ तथा खैर के ही अधिक पेड़ हैं। खैर तथा चीड़ के पेड़ तो कम ऊंचाई वाली पर्वतीय भूमि पर पाए जाते हैं, जबकि देवदार के पेड़ ऊंचे पर्वतों की शोभा बढ़ाते हैं। इन वनों में पेड़ों के साथ-साथ कांटेदार झाड़ियां तथा वन्य पशु पक्षियों की कई जातियां भी पाई जाती हैं। यह पशु पक्षी अपने आहार और रैन वसरे के लिए इन्हीं वनों पर निर्भर रहा करते हैं। इनमें भी ग्रीष्म ऋतु में चीड़ के वनों को प्रतिवर्ष धधकती आग की लपटें नष्ट करती रहती हैं। चीड़ के इन पेड़ों से बिरोजे के नाम से एक मूल्यवान तरल पदार्थ गर्मी के दिनों में निकाला जाता है। यह बहुत ज्वलनशील पदार्थ है। यह आग बहुत आसानी से पकड़ लेता है। इसकी सूईनुमा नोकदार पत्तियां गर्मी के दिनों में भारी संख्या में नीचे गिरती रहती हैं। आग की कोई चिंगारी यदि इन्हें छू ले तो आग तुरन्त भड़क उठती है और फैलने लग जाती है। बिरोजा निकासी का समय मार्च से अक्टूबर तक का होता है। चीड़ के यह पेड़ कांगड़ा, हमीरपुर, बिलासपुर, मण्डी, सोलन, चम्बा, ऊना आदि जिलों में अधिक पाए जाते हैं। इन वनों के बीचोंबीच कई गांवों को जोड़ते रास्ते बने हैं। इन पर लोगों का आम आना जाना भी है। कई वनों के बीच से तो अब कई राष्ट्रीय मार्ग, राज्य मार्ग तथा दूसरी सड़कें होकर जाती हैं। बिलासपुर, हमीरपुर, ऊना, सोलन, कांगड़ा, चम्बा, मण्डी, कुल्लु, शिमला के वन इन्हीं चीड़ के पेड़ों से भरे पड़े हैं।

चीड़ के इन वनों को बिरोजा निकासी के दृष्टिकोण से दो भागों में बांटा जा सकता है। सरकारी क्षेत्र के चीड़ के वन तथा निजी क्षेत्र के चीड़ के वन। निजी क्षेत्र के इन वनों का आकार बहुत छोटा है तथा सरकारी क्षेत्र के ऐसे वन ही अपने आवृत में चीड़ के बड़े बड़े तथा अनगिनत पेड़ों को समेटे हुए हैं। निजी क्षेत्र के बिरोजे की निकासी संबंधित विभाग की अनुमति के पश्चात् उनके स्वामी करवाते हैं और वन विभाग के पेड़ों से बिरोजे की निकासी का कार्य हि० प्र० राज्य वन निगम करवाता है। कुछ वर्ष पूर्व वन विभाग स्वयं अपने मजदूरों द्वारा ही बिरोजा निकासी के इस कार्य को सम्पन्न करवाता था। परन्तु वन निगम के अस्तित्व में आने के कारण अब वन विभाग के चीड़ के पेड़ पूरी ग्रीष्म ऋतुओं में बिरोजा निकासी हेतु वन निगम के ही हवाले रहते हैं। वन विभाग ५ वर्ष में एक बार चीड़ के पेड़ों की गिनती करवाता है। वन निगम प्रति वर्ष फरवरी मास में लेवर सप्पलिमेंट योजना के अधीन आमन्त्रित निविदाओं द्वारा बिरोजा निकासी के कार्य को सम्पन्न करवाता है। हिमाचल प्रदेश में २००४-०५ में

लगभग ८४ हजार क्विंटल बिरोजा निकाला गया। निजी क्षेत्र के चीड़ के पेड़ों से इसी अवधि में लगभग ३२ हजार क्विंटल बिरोजा निकाला गया। बिरोजा निकालने के लिए पेड़ों में टक लगाए जाते हैं। वन निगम बिरोजे को बिलासपुर तथा नाहन की फैक्ट्रियों में पहुंचाता है जहां इससे तारपीन का तेल तथा पक्का बिरोजा तैयार होता है। सरकार को प्रति वर्ष अरबों रूपयों की आय चीड़ के इन वनों से हो जाती है।

निजी क्षेत्र के बिरोजे की बिक्री आवश्यक अनुमति के पश्चात् खुले बाजार में की जा सकती है। इस समय बिरोजे का भाव ३१ रुपये प्रति किलोग्राम से कम नहीं है। वनों से बिरोजा निकासी मार्च से आरम्भ होती है और इसी के साथ आग लगने का मौसम अपने द्वार खोल देता है, जो वर्षा ऋतु तक इसे खोले रखता है। आग तो पहले भी लगा करती थी परन्तु इसे बुझाने का तरीका और दृष्टिकोण आज बदल गया है। भारत की स्वतन्त्रता के कुछ बाद के समय तक इस आग को बुझाने के लिए संबंधित गांव के लोग तुरन्त वन में पहुंच जाते थे और उसे बुझा कर ही घर लौटते थे। आधी रात को भी बिस्तर से उठकर आग बुझाने के लिए तुरन्त इकट्ठे होकर वन को चले जाने में लोग कोई संकोच नहीं किया करते थे। परन्तु आज उसे बुझाने कोई नहीं जाता है। वन विभाग के कर्मचारियों को ही इसकी चिन्ता करनी पड़ती है। आग बुझाने की चिन्ता के मार्ग को सरकारी छुट्टियों की बढ़ती संख्या तथा व्यक्तिगत कुशलता का गिरता स्तर और भी लम्बा कर देता है। उस पर भी फायर ब्रिगेड पर बढ़ती निर्भरता तथा उनकी गाड़ी का प्रत्येक स्थान पर न पहुंच पाना या वहां पानी का तुरन्त न मिल पाना भी आड़े आता है। नई उपजी इन समस्याओं के कारण चीड़ के वनों की आग अब कई कई दिनों तक लगातार जलती रहती है। इस प्रकार करोड़ों रूपयों की यह वन सम्पदा प्रतिवर्ष अग्नि की लपेटों के हवाले होती हुई अनेकों वन्य पशु पक्षियों को भी अपने साथ भस्मीभूत कर देती है।

आग लगने के चाहे जो भी कारण हों परन्तु इसका तुरन्त बुझाया जाना प्रमुख मुद्दा होना चाहिए। चीड़ के वनों को आग पहले भी प्रत्येक वर्ष लगा करती थी। उस समय विशेषता यह थी कि इस आग पर तुरन्त काबू पा लिया जाता था। आज की तरह कई दिनों तक एक ही वन के लगातार जलते रहने जैसी स्थिति उस समय नहीं हुआ करती थी। समाज में व्याप्त वन सम्पदा को बचाने के प्रति उत्तरदायित्व की भावना तथा वन्य जीव जन्तुओं की रक्षा के प्रति करुणा के कारण लोग आग को तुरन्त बुझाने के लिए प्रेरित हो जाते थे। परन्तु आज जनता तथा विभाग दोनों के ही दृष्टिकोण में परिवर्तन को साफ देखा और समझा जा सकता है। लोग उत्तरदायित्व तथा करुणा के स्थान पर व्यक्तिगत आर्थिक लाभ के मुद्दों की ओर अधिक ध्यान देने लगे हैं। उन्हीं की प्राप्ति के लिए समय का अधिकाधिक प्रयोग करना ही वे अब अधिक पसन्द करने लगे हैं।

आज से कोई ४५ वर्ष पूर्व तक आग को बुझाना कठिन था। परन्तु फिर भी लोगों के सहयोग से वनों में लगी आग तुरन्त बुझा दी जाती थी। आज वनों में जगह जगह सड़कें तथा रास्ते बने हैं। जिसके कारण आग को बुझाना अब आसान है। परन्तु फिर भी वन को लगी आग कई दिनों तक पेड़ों को जलाती ही रहती है। यह शीघ्र नहीं बुझती। जबकि आग बुझाने के लिए अपनाई जाने वाली विधि के अनुसार सूखी पत्तियों को साफ कर आग पर नियन्त्रण के लिए रास्ते जैसे ही बनाए जाते हैं।

१९५० से १९६० तक तो सभी पक्षों द्वारा वनों की आग तुरन्त बुझाने के मुद्दे को गंभीरता से लिया जाता रहा। परन्तु उसके बाद जैसे जैसे विकास की सीढ़ियां ऊंची होती गईं वैसे वैसे आग की ऊंची लपेटों को तुरन्त नीचे करके शान्त करने पर जाता ध्यान भी कम होता गया।

कारण चाहे जो भी रहे हों पर यह एक विडम्बना ही है कि पिछले ४५ वर्षों से चीड़ के वनों को प्रतिवर्ष लगती इस आग को तुरन्त बुझा कर प्रदेश तथा देश की बार बार जलती करोड़ों रूपयों की सम्पत्ति को बचाने के लिए हम कोई कारगर योजना अभी तक न तो बना पाए हैं और न ही उसे लागू करवा पाए हैं। जबकि इसके निर्माण तथा क्रियान्वयन के ढेरों साधन सरकार के पास मौजूद हैं।

आग से तुरन्त बचाव हेतु सुझाव :-

चीड़ के पेड़ों से बिरोजा निकालने वाले लोगों को भी आग बुझाने के दायित्व के घेरे में लिया जाना चाहिए। क्योंकि आग गर्मियों के ही दिनों में लगा करती है और इन्हीं दिनों में बिरोजा निकालने के सम्बन्ध में कोई न कोई मजदूर या कर्मचारी प्रत्येक दिन चीड़ के प्रत्येक पेड़ के पास कम से कम एक बार तो पहुंचता ही है। कहीं कहीं तो वह दिन में दो बार भी पहुंचता है। ऐसे में आग बुझाने के लिए जन शक्ति को जुटाने और सूचना तन्त्र के विस्तार में तो आसानी ही होनी चाहिए। इस उत्तरदायित्व का वर्णन बिरोजा निकासी के लिए आमन्त्रित निविदाओं में किया जाना चाहिए।

आग बुझाने के इस उत्तरदायित्व में संबंधित पंचायतों को भी सम्मिलित किया जाना चाहिए। इससे जहां लोगों में जागरूकता आने से उनका आग बुझाने की ओर ध्यान आकर्षित होगा वहीं इस आग के कारण या उसके बुझाने में बरती जाने वाली जानी अनजानी लापरवाही पर भी पंचायत या गांव के लोगों का ध्यान जाएगा।

बिरोजा निकासी की निविदाएं जो इस समय प्रत्येक वर्ष फरवरी या मार्च मास में आमन्त्रित की जाती हैं उन्हें प्रत्येक वर्ष दिसम्बर मास में आमन्त्रित किया जाए ताकि आग बुझाने के उत्तरदायित्व में आने वालों को इसके लिए योजना बनाने के लिए पर्याप्त समय मिल सके। आग का तुरन्त पता कैसे चलेगा, सूचना तुरन्त कहां कहां तथा कैसे दी जाएगी, जनशक्ति कहां केन्द्रित होगी, कैसे उपलब्ध होगी, उसका अग्निस्थल पर तुरन्त पहुंचना कैसे सम्भव होगा, यदि फायर ब्रिगेड ने आना है तो गाड़ी तुरन्त कहां पहुंचनी चाहिए, पानी की व्यवस्था अग्रिम कहां कहां और कैसे कैसे होगी, क्या क्या उपकरण कहां कहां होंगे तथा तुरन्त कैसे पहुंचाए जायेंगे आदि सब आवश्यक साधनों की उपलब्धि तथा उनके तुरन्त प्रयोग को सुनिश्चित करने पर विचार किया जा सके। निविदाओं के निपटारे की सूचना संबंधित पंचायत को दी जानी चाहिए ताकि पंचायतें, ठेकेदार तथा विभाग आग बुझाने में अपनी अपनी भूमिका का ज्ञान तथा आपसी तालमेल को सुनिश्चित कर सकें।

पंचायतों की भूमिका को भी निर्दिष्ट किया जाना चाहिए ताकि उनमें आग बुझाने के प्रति समय से पहले कर्तव्यबोध की भावना उत्पन्न हो। वे भी संबंधित पक्षों के साथ अपना तालमेल बैठाने का पूर्व प्रबन्ध कर सकें। लोगों में जागरूकता को बढ़ाने में अपना प्रभावी योगदान दे सकें।

इसके लिए संबंधित पक्षों को प्रोत्साहन स्वरूप कुछ लाभ देने की व्यवस्था भी की जानी चाहिए तथा इसका उल्लेख भी प्रति वर्ष दिसम्बर मास में निविदाओं के आमंत्रण के समय ही किया जाना चाहिए। इन उपायों से आग तुरन्त बुझ जाएगी और सरकारी कोष पर भी अनावश्यक बोझ नहीं पड़ेगा। सरकार की प्रति वर्ष जलती करोड़ों रूपयों की वन सम्पदा तथा असंख्य निरीह पशु पक्षियों के प्राण भी बच जाएंगे।

‘हिमाचल प्रदेश में परम्परागत दालों की घटती मात्रा तथा गुणवत्ता’

प्रकृति ज्यों ज्यों जीवों की उत्पत्ति तथा उनके भरण पोषण की प्रणालियों एवं पदार्थों के निर्धारण की ओर बढ़ती गई वैसे वैसे इस ओर होती उसकी क्रियाएं स्थायित्व के साथ मर्यादा का रूप लेती चली गई। मर्यादा की इन्हीं सीमाओं ने भिन्न भिन्न रूप रंग, आकार-प्रकार और जीवन के विकास में योगदान देने वाले गुण दोषों वाले भोज्य पदार्थ निर्धारित किए। मर्यादा के इस आवृत में अमूल चूक परिवर्तन करना फिर मानव मात्र के वश में नहीं रहा। भले ही वह अपने प्रयासों द्वारा मनचाहे परिणाम प्राप्त करने की दिशा में मर्यादा के इस स्वरूप का कृत्रिम निर्माण करने में प्रकृति द्वारा निर्धारित समय सीमा और भौगोलिक अनिवार्यताओं की अनदेखी में सफल होता क्यों न लग रहा हो। प्रकृति की मर्यादा की स्वीकारोक्ति की अनुपस्थिति में मानव निर्मित ऐसा परिवर्तन गुण दोष की कसौटी पर न तो प्राकृतिक गुणवत्ता की बराबरी कर सकता है और न ही चिरकाल तक स्थायित्व के साथ टिका ही रह सकता है।

हर मानव के भोज्य पदार्थों में पाए जाने वाली फसलों को ही लें तो उनके लिए प्रकृति ने मौसम का चक्र बना रखा है। मौसम तथा भौगोलिक सीमा रेखाओं के भीतर हमें अलग अलग समय में अलग अलग रूप रंग और स्वाद वाली फसलों की उपज प्राप्ति होती है। मनुष्य के डील डौल तथा अवस्था के अनुसार उनके उपभोग की मात्रा निर्धारित होती है। परन्तु व्यक्तिगत आर्थिक विकास की बढ़ती प्यास तथा प्रकृति के कुछ अज्ञात प्रभावों का समुचित ज्ञान न होने के कारण बढ़ती आबादी के दबाव का सही दिशा में विस्तार न कर पाने के कारण प्रबन्धन की जंजीर में कुप्रबन्धन की कुछ कड़ियां भी जोड़ते चले गए। इसके कारण फसलों के अधीन आने वाले सिकुड़ते क्षेत्र के आकार को न तो हम ठीक विस्तार दे सके और न ही फसल की मात्रा में कृत्रिम साधनों द्वारा बढ़ोतरी के कारण उनकी गुणवत्ता का ध्यान ही रख सके।

वर्तमान स्थिति :-

फसलों की उपज की गिरती गुणवत्ता अब दो प्रकार से विपरीत प्रभाव का सृजन करती जा रही है। एक तो इसकी घटती पोषक गुणवत्ता से मानवीय शरीर इसकी अधिक खपत की मांग करता जा रहा है। दूसरे इन फसलों की उपज बढ़ाने के उद्देश्य से खेती बाड़ी में प्रयोग किए जाने वाली रासायनिक खादों तथा कीटनाशकों के प्रयोग से उपज पर विपरीत प्रभाव पड़ता जा रहा है। एक ओर अधिक अन्न की मात्रा की मांग बढ़ रही है तो दूसरी ओर शरीर को रोग ग्रस्त करने वाली बीमारियों की संख्या भी बढ़ती जा रही है।

धरती की ऊपरी परत के स्वास्थ्य पर भी बुरा प्रभाव पड़ता जा रहा है। इससे धरती की उपजाऊ शक्ति पर भी उसी प्रकार विपरीत प्रभाव पड़ रहा है जिस प्रकार उपज से मानवीय स्वास्थ्य पर पड़ता जा रहा है। इस प्रकार उपज बढ़ाने के कृत्रिम तरीकों तथा बेमौसमी फसलों की ली जा रही पैदावार के जारी रहते एक दिन धरती इन फसलों की ऐसी पैदावार करने से जवाब दे जाएगी। ऐसा होने के संकेत पिछले कुछ वर्षों से मिलते जा रहे हैं। भले ही कम आर्थिक सामर्थ्य में बढ़ौतरी से किनारा न कर पाने के कारण वास्तविकता को समझने और शीघ्र परम्परागत उपायों की ओर जाने में चूक क्यों न करते जा रहे हों।

हम हिमाचल प्रदेश के सन्दर्भ में स्थिति पर गहराई से दृष्टिपात यदि करें तो हमें पता चलेगा कि यहां की परम्परागत दालों की कुछ फसलें तथा उनकी पैदावार लुप्तप्रायः होती जा रही है।

कम पैदावार देने वाली इन दालों में परम्परागत चने, उड़द, मसूर, कुल्थ आदि हैं। जो दालें अब पैदा हो रही हैं उनकी गुणवत्ता, स्वाद आदि अब वैसा नहीं है जो गोबर की खाद से तैयार परम्परागत दालों में हुआ करता था। कम पैदावार होने के कारण किसानों ने दालों की इन फसलों को बोना ही कम कर दिया है। जबकि पहले पुराने हिमाचल तथा पंजाब से हिमाचल में मिले क्षेत्रों में इन दालों की पैदावार बहुत हुआ करती थी। जिन खेतों में किसान से गोबर की खाद नहीं पहुंचती थी उनमें चना तथा गेहूं का मिश्रित बीज बोया जाता था और फसल भरपूर होती थी। कुल्थ को तो किसान अपनी वनों के समीप वाली भूमि या घासनियों में ही बो दिया करते थे। वहां न तो खाद पहुंचती थी और न ही इसकी देखरेख ही होती थी। किसान दूसरी बार केवल फसल काटने के लिए ही वहां जाया करते थे और भरपूर फसले लेकर आते थे। उड़द को मक्की लगे खेत में उस समय बोया जाता था जब मक्की का पौधा लगभग ६" का होता था और निराई और गुड़ाई का काम समाप्त हो चुका होता था। उड़द की यह फसल मक्की के साथ एक ही खेत में एक साथ पक जाया करती थी और दोनों ही फसलें भरपूर हुआ करती थी। दालों की अधिक पैदावार ही के कारण इनका भाव गेहूं के बराबर या उससे भी कम हुआ करता था। आज से करीब पचास वर्ष पूर्व गेहूं चार रुपये प्रति कच्चा मन बिकता था और उड़द का भाव था तीन रुपये प्रति कच्चा मन। उस समय का कच्चा मन आज के लगभग १५ किलोग्राम के बराबर हुआ करता था। उस समय की परम्परागत उन दालों की गुणवत्ता तथा स्वाद दोनों आज पैदा हो रही दालों के मुकाबले बहुत ही उत्तम प्रकार का था।

परम्परागत बीजों की फसल का रूप रंग तथा उनका स्वाद आज की पैदा की जा रही इन दालों से भिन्न था। परम्परागत यह दालें यहां की पहाड़ी जलवायु तथा भूगत विशेषताओं के अनुरूप ढली होने के कारण खाद की कमी में भी उपज की मात्रा तथा स्वाद दोनों को ही बनाए रखने में समर्थ थीं। परन्तु रासायनिक खादों, विषैले घोलों, उन्नत बीजों के बढ़ते प्रचार तथा उनके मुकाबले में परम्परागत इन फसलों के कम होते आकलन ने लोगों में इन्हें पैदा करने के रुझान को कम तो कर ही दिया साथ ही इन दालों के मूल परम्परागत बीजों का संरक्षण भी रोक दिया है। यह सब कुछ खेती बाड़ी के आधुनिक तरीकों तथा प्रयोग की जाने वाली खादों के ही उजाले में होता चला जा रहा है। इस से तो अब यह स्पष्ट हो ही जाता है कि जहां हमारे आधुनिक ढंगों द्वारा जलवायु तथा धरती की गुणवत्ता में परिवर्तन कर पुरानी उन दालों की पैदावार पर प्रहार किया जा रहा है वहीं उन्नत बीजों के किए जा रहे प्रयोग से फसलों की बढ़ती पैदावार के स्तर को चिरकाल तक बनाए रखना भी तो असंभव ही होता जा रहा है। प्रकृति तथा इसकी मर्यादा के विरुद्ध निरन्तर जारी रहते हमारे ऐसे प्रयास एक दिन उन्नत बीजों की फसल की पैदावार भी कम कर देंगे। फसल बढ़ाने के लिए अंधाधुन्ध होते रासायनों के प्रयोग द्वारा धरती में घुसता इनका विष तथा विपरीत रूप से परिवर्तित जलवायु के संयुक्त प्रभाव से एक लम्बे समय तक मृदा को पुनः ऊर्जावान होने से भी रोके रखेगा। प्राकृतिक रूप से होते मौसमी परिवर्तन, जलवायु तथा खेतीबाड़ी के सहज परम्परागत तरीकों की परवाह के बिना यदि पैदावार बढ़ाने का क्रम यूं ही जारी रहा तो दालें तो क्या गेहूं और धान की फसलें भी पहाड़ों की ऊंची नीची धरती से इसी शताब्दी में लुप्त हो जाएंगी। यही नहीं यदि पर्यावरण की बिगड़ती स्थिति यूं ही जारी रही और मनुष्य ने प्रकृति विरोधी अपने दिखावटी आचरण पर लगाम न कसी तो अधिक उन्नति की चकाचौंध में जीवन से भटकें उसके पांवों के कारण यह पृथ्वी इसी २१वीं शताब्दी में जीवन विहीन हो जाएगी।

फसलों को बचाने के उपाय:—

१. रासायनिक खादों तथा कीटनाशकों के प्रयोग को कम किया जाना चाहिए। पैदावार को बढ़ाने के लिए गोबर तथा हरी पत्तियों की खाद का प्रयोग किया जाना चाहिए। ऐसी खाद रेशेदार होने के कारण मृदा को बहने से रोकती है जब कि रासायनिक खाद रेशाविहीन होती है और मिट्टी को बहने से नहीं रोक पाती।
२. फसलों को बीमारियों से बचाने के लिए परम्परागत तरीकों को प्रयोग में लाया जाना चाहिए।
३. बीज बोने के बाद खेत में जो सोहागा ट्रैक्टर के साथ फेरा जाता है उससे मृदा की ऊपरी परत आपस में ठीक प्रकार नहीं मिल पाती है। हल बैल के मुकाबले जैसा सोहागा ही फेरा जाना चाहिए ताकि खेत की मिट्टी की ऊपरी परत ठीक प्रकार आपस में मिल जाए।
४. फसलों की उपज मौसम की प्राकृतिक प्रक्रिया को ध्यान में रख कर ही अधिकाधिक ली जानी चाहिए।
५. कृषि योग्य भूमि के क्षेत्रफल को बढ़ाया जाना चाहिए। पेड़ विहीन सभी प्रकार की धरती को कृषि या फलदार पेड़ों के अधीन लाया जाना चाहिए।
६. सफेदा लगाने को प्रोत्साहित नहीं किया जाना चाहिए। इससे धरती शुष्क और जल विहीन हो जाती है। इसके स्थान पर फलदार तथा लकड़ी देने वाले पौधे लगाए जाने चाहिए।
७. पहाड़ी जलवायु तथा भूमिगत विशेषता के अनुकूल परम्परागत पुराने चने, कुल्थ, मसूर, राँगी, उड़द, मंडल, सौंक आदि के बीजों को संरक्षित किया जाना चाहिए।
८. शैक्षणिक व्यवस्थाओं में ऐसी जानकारी के अभाव के कारण यहां के गांवों के बड़े बूढ़ों के अनुभव का लाभ उठा कर जानकारी में वृद्धि की जानी चाहिए। संबंधित विभाग के अधिकारियों को इसका विशेष ध्यान रखना चाहिए। मात्र केवल बढ़ती आबादी के बजते डंके की ऊंची आवाज से सही दिशा की ओर बढ़ने वाले कदमों के प्रयास को अपनी किसी कमी के कारण नहीं रोका जाना चाहिए।
९. ज्ञान को मात्र केवल पढ़ी गई पुस्तकों की सीमाओं में ही नहीं बांधे रख कर देखा जाना चाहिए बल्कि व्यावहारिक क्षेत्र में बदलती परिस्थितियों, प्रभावों तथा परिणामों की अनदेखी न कर उन्हें ठीक प्रकार जानने समझने तथा भविष्य के लिए संजो कर रखने का प्रयत्न करना चाहिए। ऐसा न करने से भविष्य में समाज तथा व्यवस्था दोनों को ही हानि पहुंचेगी।

‘हिमाचल और भूकम्प’

प्रकृति के बीच, प्रकृति द्वारा तथा प्रकृति ही की उच्च रचना होने के कारण मनुष्य जीव जगत में सर्वाधिक बुद्धिमान तथा सामर्थ्यवान प्राणी है। नित नई नई खोजों तथा विकास की आगे से आगे बढ़ती ऊंचाईयों के कारण मानव ने आज अपने ऊंचे सामर्थ्य की सार्थकता को कुछ सिद्ध कर भी दिया है। परन्तु इतने पर भी वह कई बार प्रकृति की रहस्यमयी क्रियाओं तथा उनके प्रभाव की तीक्ष्णता के आगे बहुत बौना एवं पंगु भी दिखाई देता जा रहा है। प्रकृति की अनगिनत रहस्यमयी कुछ घटनाओं के पड़ते प्रतिबिम्ब के आकलन में भूकम्प को यदि हम लें तो मनुष्य जितना अधिक समझदार और सावधान लगता है उतनी ही अधिक तबाही भूकम्पीय त्रासदी के समय उसकी होती है। जबकि दूसरे जीव जन्तु अपेक्षाकृत कम मरते देखे गए हैं।

२६ जून २००१ की गुजरात भूकम्प त्रासदी में सारे संसार का ध्यान भूकम्प में होती मौतों की तरफ आकृष्ट हुआ। एक एक कर गिरते भवनों के मलबे के नीचे एक साथ दबते हजारों लोगों के मौत के ताण्डव ने विशेषज्ञों को कम ऊंचाई के भूकम्परोधी भवन निर्माण की तकनीक के प्रचार के लिए विवश किया। परन्तु बढ़ते आर्थिक सामर्थ्य के कारण भवनों की ऊंचाई पर ध्यान हटकर केवल भूकम्परोधी निर्माण पर केन्द्रित हो गया। ऐसी समझदारी भरी सावधानी भी बौनी पड़ती ही दिखाई दी और सुनामी के ताण्डव ने २६ दिसम्बर २००४ को खुले में भी पानी द्वारा लाखों लोगों को एक साथ मौत की नींद सुला दिया। बचाव की उस समय तक की सारी तकनीकें बौनी पड़ गईं। पूरा संसार कुछ नहीं कर सका था। ८ अक्टूबर २००५ को पाकिस्तान के इस्लामाबाद मुज़फ़्फराबाद में भूकम्प के समय लगभग ५०००० लोग मारे गए। जम्मू कश्मीर में भी लगभग डेढ़ हजार जाने गईं। २००५ को प्रभावित क्षेत्रों का दौरा करते हुए प्रधानमन्त्री ने इसे राष्ट्रीय आपदा घोषित किया। उस समय सारे का सारा हिमाचल प्रदेश भी भूकम्प से हिल उठा था।

इस सन्दर्भ में हिमाचल प्रदेश पर सावधानी पूर्वक एक दृष्टिपात यदि करें तो पता चलता है कि ५ अप्रैल १९६५ को कांगड़ा भूकम्प त्रासदी ने लगभग २०००० लोगों के प्राण ऐसे समय में हर लिए थे जब कि उस समय इतनी अधिक आबादी भी नहीं थी जितनी आज है। हिमाचल प्रदेश का शहर शहर, गांव गांव उस समय के मुकाबले में आज कई गुना अधिक घना आबाद है। यही नहीं यहां की धरती भी ऊंची नीची और लगभग सभी जगह ढलानदार है। हर ओर यहां ऊंचे ऊंचे पहाड़ और उनके शिखर हैं। मानवीय आबादी यहां की घाटी घाटी और छोटे पहाड़ों की चोटी चोटी पर है। ऐसे में भूकम्प के समय अलग अलग भू विशेषताओं तथा स्थितियों के कारण एक ही प्रकार की तकनीक द्वारा प्रत्येक प्रकार की भौगोलिक स्थितियों में बचाव के एक जैसे उपायों द्वारा वांछित परिणाम की आशा करना व्यर्थ है। इस तथ्य को दृष्टिविगत करना उतना ही घातक है जितना मानव पर प्राकृतिक मौत का प्रहार है।

भूकम्प की संवेदनशीलता के दृष्टिकोण से समस्त भू भाग को पांच जोनों में बांटा गया है। प्रदेश का लगभग ३२% भूभाग जोन नं० ५ में आता है। यह क्षेत्र भूकम्प की दृष्टि से सर्वाधिक संवेदनशील है जहां ६ या इससे अधिक तीव्रता का भूकम्प भी आ सकता है। कांगड़ा का ६८.६%, कुल्लु का ५३.१%, हमीरपुर का ६०.६%, ऊना का ३७%, मंडी का ६७.४%, बिलासपुर का २५.३% भाग जोन नं० ५ में आता है। चम्बा जिला का भी एक भाग जोन पांच में है। प्रदेश का शेष भाग जोन चार में आता है। बिलासपुर में भाखड़ा बांध से रुके पानी से बने गोबिंदसागर का भू भाग जोन चार में है जब कि इस पर अरबों टन पानी का अतिरिक्त बोझ इस समय लदा पड़ा है।

भूकम्प कभी भी और कहीं भी आ सकता है। इस दृष्टि से धरती का कोई भी क्षेत्र सुरक्षित नहीं है। विज्ञान अभी तक यह बताने में भी असमर्थ है कि भूकम्प कब, कहां और कितना आएगा। पृथ्वी की गहराई हजारों किलोमीटरों में है। इसका अर्धव्यास लगभग १२८०० किलोमीटर है। वैज्ञानिक ऊंचाई के इस युग में भी हम अभी पृथ्वी की सतह से कुछ ही किलोमीटर गहरे से आगे का सही कुछ भी नहीं देख पाए हैं। इस दिशा में एकत्रित ज्ञान का पुंज अनुमान तथा कुछ आंकड़ों के विश्लेषण पर ही आधारित है। धरती के गर्भ में बहुत नीचे सही सही क्या क्या और किस रूप में है इसका ठीक पता किसी को भी नहीं है।

गुजरात की भूकम्प त्रास्दी से लेकर अब तक भूकम्प के पूर्व सूचना तन्त्र को विकसित करने के लिए कई राष्ट्रीय और अन्तराष्ट्रीय कार्यशालाएं आयोजित हो चुकी हैं जिन में दुनिया भर के भूकम्प से जुड़े विशेषज्ञों ने भाग लिया है।

इस शताब्दी में जब और जहां कहीं भी भूकम्प आया, उसका कारण विशेषज्ञों द्वारा टैक्टानिकल प्लेटों का टकराना ही बताया गया। इन प्लेटों की गति एक दूसरी की ओर, एक दूसरे के विपरीत तथा एक दूसरी के साथ एक ही दिशा की ओर बताई गई है। इनकी गतिशीलता भी कुछ सेंटीमीटर प्रति वर्ष ही बताई गई है। इन प्लेटों की आपसी टक्कर को ही भूकम्प का कारण माना जा रहा है। यहां प्रश्न उत्पन्न होता है कि यदि वास्तव में ही भूकम्प का कारण इन प्लेटों की टक्कर ही है और इन की गति भी २ से ०मी० प्रतिवर्ष ही है फिर तो भूकम्प की भविष्यवाणी में सुगमता होनी चाहिए। परन्तु यह गुत्थी तो अभी तक सुलझाई ही नहीं जा सकी है। इस का अर्थ यह भी निकलता है कि भूकम्प के कारण कुछ और भी हैं या फिर इनका आकार, प्रकार, गहराई और गति कुछ और ही हो। इसलिए इस दिशा में पुनः अनुसंधान की नए सिरे से भी आवश्यकता हो सकती है।

हिमाचल प्रदेश में इस समय भूमि असंतुलन बढ़ता जा रहा है। यहां भूकम्प के आने तथा उसकी तीव्रता के बढ़ने का अधिक खतरा है।

बर्फ का पिघलना, भूमि का कटान, खदान, क्षरण तथा भण्डारण होने से भूमि कहीं हल्की तो कहीं भारी होती जा रही है। विकासात्मक गतिविधियों का केन्द्र नदी किनारे तथा घाटियां हैं।

बिलासपुर से लेकर किन्नौर तक सारी विकासात्मक गतिविधियों का केन्द्र सतलुज नदी की यह घाटी ही है जहां नदी किनारे या उसके समीप बनती तथा चौड़ी होती सड़कों के लिए बार बार भूमि कटती रहती है। कटी हुई यह मिट्टी की परत पर परत चढ़ती जाती है। यही स्थिति मनाली तक ब्यास नदी किनारे की है। चम्बा में वाथरी से लेकर होली तक रावी नदी के किनारे का भी यही हाल है। मंडी जिले में तो पहाड़ों के नीचे कई लम्बी-लम्बी सुरंगें बन चुकी हैं जिन्होंने पहाड़ों को खोखला कर डाला है। नित नई बनती तथा बनकर चौड़ी होती सड़कों, पेट्रोल पम्पों के निर्माण, बड़ी-बड़ी इमारतों के निर्माण के लिए जगह जगह धरती कटती जा रही है। इस समय प्रदेश में ऐसी सड़कों की लम्बाई लगभग ३०००० किलोमीटर है। सोलन के दाड़लाघाट तथा बिलासपुर के बरमाणा में सीमेंट के भारी भरकम उद्योगों के कारण भी भूमि कटती जा रही है।

कांगड़ा में पौंग बांध तथा बिलासपुर में भाखड़ा बांध की गोबिन्द सागर झील में अरबों टन अतिरिक्त गाद तथा पानी भरा पड़ा है। इसी प्रकार चम्बा, कुल्लु, मण्डी, शिमला में भी कई जलाशयों तथा बांधों

का निर्माण हो चुका है। कोलडैम, नाथपा झाकड़ी, लारजी, कशांग, ऊहल, चमेरा, पार्वती, कड़छम बांगटू, वासपा, मलाणा आदि कई जल विद्युत परियोजनाएं हैं।

यहां के गांव गांव, कस्बे कस्बे, शहर शहर और शिखर शिखर पर भारी भरकम बहुमंजिले भवनों का अनावश्यक निर्माण भी तीव्र गति के साथ जारी है। ऐसे निर्माण से एक ओर ढलानों पर भारी बोझ लदता जा रहा है और दूसरी ओर भारी तीव्रता के भूकम्प के समय भवनों के गिरने से मरने वालों की बढ़ती संख्या का जोखिम भी बढ़ता जा रहा है।

हाल ही में प्रकाशित समाचार के अनुसार सरकार शिमला, कांगड़ा, धर्मशाला, मनाली आदि नगरों तथा इनके आस-पास के क्षेत्रों में दो मंजिल से अधिक निर्माण को रोकने के लिए नियम निर्माण की ओर अग्रसर है। परन्तु अभी प्रदेश में जगह जगह पांच मंजिला निर्माण निरन्तर जारी है। यही नहीं लोग अपनी शान बढ़ाने तथा आर्थिक सामर्थ्य के प्रदर्शन के लिए भवनों को नए-नए रूप रंग और आकार देने के लिए अनावश्यक भारी भरकम कंकरीट की मोटी मोटी परतें चढ़ा कर धरती पर अत्याधिक बोझ लादते जा रहे हैं।

परिणाम:-

1. खदान, कटान तथा बांध निर्माण के कारण प्रदेश के पर्वतों की तराई के क्षेत्रों में मिट्टी, गाद और पानी रुकता जा रहा है और यहां की धरती को बोझिल बनाता जा रहा है। यह स्थिति भूकम्प की तीव्रता तथा जान माल की हानि को बढ़ाने और बाढ़ों को लाने का कारण बन सकती है।
2. हिम शिखरों की दिन रात पिघलती वर्ष से निकलता अत्यधिक पानी, वर्षा के पानी से मिल कर नदी किनारे या ढलानों पर पड़ी कटान की मिट्टी से गठबन्धन कर अचानक नदी के तल को ऊपर उठाता हुआ बाढ़ द्वारा जान माल की भारी तबाही कर डालेगा तथा असंतुलन भी बढ़ाएगा। २६ दिसम्बर २००४ को सुनामी लहरों के कारण लाखों लोग मरे। भारत में भी इन लहरों ने अपना प्रभाव दिखाया।
3. बिलासपुर के गोबिन्द सागर झील के पानी के नीचे तथा समीप का भू-भाग भूकम्पीय संवेदनशीलता के जोन ४ में आता है। यह भू-भाग पानी तथा गाद के भारी बोझ के कारण अब अधिक संवेदनशील बन चुका है। इसलिए अब इसे जोन नं० ४ में जारी रखना असावधानी को निमन्त्रण दे रहा है। यहां भूकम्प के समय अपेक्षा से अधिक हानि हो सकती है। इसके कारण इससे साथ लगते पंजाब के नंगल आनंदपुर के क्षेत्र भी प्रभावित हो सकते हैं।
4. भूकम्परोधी भवन निर्माण की तकनीक के कई प्रकार के प्रचार ने लोगों को फिर भारी भरकम भवन निर्माण की ओर प्रोत्साहित कर डाला है। इसके कारण लोग भूकम्प के प्रति असावधान भी होने लगे हैं। भारी मात्रा में प्रदेश के बाहर से आता लोहा, पत्थर तथा भवन निर्माण में प्रयुक्त होता अन्य कई प्रकार का सामान भी यहां की धरती के बोझ को बढ़ाता जा रहा है। इससे अधिक संवेदनशीलता के भूकम्प के समय भारी जान माल की तबाही हो जाएगी।
5. प्रदेश की तराई के क्षेत्रों में बने बड़े बांधों के कारण सहज भू-क्षरण द्वारा मिट्टी का वह कर आगे चले जाना भी अब रुक गया है। इससे भी संतुलन प्रभावित हो रहा है।

६. ऊंचे पर्वत, खदान, कटान, सुरंग निर्माण तथा बर्फ पिघलने से हल्के और खोखले होते जा रहे हैं। इनके प्राकृतिक स्वरूप और प्रभाव की स्थिरता एवं विश्वसनीयता बिगड़ती जा रही है। इससे भी असंतुलन बढ़ रहा है।
७. बहुमंजिले तथा भारी भरकम निर्माण के कारण नदियों, नालों तथा खड्डों से दिन रात उठती रेत बजरी भी विपरीत प्रभाव उत्पन्न करते जा रहे हैं।
८. नित नई नई और संख्या में बढ़ती जल विद्युत परियोजनाएं भी यहां के भू संतुलन को प्रभावित कर रही हैं।
९. प्रदेश में टैक्टाणिकल प्लेटों की टक्कर से हटकर मानव निर्मित कारणों से आते भूकम्प की संवेदनशीलता के बढ़ जाने की संभावनाएं बढ़ रही हैं।
१०. निर्माण भी आवश्यकता के लिए तो कम परन्तु दिखावे और धन छुपाने के लिए अधिक किया जा रहा है।

उपाय:—

१. गोबिंद सागर झील का क्षेत्र तथा इसके समीप बिलासपुर का वह क्षेत्र जो भूकम्पीय संवेदशीलता के जोन नं० ४ में है उसे तुरन्त जोन नं० ५ में रखा जाना चाहिए ताकि अधिक सावधानी बरती जा सके।
२. प्रदेश की धरती क्योंकि ढलानदार और भूकम्प के दृष्टिकोण से बहुत संवेदनशील है इसलिए यहां दो मंजिल से अधिक ऊंचे भवन निर्माण पर तुरन्त पूर्ण प्रतिबन्ध लगाना चाहिए। क्योंकि भूकम्प के समय तथा संवेदशीलता के बारे में हम ठीक ठाक न तो कुछ जानते हैं और न कह सकते हैं।
३. सादे भवन निर्माण को प्रोत्साहित करने तथा इसके लिए व्यक्तिगत आवश्यकता को कम करने का प्रचार किया जाना चाहिए।
४. भवनों के निर्माण में प्रयोग हेतु बाहर से आने वाली भारी भरकम वस्तुओं पर नियन्त्रण हेतु भी कुछ माप दण्ड निर्धारित किए जाने चाहिए।
५. पेट्रोल पम्पों के निर्माण के लिए अधिक ढलान वाली भूमि का चयन विधि निर्माण द्वारा रोका जाना चाहिए। इस से पहाड़ गहरे तक कट रहे हैं।
६. हर छोटी-छोटी जगह को सड़क से जोड़ने में शान और विकास को नहीं देखा जाना चाहिए। बिगड़ते पर्यावरण तथा भू असंतुलन के मूल्य का भी ध्यान रखा जाना चाहिए।
७. प्रदेश के लिए केवल मात्र राजस्व को ही सब कुछ समझ कर परियोजनाओं के निर्माण को अत्यधिक प्राथमिकता नहीं दी जानी चाहिए। इन से ध्वस्त होने वाले पर्यावरण को बचाने में लगने वाले मूल्य को भी ध्यान में रख कर निर्णय लेने से पहले लाभ हानि की तुलना की जानी चाहिए।
८. भवन निर्माण में अनावश्यक कंकरीट का प्रयोग न हो इसके लिए नालों, खड्डों और नदियों से पत्थर रेत और बजरी उठाने के नियम निर्धारित कुछ वसूली दरों के साथ कड़े किए जाने चाहिए।

६. प्रदेश के लोगों में दिखावे की बढ़ती लत की हानियों को प्रचार द्वारा उजागर किया जाना चाहिए। क्योंकि अनावश्यक दिखावे के कारण जहां हमारे संसाधनों का अधिक दोहन हो रहा है वहीं ऐसी बढ़ती प्रवृत्ति से भू संतुलन भी प्रभावित हो रहा है।
१०. भविष्य में भाखड़ा बांध की तरह बनने वाले बांधों के निर्माण से पहले भू संतुलन के आवश्यक पहलू को दृष्टिविगत नहीं किया जाना चाहिए।
११. ऊंचे भवन तथा बड़े भवन निर्माण वालों से उचित अग्रिम जोखिम धन राशि की वसूली कर उसे संबंधित जिला के मुख्यालय में रखा जाना चाहिए ताकि भूकम्प के समय प्राण हानि होने पर औचित्य के आधार पर यदि आवश्यक हो तो ऐसी धन राशि से प्रभावितों की तुरन्त सहायता हो सके। भवन के स्वयं गिराने या अन्य किसी कारण के उत्पन्न होने पर वह धन राशि भवन स्वामी को लौटा दी जानी चाहिए।
१२. जिला मुख्यालय पर राहत सामग्री के रूप में कपड़ों तथा दवाईयों का पर्याप्त प्रबन्ध अग्रिम रहना चाहिए।

‘फसल भी बचेगी बंदर भी बचेंगे व्यय भी नहीं होगा’

प्रकृति ने धरती पर मानव से पहले कई प्रकार के अन्य जीव-जन्तु उत्पन्न कर दिए थे। इसलिए ही तो कुछ को हमारे पूर्वज कहलाने का श्रेय मिला है। जीव-जन्तुओं की इस श्रेणी में वनचर बंदर का स्थान प्रथम पंक्ति में आता है। मानव की तरह शक्ल सूरत में कुछ समानता रखने वाले बंदर समूहों में बस्तियों से दूर घने जंगलों में रहा करते थे।

हम रामायण के यथार्थ या काल्पनिक प्रसंगों पर भी यदि दृष्टि डालें तो पता चलता है कि इस महाकाव्य के प्रसिद्ध नायक तथा श्री राम के विश्वासपात्र हनुमान तथा सुग्रीव के नेतृत्व में इन्हीं वानरों की सेना का एक सुदृढ़ संगठन तैयार किया गया था। यह सब वन्य परिवेश में ही हुआ था। तब से लेकर अभी कुछ ही वर्ष पूर्व तक तीर्थ स्थलों के कुछ विकल्प को छोड़ कर बंदरों का आवास और विचरण स्थल जगह-जगह फैले चीड़, देवदार तथा बांस सहित दूसरे प्रकार के पेड़ों के घने वन ही रहे हैं। परन्तु अब परिस्थितियां बदल गई हैं। पर्यावरण के अवयव बंदर खतरे में हैं।

मनुष्य ने अपने स्वार्थ के वशीभूत दो प्रकार से बंदरों के घर इन वनों पर प्रहार कर डाला है। एक तो अपनी जनसंख्या को बढ़ा कर वनों के बीच या समीप आवासीय निर्माण कर डाला है। दूसरे बढ़ते अपने लालच के कारण वनों में विद्यमान संसाधनों का दोहन भी बढ़ा दिया है। वनों में फल नहीं रहे। छुपने के लिए घने वनों ने अपना घनापन खो डाला। छिनती तथा छिन्न-भिन्न होती भोजन प्रणाली के कारण ये बंदर अपना पेट भरने के लिए सड़कों, रास्तों तथा बस्तियों के किनारे आ गए।

अब ये बंदर किसानों की फसल को नष्ट कर रहे हैं। खाने की जो भी वस्तु हाथ लगती है उसे घर आंगन से उठा ले जाते हैं।

बिलासपुर, मण्डी, कुल्लु, हमीरपुर, शिमला, कांगड़ा, ऊना, चम्बा, सोलन, सिरमौर, किन्नौर आदि सभी जिलों में सड़कों, बस्तियों के किनारे इन्हें देखा जा सकता है। भोजन की खोज में भागते ये बंदर फसल के दिनों में प्रतिदिन किसानों की फसलों पर धावा बोल देते हैं और उसे नष्ट कर डालते हैं। न फल बचते हैं, न मक्की, न चने बचते हैं और न बचती है सब्जियां ही। कभी-कभी तो किसी छोटे किसान की सारी की सारी फसल ही नष्ट हो जाती है। बार-बार नष्ट होती जा रही फसलों के कारण कई स्थानों पर किसानों ने अपने कुछ खेतों में फसल बोना छोड़ दिया है।

सरकार द्वारा बंदरों का मारने के उद्देश्य से परमिट जारी करने की व्यवस्था बनी। सरकार ने १५०० हैक्टेयर भूमि पर फलदार पौधे लगाने का निर्णय भी लिया। इसे २५०० हैक्टेयर तक बढ़ाने की योजना भी बनने लगी।

मनुष्य ने प्राकृतिक न्याय की परिधि से बाहर जाकर बंदरों का भोजन उनसे छीना है। इसलिए बंदरों द्वारा भोजन हेतु संघर्ष की परिणिती अब फसलों की बर्बादी के रूप में है।

यह प्राणी सुअर, नीलगाय जैसे पशुओं की अपेक्षा छोटा है। व्यवस्थित ढंग से दी जाने वाली भोजन की कम मात्रा पर निर्भर करता है। ऐसी परिस्थिति में फसलों को बचाने के अन्य विकल्पों को खोजे बिना इन निरीह और मानवीय लालच में त्रस्त प्राणियों को जान से मार डालने का मार्ग खोलना अन्यायपूर्ण व्यवस्था के रूप को उजागर करेगा।

किसानों की फसलों की बर्बादी तथा बंदरों के प्रति न्याय के दृष्टिकोण से इनके लिए पंचायत समूहों में ऐसे अभयारण्य बनाए जाएं जो दीवारों से घिरे हों। इनका स्थान कृषि योग्य भूमि न होकर पेड़ों के बीच में ही हो। दीवार के साथ भीतर की कुछ जगह पेड़ों से मुक्त रखी जानी चाहिए ताकि बंदर उछल कर बाहर न जा सकें। इसके बीच कुछ फलदार पेड़ भी लगाए जा सकते हैं इन्हें बंदरों से अलग भी रखा जाए तथा फलों के समय कुछ देर बंदरों को वहां छोड़ा भी जाए।

ये अभयारण्य आम लोगों के आने-जाने के मार्ग या सड़क किनारे बनाए जाने चाहिए। इनके भोजन की व्यवस्था पंचायतों के माध्यम से किसानों द्वारा दिए जाने वाले अन्न दान से हो जाएगी। फसल की सुरक्षा के कारण किसान ऐसा सहर्ष करेंगे। बंदरों के प्रति लाखों लोगों की जुड़ी भावना के कारण अभयारण्यों में रखे दान पात्र तथा रसीद देने की व्यवस्था द्वारा लोगों से धन भी प्राप्त हो जाएगा। इससे वहां लगे कर्मचारियों पर होने वाला कुछ व्यय भी पूरा हो सकेगा।

इनके प्रबन्धन में सहायता के लिए स्थानीय लोगों की समिति बनाई जाए। इनमें पंचायत के लोग, पूर्व सैनिक तथा सेवानिवृत्त स्वयंसेवी अधिकारी रखे जाएं इससे तुरन्त फसल भी बच जाएगी, नसबंदी भी सुगम हो जाएगी और जान भी नहीं जाएगी। रोजगार के अवसरों की संख्या भी बढ़ जाएगी। सरकार की पूंजी भी बच जाएगी।

