

Chapter 23

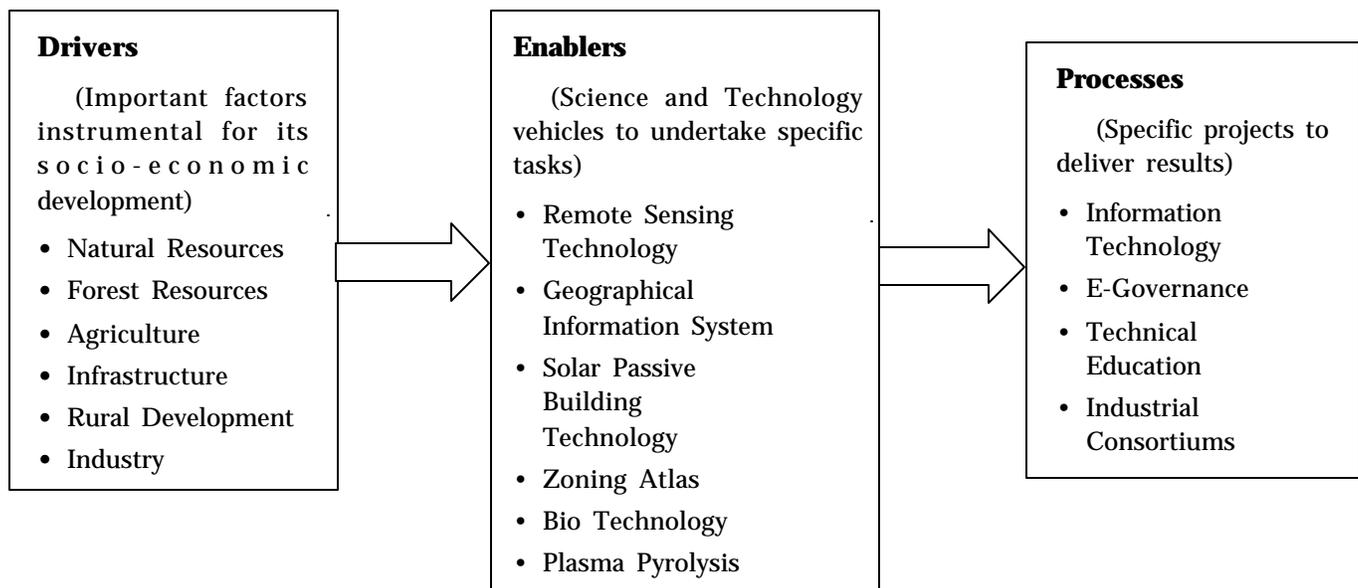
Science and Technology

The methodology followed in the chapter on Science and Technology is based on identifying Drivers, Enablers, and Processes in the context of Himachal Pradesh to provide with recommendations. This conceptual framework can be better understood with the help of the following figure

Natural Resources

Natural Resources of Himachal Pradesh which should draw the attention of Science & Technology have been grouped, for the purpose of this note, as follows:

- Physiographic Zones



Drivers

Important factors instrumental for its socio-economic development

- Natural Resources
- Forest Resources
- Agriculture
- Infrastructure
- Rural Development
- Industry

- Drainage Network
- Soil Types
- Land Resources
- Water resources
- Mineral Resources
- Natural Disasters

Natural Resources of Himachal Pradesh have direct relationship to its physiographic conditions including relief, drainage, climate and geology. These in turn

influence the type of soils and kind of vegetation cover. Integrating Remote Sensing based thematic information, meteorological and collateral data for scientific management of various natural resources should be an important priority for S&T. Using GIS to provide information regarding

- District/Block Boundaries (With Areas)
- Settlement/Roads (With Names),
- Contour/Elevation Points (In Meters),
- Watershed/Drainage (With Area),
- Soils (Types),
- Lithology/Geology,
- Hydro-Geomorphology (Water Potential Zone, Land Use/Cover (Latest Satellite Information),
- Hazard Zonation (Risk Prone Area),
- Action Plan For Water Management (Number of Locations),
- Action Plans For Land Resource Development (Spatial)

Physiographic Zones

Himachal Pradesh has been divided physiographically into four distinctly identified zones based on the variations in altitude, climate, geology, soil, flora, fauna and topography namely:

- Outer Himalayas/Shivalik Hills
- Lesser or Lower Himalayan Zone
- Main or Great Himalayan Zone and
- Trans-Himalayan Zone

Drainage Network

The state is drained by nine major river systems and thereby has nine catchments areas. Some of these are: the Satluj, the Beas, the Chenab, the Yamuna, the Ravi and the Indus.

The system of sustainable water management has to be preceded by understanding the dynamics of the hydrological regime. This would involve studying the movement of glaciers and their role in water regulation, the role of precipitation, percolations and fluctuations of ground water

Soil Types

The soils of Himachal Pradesh vary from thin and bare soils of High Mountain to rich deep alluvial soils

of valleys and to snow covered soils. These can be classified into

- Udalfs-Ochrepts Soils
- Othents-Ochrepts Soils
- Udolls Soils
- Glaciers and Snow-capped Soils

Soils are under gully and sheet erosion. About two-fifths of the state's area is under the impact of very high soil erosion. The unsurveyed parts of the state need to be studied and mapped by remote sensing cell using satellite data.

Land Resources

The total state area is 55673 kms. Hardly 10 per cent of the total area is cultivated and actual forest cover make 22.5 per cent of the total area. Permanent pastures and other grasslands account for 24 per cent of the total area. Barren and Unculturable land covers about 14 per cent of the area of the state. About 23 per cent of the total area remains unsurveyed.

On the basis of land use Himachal Pradesh can be divided into three broad regions.

- Intensively Ploughed, moderately forested, southern region with marginal presence of pastures and other grazing lands;
- Moderately Cultivated, highly forested central region, with a considerable proportion of pastures and other grazing lands; and
- Poorly cultivated, sparsely forested, northern region with a high proportion of pastures and other grazing lands

Considerable improvements are required for an optimum utilisation of land resources.

- The forest cover needs to be extended to more areas, as it is much below the target of the National Forest Policy according to which a hill state should have 60 per cent of its area under forest.
- There is a need for proper management of extensive wastelands.
- The policy of shifting of management of common lands from the community to the state has not proved beneficial as it reduced the scope of people's participation in resource management.
- Using satellite data (IRS-1D) for preparing risk maps and landslide management maps to

formulate the strategies for minimising the social impact of land slides

Water Resources

The state is richly endowed with the hilly terrain with significant volume of water of its perennial rivers flowing down in steep gradient in the mountain catchments. This permits the required natural head for the generation of hydroelectric power, refer Annexure A-23.3.

The State also has many water resources in the form of (a) surface water resources (glaciers, rivers, lakes, reservoirs Table 2.1 & 2.2, Chapter 2 of the present Report), (b) ground water resources, and traditional sources of water (Table 2.3, Chapter 2) (refer Annexure A-23.4)

S&T issues related to water are

- Ensuring infrastructure facilities for ground water management,
- Tapping hydro-power potential,
- Keeping in view the ecological impact on upstream and downstream parameters,
- Realising the importance of glaciers as “Frozen Water Banks”,
- Emphasis should be given to the collection of hydrological and hydro-geological data for exploration of surface and groundwater resources,
- Using GIS to access Hydro-geomorphology (water potential zones)
- Using Remote Sensing Satellite data for delineation of potential groundwater zones (IRS-1A, 1B, IC & 1D satellite data)
- Using Remote Sensing Techniques for the selection of sites for setting of hand pumps/bore wells.
- Construction of low cost Ferro-cement rainwater harvesting structures.
- Setting up Hydrams (an apparatus which utilises the kinetic energy of moving column of water to pump up a part of this water to a greater height than that of supply head).

Mineral Resources

The state has rich mineral resources such as limestone, gypsum, rock salt, manganese, silica sand and quartzite etc. In addition, building materials like slate, granite, clay and sandstone are available. Other minerals

reported are iron, beryl, copper, lead, silver, uranium, kyanite etc. (Table 2.7, Mineral Resources of Himachal Pradesh, Chapter 2 and refer to Annexure A-23.5)

Data in Zoning Atlas should be used for granting future permissions for establishing new industries, particularly plants that use mineral resources e.g. cement plants.

Natural Disasters

Himachal Pradesh is exposed to natural disasters of various intensity, which prominently hamper the development process of the state.

Disasters in the form of earthquakes (Table 3.1 & 3.2 Chapter 3), landslides, flash flood and cloudbursts (Table 3.3, Chapter 3), avalanches (Table 3.4, Chapter 3), soil erosion, forest fires (Annexure A-23.6) have caused substantial loss to the state.

Using information generated from IRS-1D satellite data should be used for:

- Base map
- Lithological Map
- Rock Weathering
- Soil Map
- Geomorphological Map
- Slope Map
- Slope Aspect
- Slope Morphology
- Drainage Density,
- Intersection of Lineament
- Density of Lineament
- Proximity to Fault
- Land Use/Land Cove
- Anthropogenic Factors
- Land Slide

Forest Resources

Forests are a key natural asset of the state. The striking feature is the diversity of woody plant species, representing soft wood conifers and hard wood deciduous flowering plant species occupying temperate climate zones. Of the 45,000 species of plants found in the country as many as 3,295 are reported in the state. Himachal Pradesh comprises four forest zones:

- Sub-tropical Forests

- Sub-temperate Forests
- Wet-temperate Forests
- Dry-temperate Forests

(Table 4.1, Chapter 4)

The forest cover in Himachal Pradesh is 14,360 sq km, which is 25.79 per cent of the geographical area. This includes area under orchards and natural regenerated area. Forest classification shows a decline in the total forest area during 1995-96 over 1990-91 due to decrease in unclassed forest area and protected forest area. In 2000-2001, the total forest area exceeded that of 1995-96 but remained below what it was in 1990-91 (Table 4.5 & 4.6 Chapter 4).

The data on annual prescribed yield and growing stock of commercially important species (Table 4.9, Chapter 4) reveal that Fur/Spruce followed by Deodhar are the important species which the state government exploits for different purposes. District-wise percentage of the forest cover to the total geographical area of Himachal Pradesh in 1999 varies from 1.1 per cent in Lahaul-Spiti to 46.6 per cent in Shimla (Table 4.10, Chapter 4).

S&T actions in the area should include

- Use of plant biotechnology for reforestation (involving micro propagation)
- Systematic organic cultivation of appropriate species of medicinal plants in proper ecosystem for sustained availability with suitable regulation on extraction of Wild Flora
- Development of processing technology for all the year round, harnessing of the crops in appropriate harvesting season and preservation thereof without loss of quality for the year round consumption

Agriculture

Major aspects under agriculture that should draw S&T actions in the State are:

- Horticulture
- Medicinal and Aromatic plants
- Irrigation
- Watershed Development

The state is dominated by agriculture including horticulture and animal husbandry. Important crops grown in the state are Cereals-Maize, Wheat, Rice and Barley, Pulses, Oil seed, Buckwheat, Minor Millets,

Cash crops—Potato, Ginger, Tea, Peas, Kuth, Hops, and a variety of vegetables including out of season and exotic vegetables and fruits particularly Pome, Stone and dry fruits like *Chilgoza*, Walnut, Pecan nut, Pistachio etc. and vegetables like Seed potato, Ginger, Chickery seed, Olives, Figs, Apples and Mushrooms besides certain medicinal and aromatic plants.

The texture of the soil, climate and rainfall vary in the four zones and so does the cropping pattern (Table 11.1 & 11.2, Chapter 11).

IRS-1C, 1D remote sensing data should be extensively used for crop acreage and production estimation for providing pre-harvest district/state level crop acreage estimate and integrating these estimates with yield relationship for district/state level production forecasting

Horticulture

Himachal Pradesh has the advantage of the climate and topography in the cultivation of a variety of fruits. Temperate fruits cover about 64 per cent of the total cultivated area of the state of which more than 40 per cent is under apple cultivation. The area under fruits more than doubled in the last two decades.

Similarly the productivity of apples almost doubled to 4500 kg per hectare during 2000-01 but the productivity of Nuts, Dry fruits, Citrus and other subtropical fruits decreased even though the area under these crops increased (Table 11.9, Chapter 11).

Fruit production which was 1200 metric tonnes in 1950-51 increased to 4.3 lakh metric tonnes but the yields are about 10 to 12 times below what is produced in European countries (Table 11.11, Chapter 11)

The S&T activities in the area of horticulture should include

- Use of low cost and easy to use fertilisers –Bio Fertilisers
- Popularising fertilisers which rejuvenate the soil strata and add organic fertilisers to the soil
- Popularising use of fertilisers, which provide nitrogen and phosphorus and liberate growth regulators

Medicinal and Aromatic Plants

The state is a rich repository of medicinal and aromatic plants because of its situational advantage. It is estimated that about 500 medicinal, 150 aromatic and a large no of potent alternative and substitute drug

plant species are available in the area (Table 11.15, Chapter 11). Some of the herbs and plants available in the state are *Guchhi*, *Tejpatta*, *Patish*, *Banka Kari*, *Dhooproots*, *Bharami*, *Katha*, *Kala Jira*, *Karu*, *Banaksha*, *Kesar*, *Hyphopia* etc.

Besides, there are many species which remain unidentified due to lack of knowledge and research. Unsustainable ways of harvesting and unrestricted marketing have led to the reduction in population of some of the high demand medicinal plants leading to sudden escalation of prices.

This calls for urgent measures for *in-situ* and *ex-situ* conservation of such species coupled with cultivation for sustained development of growing herbal drug industry. To identify new species and to avoid unscientific ways of extraction training programs should be organised in the state.

Setting up of herbal-based clusters has been suggested. These clusters will provide high quality infrastructure in terms of marketing, financial and technical support. Other important horticulture activities include Mushroom Cultivation and Bee Keeping.

Suggested actions for S&T are:

- To develop agro technology of endangered and commercial species of medicinal and aromatic herbs/plants
- Use of GIS and Remote Sensing for the study of bio-diversity supported by ground truth realities
- Use of biotechnology for multiplication of species, shy seed bearer or have low germination rate

Irrigation

While there is plenty of water in the hills, yet water used for irrigation is limited to over 1.05 lakh hectares out of nearly 6 lakh hectares of cultivated land. More than 50000 hectares of cultivated land can be brought under irrigation through major and medium irrigation projects, which are underway, and the remaining area can be provided with irrigation through minor and other irrigation schemes.

Using satellite data interpretation for mapping of glaciers and snow fields/disaster warning/estimation of irrigation potential/planning and operation of mini and micro hydel electric power stations is required.

Watershed Development

The objective of the Watershed Development Projects is to promote economic development of the

village community and to check the adverse affects of drought by restoring the ecological balance and generating the employment for the people of the watershed area. Nearly 70–75 per cent of the rain occurs during the monsoon season, which flows as run-off without much use or conservation.

As a consequence all areas which are without assured irrigation suffer from water stress and low productivity. For the Tenth Five Year Plan, 70 watersheds have been identified in 8 districts of Himachal Pradesh. These watersheds when commissioned will irrigate about 44000 hectares of cultivated land in the dry season (Table 11.18, Chapter 11).

Infrastructure

Two areas, namely, Energy and Transport-Roads are suggested as focus for S&T.

Energy

The state has a Hydro Power Potential of 20000 MWs of which only 20 per cent has been harnessed so far. Power can be tapped from both renewable and non-renewable resources. Himachal Pradesh has the highest heat flow and highest thermal gradient geothermal basin in India (Table 17.1, Chapter 17).

The non-conventional sources of Geothermal and Solar Power have potential for rural and hamlet electrification schemes. As of now, 20 per cent of the total available potential has been harnessed with another 7060 MWs under various stages of execution (Table 17.4, Chapter 17).

S&T actions proposed in this area are:

- Use of solar passive housing technology for public and industry
- Simulation of solar passive buildings using computer software

Transport-Roads

Considering the geography of the state, roads in the form of National Highways, border roads, state highways and other arterial and rural roads are an important component. Various schemes like The Pradhan Mantri Gram Sadak Yojna, The Rural Infrastructural Development Fund (RIDF), Central Road Fund are being undertaken to fill the inadequacies of the road network like less all-weather roads (Table 17.14, Chapter 17), poor village connection (Table 17.15, Chapter 17), poor road quality, lack of environmental consideration in road design and construction etc.

Remote Sensing Technology, Satellite data and 3-D Modelling software (surface modellers, surface modellers, polygon modellers) for economical position and structure assessment of roads and bridges should be used.

Rural Development

The proposed areas of focus for S&T are rural industrialisation and rural informatics.

The State with 90.2 per cent of its population in the rural areas (Table 13.1, Chapter 13) has a sizeable deprived population consisting of marginal farmers, landless labourers, besides schedule castes, the schedule tribes and other backward castes. This component of population has to be brought into focus for upliftment with emphasis on the skill up-gradation, removal of unemployment and vertical growth.

A better network of physical infrastructure facilities is essential for development of rural economy. Table 13.3, 13.4, 13.5 and 13.6, of Chapter 13 highlight inter-district disparities with regard to some of the basic development indicators. For this purpose S&T thrust in this area should include:

- Using information technology for governance by focussing the tension on improvement of production, consumption and social services
- Using IT for marketing rural goods
- Maintaining and upgrading existing rural infrastructure and promoting facilities such as cold chains, marketing intelligence network to facilitate the agro processing industries

Rural Industrialisation

Rural development requires a positive change in the rural areas, both qualitatively and quantitatively, which is possible by providing gainful employment, proper utilisation of land resources, introduction of modern technology industries and micro planning under the Panchayati Raj setup with decentralisation of finances and delegation of powers

Rural Informatics

Components of rural development, viz., agricultural growth, infrastructure development, human resource development, rural industrialisation and grassroot level rural governance, can benefit from information technology by focusing attention on improvement of production, consumption and social services.

Computerised information can be used in decision making at the village, block and district levels for

maintaining land records, afforestation, beneficiary details, development schemes, rural banking, rural environment and other socio-economic indicators.

Industry

The focus areas for S&T concern in Himachal Pradesh are suggested to be:

- Concentration of Industry
- Industrial Infrastructure
- Agro/Food Processing
- Textile and Hosiery
- Cement
- Handloom Industry
- Sericulture
- Waste Management

Concentration of Industry

By March 2002 the total production for SSI and L&M sectors was worth Rs. 5000 crore providing direct employment to 1.556 lakh persons with an investment of Rs. 3048 crore (Table 16.2, Chapter 16)

Industrial development in the state has been uneven. The state has been classified into two categories viz., industrially developed and backward areas/districts. The periphery districts of Solan and Sirmour are the most developed and have been categorised as developed districts, while Kangra and Una are less developed and come under the category of backward districts.

In the industrially developed areas of Solan and Sirmour districts, L&M units account for 88 per cent, investment 70 per cent and employment 34 per cent, while in the remaining 10 districts categorised as backward areas/districts SSI and tiny sector units account for 82 per cent, investment 30 per cent and employment 66 per cent (Table 16.3, 16.4, and 16.5, Chapter 16)

S&T should take help of Zoning Atlas to:

- Zone and classify the environment in a district;
- identify locations for siting of industries; and
- identify industries suitable to the identified sites

Industrial Infrastructure

Himachal Pradesh has developed 30 industrial areas and 10 industrial estates with all basic amenities like roads, power, sewerage, water and communication etc. (Table 16.7, Chapter 16). The existing industrial areas

and estates provide the basic infrastructure but modern and technological infrastructure is highly inadequate.

The State with diverse agro climatic conditions and geographical features, horticulture, floriculture, sericulture, forestry, hydro-power generation, handicrafts, handlooms, herb based and aromatic, minerals, wool based industries are comparatively better developed. These industries have been identified as thrust industries.

This makes it imperative to develop modern and appropriate infrastructure setting up clusters at conducive destinations (for example, Table 16.8 of Chapter 16 gives an overview of recommended clusters location wise).

Agro/Food Processing

The number of units in this area is 8000 in the SSI and tiny sectors and 27 in L&M sector and employ approximately 30000 people. This industry at present is mainly limited to traditional processing of agricultural and horticultural raw materials using low-grade technology. The production of all kinds of fruits has decreased sharply during the year 1999-2000 evident from the fact that as against the production potential of 4.92 lakh tonnes, the production of fruits during the year 1999-2000 was 0.89 lakh tonnes.

S&T initiatives should take effective steps to raise the productivity and quality of apples and other fruits and to evolve an integrated strategy for fruit farming and food processing.

Textile and Hosiery

This industry accounts for 60 per cent of the total employment offered in the large and medium sector. The major hosiery industries are in SSI and tiny sectors located in the backward areas. The main products of this industry are shawls, patti, caps, jackets, sweaters and mufflers. Kullu, Shillai, Udaipur and Hamirpur have been identified for setting up the textile and hosiery clusters.

Cement

Mining in recent years has intensified in the state due to abundance of Limestone, Gypsum, Slates etc. In the aftermath of this activity many adverse environmental factors have arisen. The exploitation of limestone and the quarrying of slate have affected the ecosystem of the state, leading to encroachment and destruction of forests.

At present there are four cement plants in the L&M sectors in addition to three mini plants (Table 16.9,

Chapter 16). Quality limestone which is one of the important ingredients in the manufacture of grey port land cement is available in plenty in Himachal Pradesh.

Three more large-scale cement plants based on limestone have been approved to be set up in Sundernagar, Alsindi (Mandi District) and Chamba. These private sector plants are being set up by M/s Larsen and Toubro Ltd, M/s Grasim Industries Ltd and M/s Harishchanra Ltd. M/s Gujrat Ambuja Cement Ltd. has proposed to set up new plans near their plant already in production in Solan district. In addition, one at Koti and in Gumma in Shimla district are also under consideration.

The installation of these plants poses a threat to the ecology and environment of Himachal Pradesh.

Handloom Industry

With 42000 handlooms in the state, primarily based on wool, the handloom industry is an important cottage industry providing gainful employment to about 45000 weavers. The main products woven in handlooms are Woollen Ladies' Shawls, Woollen Gents' Shawls, Woollen Tweeds, Shirting, Dress Material and Woollen Carpets etc. This industry is mainly concentrated in Kullu, Mandi, Kinnaur, Kangra, Lahaul and Spiti and Chamba districts of the state.

Sericulture

Climatic conditions of Himachal Pradesh are most favourable for the growth of this industry. It is a village oriented labour intensive industry in all its phases from cultivation of silk worms and food plants to silk worm rearing, silk reeling and other processes such as twisting, dyeing, weaving, printing and finishing. At present this industry provides subsidiary occupation to more than 10000 families mainly belonging to the poorer section.

Waste Management

As Solan and Sirmaur have the maximum number of L&M units, they also have the largest concentration of hazardous waste generating industries. The waste generated by different towns and industries is polluting rivers, their tributaries and streams. A major pollutant in the river is the synthetic waste. The condition of major rivers like Gumbher, the Kuni, the Kaushalya, the Asni, and the Sarsa are receiving industrial waste which carry filth and non-biodegradable waste [refer to Annexure 8 (a) and (b)]

Productivity and quality improvement initiatives in each of the above sectors should be taken up by S&T.

The Enablers

Science and Technology vehicles to undertake specific tasks

- Remote Sensing Technology
- Geographical Information System
- Solar Passive Building Technology
- Zoning Atlas
- Bio-Technology
- Plasma Pyrolysis

Remote Sensing Technology

Geographical Information System

- Tax (Parcel) Map Maintenance
- Producing Mailing Labels for Abutter Notifications
- Standard Theme Maps
- Custom Maps
- Providing Basic Information for Building Permit
- Public Access Terminal
- Network Infrastructure Maintenance Tracking
- Export Data to Computer Assisted Drawing (CAD) Software
- Fire Equipment Response Distance Analysis
- Preparation of Existing Land Use Map
- Analysis of Urban Sprawl
- Land Suitability Analysis
- Transportation and Network Analysis
- GIS in Municipal Governance
- Land Use/Cover Analysis
- Land Use Change Detection

The broad spectrum of application areas in GIS suggests that GIS can be a promising tool to the urban planners in finding the solutions to the problems confronting them today.

Remote Sensing is of immense use in field of scientific mapping of natural resources, especially in the remote and inaccessible areas of the state. The capability of high resolution, synoptic prospective and repetitive coverage over the same area from Remote Sensing Satellite orbiting the earth have been an added advantage for monitoring the seasonal changes on vegetation and timely forecasting of the future events on the earth's surface.

Facilities for the analysis, interpretation and use of satellite data have been created in the state. Using these facilities, the following studies have been completed.

- Hydro-geomorphologic mapping on 1:250000 scale
- Land use/land cover mapping on 1:250000 scale
- Lineament mapping on 1:250000 scale delineation of prospective areas for mineral exploration
- Delineation and generation of digital database of the wasteland in nine districts of the state namely Shimla, Mandi, Kullu, Lahaul & Spiti, Sirmaur, Una, Solan, Kinnaur and Bilaspur districts on 1:50000 scale
- Wetland inventory prepared and digital database made available to the fisheries department
- Integrated evaluation of natural resources of Chamba district on 1:50000 scale and generation of digital database for planning.
- Assessment of tea plantation in Kangra district
- Glacier and snow cover mapping for the Satluj and Beas basins

Remote Sensing Techniques can further help in providing consultancy services in the field of ground-water management, micro Hydel project pre-feasibility study, environmental impact assessment studies etc.

Geographical Information System

GIS is a computer aided decision support and planning tool, which integrates data from maps and other auxiliary information from geographical area of interest. It does a complex analysis of spatial data and non-spatial information. Its objective is to bring data from a multitude of sources together and to uncover complex relationships otherwise difficult to comprehend.

The enormous data on natural resources, socio-economic and demographic set-up required for district level planning could be efficiently handled and analysed using GIS. Different management scenario can also be processed allowing the planners/managers to analyse various alternatives before selecting the most appropriate plan.

GIS can be used as an effective tool for civic administration. However, till date most of the organisations are manually creating and utilising a variety of maps in their daily activities. With the ever-exploding population, the basic infrastructures in urban and rural areas could crack down in the absence of an

adequate planning due to these analogue maps. GIS tools can effectively be used as front ends, if designed appropriately for use of novice officers in the administration”.

Suggested Applications of GIS

Tax (Parcel) Map Maintenance

As property boundaries change, the Assessor’s tax maps need to be updated. Once property boundaries are part of the GIS database, they can be edited using the GIS software. The system of property tax management can also be upgraded while using GIS and preparing property tax information system.

Producing Mailing Labels for Abutter Notifications

Zoning board of appeals hearings or proposed actions by a town/city require notifying abutting property owners. A GIS application for producing abutter mailing labels enables you to identify abutting property owners in different ways (“within 300 feet”, “abutters and abutters-to- abutters”, “abutters on a Main Street between house numbers 23 and 77”). Once the properties are identified this kind of GIS application can produce mailing labels and be integrated with a word processing “mail merge” capability.

Standard Theme Maps

Many communities produce or need maps for specialised purposes (e.g., property maps for revaluation by the assessor, maps of the water system, police zone maps, urban zoning maps, etc.). A GIS typically includes a programming capability that makes it possible to create a standard map set. When the program is run it produces one of each sheet in the set and sends them to a colour printer.

Custom Maps

GIS allows you to make maps of virtually any size and scale for any area of your jurisdiction. In addition, these maps can combine any set of features you want from the database. This is simply not practical without a GIS.

Providing Basic Information for Building Permit

At its simplest level this involves using the GIS to find a property location using an address. Once the property to which the permit applies is identified, the GIS can be used to provide some of the essential information (e.g., address, property ID, zoning

classification, lot area, street frontage) needed for filling out the permit.

Public Access Terminal

GIS can be used at public counters, either by the public or by town staff assisting the public, to view information such as properties and related information about assessed value. Similarly information about streets, open space, natural features, school districts, election wards or zoning districts can also be displayed. If provided, such a terminal might also enable users to make maps of the requested information.

Network Infrastructure Maintenance Tracking

Public Works Department may systematically and annually perform certain kinds of maintenance on road, sewer, water or storm drain networks. These actions might consist of street re-paving, water main flushing or similar activities. A GIS could be used to track work that has been performed in prior years, the work planned for the current year and the work proposed for future years. This information can then be summarised on a map and/or in tabular form.

Export Data to Computer Assisted Drawing (CAD) Software

GIS software will be able to export your data to other file formats, such as DXF or drawing exchange format. This format is read by many software packages including the CAD software AutoCAD. This kind of application might allow you to select features (e.g. property boundaries, building outlines, sewer pipes) for an area you select and then save them to .DXF file format for use in creating engineering design drawings.

Fire Equipment Response Distance Analysis

A GIS can be used to evaluate how far (as measured via the street network) each portion of the street network is from a firehouse. This can be useful in evaluating the best location for a new firehouse or in determining how well the fire services cover particular areas for insurance ratings.

Preparation of Existing Land Use Map

A remote sensing and GIS can be used to prepare an existing land use map and update the old town planning scheme maps.

Analysis of Urban Sprawl

To study the extent and direction of the city expansion, also to understand the underlying driving

forces for the expansion. Assessment of Land use conversion in different parts of the city to help understanding of the impact of the policy pursued.

Land Suitability Analysis

Expansion of any activity requires land. And the purpose of the land use requires the suitability of the land. It depends upon several parameters such as soil, topography, slope, drainage, etc., A GIS can be used to integrate all these parameters and identify the land suitability for the required purpose.

Transportation and Network Analysis

Besides these, there are many planning tasks that can be carried out using GIS for meaningful applications. It is essential to look into the technical, financial and institutional processes and lacuna in order to make the use of GIS in municipal organisation for its effectiveness.

GIS in Municipal Governance

In the municipal administration GIS can contribute to improved productivity and streamlining of internal government administration by helping to remove paper work from the process or by facilitating coordination and consolidation of information.

Land Use/Cover Analysis

Remote Sensing and GIS finds a major role in detecting changes in land use. Through remote sensing, one can get various season data, clearly indicating the changes in the land. Through visual interpretation, the changes can be identified. However GIS is essential for detailed land use/land cover analysis. The interpreted data when taken into GIS through R to V conversion and the relevant database attached to land use/land cover map, different types of overlay analysis can be done in no time.

Land Use Change Detection

GIS can be effectively used in detecting the changes in land use. Base map of the area for which the change in land use needs to be analysed needs to be prepared over two time periods. One would be the present land use map and the other would be the land use map for preceding time. The two base maps of different time periods when overlaid and if required rubber sheeted (is done to equalise the analysis areas), the changes can be interpreted for different parcels or layout subdivisions. Land use change detection is very critical for tax planners for tax assessment of the parcels, urban

planners for planning for land use changes/land use analysis, detecting land use violations etc.

The endless list of application areas in GIS suggests that GIS can be a promising tool to the urban planners in finding the solutions to the problems confronting them today.

Solar Passive Building Technology

Major areas of focus for S&T are suggested as follows:

- Solar Buildings with no additional costs
- Solar Buildings with incremental costs of 5-10 per cent
- Buildings requiring retrofitting

Himachal Pradesh is the first state in the country to introduce Solar Passive Building Technology for the design and construction of Government and Semi-Government buildings on a large scale. Solar Passive Building Technology utilises the orientation of the building for the availability of solar energy at the site for natural heating or cooling of the building resulting in saving of large amounts of fossil fuels and electricity and will also result in considerable savings of the Government Exchequer.

The dependence on conventional fuels like firewood, charcoal, coal, and electricity for space heating is also lessened, thus saving forest and conserving energy. This technology is an environmentally sound and economically viable technology in which the site planning, climatic conditions, and movements of the sun during summers and winters are considered to create comfortable living conditions.

Solar Buildings with No Additional Costs

Buildings for which there is a freedom of proper site planning, appropriate building materials and efficient functional planning at initial stages, the solar passive design features will cost very little extra expenditure

Solar Buildings with Incremental Costs of 5-10 per cent

Buildings for which there is less independence in selecting the site and orientation, there may be a small incremental cost of 5-10 per cent.

Buildings Requiring Retrofitting

Buildings above 2000 meters requiring roof collector solar space/air/water heating systems with electric

backups or in which solar passive systems are to be retrofitted, the costs can go up to 15 per cent. However, due to lesser fuel consumption these incremental costs can be recovered with in 2-3 years

Solar Passive Designs Should be Used for

- Innovative Designs For Rural Buildings- incorporating earthquake resistant and solar passive designs
- Consultancy For Innovative Housing Technologies To Public- incorporating Solar passive technology, earthquake resistant features etc. thereby helping in proper utilisation and planning of the land area
- Passive Solar Cooling Technology for Hot Climates – incorporating features of passive cooling for low altitude regions of Himachal Pradesh.
- Retrofitting of Rural Houses with Solar Passive Heating System-retrofitting existing houses with low cost Thermo Symphonizing Air Heating Panels, Sunspaces and Trombe Wall Systems
- Thermal Comfort Evaluation of Buildings
- Solar Passive Designs of Primary Schools and
- Training & Field Demonstration of Technologies

Zoning Atlas

The overall deterioration of the environment has given a fresh impetus to physical planners to include environmental parameters in planning. At present, the industries and the related activities in our country are expanding at a fast rate, but the siting of these industries is not carried out in a planned manner. This has serious repercussions on the environment. The carrying capacity of the environment is not unlimited. Some areas like forests, human settlements, the flora and fauna and water bodies or air shed might be affected and the ecosystem might be harmed.

Environmental planning is a proven tool for reducing the impact from such risks.

The Zoning Atlas is not only the solution for the problems caused by haphazard industrial siting, but tackles the cause of the problem itself. The Zoning Atlas identifies suitable sites for siting of industries based on environmental considerations. The environmental parameters and conditions are evaluated and quantified and the suitability of sites is determined based on their sensitivity to air, water and land

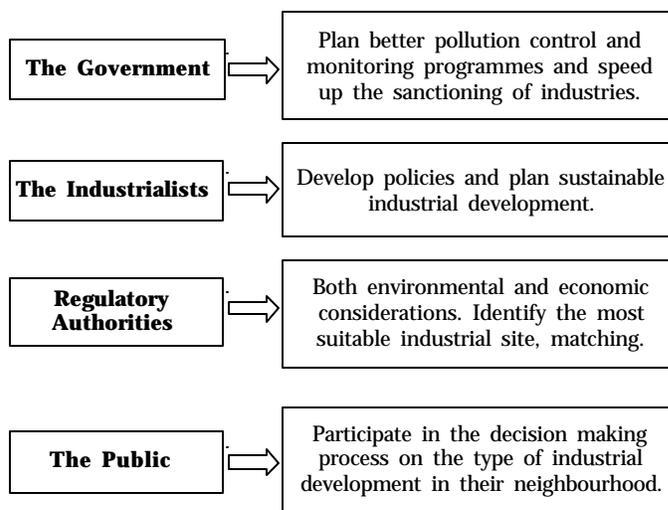
pollution. The present report deals with the Zoning Atlas for siting of industries, based on environmental considerations, for Kullu District of Himachal Pradesh.

The Zoning Atlas for siting of industries, zones and classifies the environment in a district and presents the pollution receiving potential of various sites/zones in the district and the possible alternate sites for industries through easy-to-read maps.

The objectives of preparing a Zoning Atlas for siting of industries are:

- To zone and classify the environment in a District;
- To identify locations for siting of industries; and
- To identify industries suitable to the identified sites.

The type of decisions that can be taken at various levels are given below:



Bio Technology

Suggested focus areas are:

- Bioengineering of Medicinal Plants
- In Vitro Propagation Techniques
- Biotechnology based industries
- Herbal And Floriculture Plant Production
- Floriculture

Himachal Pradesh is endowed with immense diversity of food, fruit crops, fodder, vegetables, minor forest products, diversity of micro organisms and richest wealth of forest and medicinal herbs. The state offers unlimited opportunities and has most suitable

and ideal conditions for setting up biotechnology-based industries.

Himachal Pradesh has immense microbial diversity, which needs further inputs for its meaningful exploration, documentation and usage in many industrial applications. Biotechnology as a tool has helped in the recovery of degraded eco-system.

Some of the methods based on plant biotechnology include reforestation involving Micro propagation and use of Mycorrhizae. Micro propagation has resulted in increasing plant cover preventing erosion and giving a climatic stability. It can also help in rejuvenation of degraded land, which is in plenty in Himachal Pradesh and to stop genetic erosion by Lantana and other weeds.

Bioengineering of Medicinal Plants

The biosynthetic pathways for the biologically active chemical compounds in medicinal plants are usually complex. Genetic manipulations can help increase/decrease the contents of specific compounds in the medicinal plants. Detailed understanding of these pathways will be a prerequisite for the identification, cloning and genetic engineering of the concerned structural and regulatory genes. These genetic techniques will also help develop designer medicinal plants.

In Vitro Propagation Techniques

Biotechnological tools are important to select, multiply and conserve the critical genotypes of medicinal plants by adopting techniques such as micro propagation, creation of somaclonal variations and genetic transformations. Biotechnological tools can also be harnessed for production of secondary metabolites using plants as bioreactors.

Plant cell culture is of importance for improvement of medicinal plants. Complete plants have been regenerated from callus cultures, excised anthers and isolated protoplasts of many medicinal and aromatic plants. Many of the regenerated plants showed somaclonal variation and selections were made for high active principle yielding cell lines. Protoplast fusion plant is regenerated and micropropagation techniques can be used to multiply and clone the desired species. Gene transfer is possible from wild and related species to desired cultivators through wide hybridisation including embryo rescue systems.

Various components of the application of Tissue Culture Technology are:

- Microporpagation
- Conservation through cryopreservation
- Bio production of value added secondary metabolites
- Biotransformation of bioactive molecules
- Genetic upgradation for improvement
 - Somatic Hybridisation
 - Somaclonal Variations
 - Transgenic Plants

Himachal Pradesh, a fruit bowl of India, needs immediate replacement of old orchards with high yielding disease-free fresh planting stock. Biotechnology can play an important role by use of Micro propagated plants. There is also need to improve present fruit processing units and technologies, which can help industries for Cider, Vinegar, Wine and Juice to match the international standards. In agricultural sector there is need for diversification of farming for economic rehabilitation and self-sufficiency.

High yielding improved crop varieties, transgenics specially stress tolerant (cold, rain-fed conditions), bio-fertilisers, bio-pesticides etc. (Table 11.19 to 11.23, Chapter 11) are other areas where biotechnology can play a major role.

Biotechnology Based Industries

- Commercial Micro Propagation
- Fermentation
- Pharmaceuticals
- Bio-pesticides and Bio-fertilisers
- Phyto chemicals
- Transgenic seeds
- Bio-fuels
- Post Harvest Technology
- Bio Processing
- Enzyme Production
- Environment Protection and Animal Husbandry
- Gene Therapy and
- Bio Informatics

Himachal Pradesh has a diverse and fragile eco-system, which harbours rich flora of about 4000 plant species including a large number of rare medicinal and aromatic plants and wild relatives of cultivated crops. Documentation of diversity of such resources including

agro-bio diversity is urgently required. The recent development in biotechnology infrastructure and sound industrial base of a vast market development ensure opportunities for biotech products and business in bio-pharmaceuticals, agriculture, food and nutrition sector.

Himachal Pradesh is an ideal destination to invest in bio-technology based industry because of its Bio-diversity, Eco-diversity, pollution-free environment, mild climate, availability of adequate land water and electricity, excellent law and order situation and research and development backing.

Herbal and Floriculture Plant Production

Herbal Products are gaining popularity as medicines, nutraceuticals, and skin care products across the world and the market potential is enormous. The present weaknesses of a herbal scenario include the paucity of adequate raw material, lack of large-scale cultivation activities, non-availability of standards of production and processing, age-old non-mechanised operation and non-availability of validity and claims.

Himachal Pradesh has a clear edge because of its potential of physio diversity in varying ecological zones. Emphasis need to be given at the R&D level to deeper knowledge based products via phyto genomics and studies for discovering novel bio molecules. For this it is important to create access to the testing facilities and centres within the state for this purpose.

Floriculture

In Himachal Pradesh, total production in floriculture was worth Rs. 4 crore in the year 1999-2000. Gladiolus, Liliun, and Carnations are the major floriculture crops in Himachal Pradesh.

Scientific Techniques and measures can assist the floriculture industry with:

- High quality flower bulb production
- Identifying the right crop and right variety with respect to climate.
- Developing infrastructure for forcing flower bulbs.
- Developing the Chrysanthemum industry.
- Interaction with industry, financial institutes/banks via proper networking.

Plasma Pyrolysis System for Disposal of Plastic Carry Bags

Himachal Pradesh is the first state in the country to have enacted an act for dealing with solid waste

management and the menace of plastic carry bags. The “Himachal Pradesh Non-Biodegradable Garbage [Control] Act” was formulated by the Department of Science, Technology and Environment, Government of Himachal Pradesh and enacted in 1995 to prevent throwing or depositing non-biodegradable garbage in public drains, roads and places open to public view in the state.

The natural process of degradation is inefficient in respect of plastic bags. Recycling generates toxic gases dangerous to human health. Incinerators have also proved to be inefficient as some gases such as Phosgene, Carbon Monoxide, Chlorine, Sulphur Dioxide, Nitrogen Dioxide and deadly Dioxin are released during combustion. Dumping leads to the leaching of heavy metal like lead and cadmium into the soil affecting not only soil quality but also ground water. The special problems of problems of plastic bags in the hilly state of Himachal Pradesh are

- Availability of open slopes where municipal wastes are indiscriminately thrown. The generally prevalent low temperature averages only serves to aggravate the problem further.
- The retention of wastes on the slopes causes further problems as these wastes enter into the drainage system and pollute the water sources, specifically of the lower lying rural areas.
- The polythene bags have created problems by choking the sewerage and drainage systems and also by virtue of the fact that polythene is non-biodegradable there by remaining on the slopes as such for years.
- The municipal wastes are not easily collected because of the problem of access (transport and roads). Also the rag pickers cannot collect these wastes from steep slopes.
- Disposal of solid wastes is presently being done on the slopes, as large landfill sites are not available.
- Many chemicals are added during production of polythene bags to impart strength; these chemicals leach into the food products resulting in contamination of stored food, drinks, soil and water sources.

It has been estimated that 5200 plastic bags reach a middle class colony of thousand households everyday and plastic forms 20 per cent of the total waste (*Vatavaran*).

Hence the need for an appropriate technology- "Plasma Pyrolysis" which can safely dispose the plastic material is strongly felt.

Pyrolysis is the process of disintegration and decomposition of carbonaceous material by heat. At lower temperature ash and liquid by-products are formed. At optimised temperature carbonaceous matter yields methane, carbon monoxide, hydrogen, carbon dioxide, and water.

The gas emission will be within the environment emission standards set by Central Pollution Control Board (CPCB). The Facilitation Centre for Industrial Plasma Technologies has been set up by the Institute for Plasma Research, the centre has processed development and material characterisation laboratories, technology demonstration facilities and pilot plants. FCIPT has designed and engineered plasma pyrolysis system for disposal of medical waste (Medical waste consists of all kinds of polymers including polyethylene).

The Processes

Specific projects to deliver results

- Information Technology
- E-governance
- Technical Education
- Industrial Consortiums

Information Technology

The state government should encourage private sector participation in laying High Bandwidth backbone in the state. The government should endeavour to computerise the process of governance, so that the citizens can file the documents required by the government electronically.

Priority area should include:

- Rural services such as Land Records, Acquisitions of Land and Registration of Deeds.
- Police services such as FIR Registration
- Social services such as Family Pension, Old Age Pension etc.
- Registration of Licences, Ration Cards, Birth Certificate, Death Certificate, Caste/Tribe Certificate, Driving Licence, etc.
- Public Information/Utility such as Employment Exchange Registration, Employment Opportunities,

Examination Results, Hospitals/Beds Availability, Road Transport Time Tables, Government Notifications, Government Schemes, etc.

- Agriculture/Horticulture Sector-providing the information about Mandi Rates in respect of identified Commodities in important Mandis.
- Electronic filing of Tax Returns, State Excise Duty, House Tax, Property Tax, Road Tax, etc.

Departments should be encouraged to establish web-sites. Departments where databases already exist should be asked to upgrade the same to provide dynamic information and use their sites as platforms for citizen-government interface.

Internet Kiosks should be encouraged to serve the information needs of the citizens and to provide a large number of employment to educated youth (Table 7.20, Chapter 7), work contracts with leading and reputed Information Technology service vendors can be established to avail a wide range of IT consultancy, specialist services and IT products at lower cost with shortened procurement cycle.

Boosting e-commerce in all activities of the state is a must for Himachal Pradesh. This will facilitate local industries to compete in the global market. The following initiatives can be followed up:

- Net Banking - Net Based Banking would catalyse increase in use of Internet for e-commerce and also reduce high overhead costs for banks.
- Encourage e-Commerce, EDI Implementation in Government Departments.
- Encourage e-commerce in items/goods in which the state has comparative/distinct advantage example Horticulture produce, Handicrafts etc.
- Himachal has an excellent Telecommunication infrastructure wherein all the telephone exchanges are digital and are interconnected to each other. The state has probably the highest density of OFC (Optical Fibre Cable) penetration per unit area as compared to any other state in the country. This strong background can help Himachal to emerge as a regional gateway for the "North Indian" Internet, e-Commerce and Digital Services Traffic.

In order to promote the growth of IT in the state it is imperative that Hi-Tech Habitats are built in and around all major towns. Such space would be extremely useful to promote the growth of IT enabled services

Technical Education

The state government should make concerted efforts to market the state as an ideal location for setting up institutes of excellence on the national and international scale. Himachal Pradesh has technical institutions like N.I.T. Hamirpur, I.I.T.T. College of Engineering, Kala Amb, Institute of Engineering and Emerging Technology, Baddi, Green Hill Engineering College, Kumar Hatti, Solan, The Jai Prakash University of Information Technology, Wakanaghat, Solan, with high quality education and training facilities in subjects and vocations in demand by the industry (Table 7.22, Chapter 7).

Efforts should be made to set up more institutes, which can offer courses in fields of education, which are relevant in the modern context especially in the field of Information Technology and related areas. Strong directions and measures should be undertaken to introduce the subject of IT education at the primary and secondary school level (as of now these courses are being imparted in more than 150 senior secondary schools).

The use of IT or PC penetration and availability of I-NET nodes is low in Himachal Pradesh. Presently the state government is actively implementing Himachal Pradesh State Wide Area Network (HPSWAN), connecting districts with the state headquarters. This facility should be extended to the block level and subsequently to the village level so that the benefits of IT percolate to the masses at large.

E- Governance

The Enabling Technology

Groupware technology can offer dramatic improvements in the intra-government synchronisation, optimisation of government resources, and decision support systems to boost the efficiency and efficacy of the public policy. The major contributions of groupware in improving organisational performance include on-line collaborative work, electronic community development, knowledge management and workflow applications.

In such a scenario, information will be more directly accessible to decision-makers and flow smoothly across departments through a common database and compatible systems inter-linked under a secure high-speed networked environment. In addition to a tangible improvement in the functioning of the administration, the government-public interface shall undergo a radical change for the better.

Industrial Consortium

With the infrastructural development, and implied industrial emphasis in the state plans, the number of registered industrial units has shown a sizable increase (Table 16.2, 16.3, 16.4, 16.5 and Table 16.7, Chapter 16). Besides the identified clusters, some of the District Industries Centres (DICs) of the industry department have recommended activities, which could be viable under the industrial cluster programme (Table 16.8, Chapter 16).

In addition to these, some herbal-based clusters could be set up in the state as the higher reaches are endowed with the precious herbs (Table 4.16, Chapter 4, and Table 11.15, Chapter 11). Similarly sericulture could be taken up through clusters in the districts of Kangra, Mandi and Sirmaur. The rich mineral resource of Himachal Pradesh also endows it with a conducive environment for the cement industry, slate tiles, calcium and ammonium nitrates etc (Table 2.7, Chapter 2).

Following steps can be taken to ensure this:

- Creation of dense vegetation buffers around cement plants and other industries so that pollutant particles are restricted to go beyond a certain limit. Remote Sensing Techniques can be used to assess the appropriate landscape for setting up cement plants and other industries.
- Assessment of impact of industrial emissions and pollutants on human and cattle health and also on agriculture. Need to take appropriate steps to maintain pollution control standards to conserve climatological and pollution-free industrial environment of the state.
- Provision of incentives for eco-friendly industries. Inclusion of Small Scale Industries for environmental clearance.

The state government has already developed 30 industrial areas and 10 industrial estates with all basic amenities like roads, parks, sewerage, water and communication etc. Apart from new technologies, in most industries, there is an increased demand to keep pace with national and international development. The concern is vital for development of long-term markets for the industry. The pressure mainly comes from cost effectiveness, quality and technology upgradation.

The state government should make efforts to formulate an Industrial Consortium, which will develop as a powerful vehicle to propel the technological advancement of the industry by providing a forum for interaction, exchange of ideas and a platform to carry

out technological development and services for example, The National Research and Technology Consortium (NRTC) at Parwanoo which functions as an autonomous, non-profit R&D organisation by the State Council for Science, Technology and Environment, Government of Himachal Pradesh.

NRTC programs are in the form of industrial projects, technology development, R&D facility provision to the industry, consultancy and training workshops and seminars to strengthen the skill base of people from the industries and institutions. Wherever specific expertise and knowledge base are required, links are established with national laboratories and universities to acquire the appropriate knowledge base. Various projects initiated by NRTC, which has helped the industry can be summarised as

H.P. Science & Technology Initiatives

The Himachal Pradesh State Council for Science, Technology and Environment came into being in 1985.

The council plays an advisory role in bringing up contemporary developments in the notice of the state government apart from providing active support in drafting guidelines/policies for mitigating environmental problems. The main objectives of the council are:

- To advice state government on science and technology policy issues and interventions.
- To transfer, develop and demonstrate appropriate technologies for hilly regions.
- To exchange scientific knowledge with national and international scientific institutions/organisations.
- To promote, popularise and disseminate science and technology.
- To create and strengthen science and technology facilities in the state.
- To promote research and development studies relevant to state needs.
- To establish linkages with state universities, R&D institutions.
- To provide consultancy services in successfully demonstrated/developed technologies.

Achievements During the Year 2002-03

The programs of the State Council for Science, Technology and Environment were focussed in the following areas:

- Popularisation and assessment of the potential of Remote Sensing Technology.
- Demonstrating the Potential of natural sources of energy.
- Educating and creating awareness on different facets of environment.
- Popularising and demonstrating appropriate technologies in science.

Remote Sensing Cell

Remote Sensing Technology has emerged as a modern technology for acquiring the information about the earth surface with remote access. It has been found to be of immense use in the field of scientific mapping of natural resources especially in the remote and inaccessible areas of the state.

ISRO IGBP Programme: Effect of Climatic Variation in Himalayan Glacier

International geo-sphere biosphere program is a project funded by Department of Space, GoI which will help the state in finalisation of glacier inventory for the Ravi basin in Himachal Pradesh. The main objective of this investigation is to have the systematic inventory of glaciers and snowfields for overall assessment of water availability in the Himalayan region (Annexure A-23.2 (a) and A-23.2 (b)).

Snow Cover Monitoring in Himachal Pradesh

The main objective of snow cover monitoring will be to know about the change in snow pattern in Himachal Pradesh during the last five years.

NRIS Project

NRIS is a computer-based information system that provides various sets of capabilities to handle geo-referenced data such as data input, data storage/management, data manipulation/analysis and data output.

Land Hazard Zonation Project

This project was used to prepare landslide hazards zonation maps along NH-22 and NH-88 at 1:25000 scale using IRS-1D satellite data to generate digital database for landslide related parameters such as lithology, lineament, slope, land use/land cover etc.

To prepare risk maps along Manali-Bilaspur-Shimla-Sumdo section and to prepare landslide management

maps to formulate the strategies for minimising the societal impact of landslides. Remote sensing technology should be used to prepare risk maps along the selective perpetual problematic zones along the highway corridor in the state and to prepare landslide management maps to formulate the strategies for minimising the societal impact of landslides.

Bio-Geo Database Project

The Bio-Geo Database Project funded by the Department of Science & Technology, GoI, New Delhi for evolving programmes on Bio-Geo Data Ecological Modelling of Himalayan region would be helpful to the state in terms of generation and overall development of the watershed in a scientific manner.

Disaster Management in Himachal Pradesh

As a follow-up of the government notification *vide* which the state council for science, technology and environment has been considered as the nodal agency for the management of Geological hazards in Himachal Pradesh for which a committee was constituted under the Chairmanship of Principal Secretary (S & T) to the government of Himachal Pradesh. The main recommendation was to establish a disaster management cell in the state which will look after the strategies to be adopted at the state level for the management of Geological hazards mainly the earthquakes, landslides, avalanches and floods.

Appropriate Technology Dissemination

Passive Solar House Action Plan

A passive solar house action plan for Himachal Pradesh is being implemented in the state and is being coordinated by the council in collaboration with the HPPWD, and HP Housing Board. Himachal Pradesh is the first state in the country to make the solar passive design of all Government/Semi-Government buildings mandatory. More than 50 Government buildings, offices, hospitals, primary school buildings, teacher's hostels and residential buildings have been designed and constructed until now.

- Innovative Designs for Rural Buildings.
 - Consultancy for Innovative Housing Technologies to Public.
 - Passive Solar Cooling Technology for Hot Climates.
 - Retrofitting of Rural Houses with Solar Passive Heating System.
 - Thermal Comfort Evaluation of Buildings
 - Solar Passive Designs of Primary Schools under DPEP Project.
 - Training & Field Demonstration of Technologies
- Creation & Strengthening of Science & Technology Facilities in Himachal Pradesh.
- Support to National Research & Technology Consortium (NRTC) for Industries - Science & Technology Inputs to Industry.
 - Establishment of Solar Energy Research Centre for hilly areas.
 - Establishment of Science & Technology Information Network.
 - To Set up Himachal Pradesh Science Academy.
 - To Set up a Planetarium & Sub-Regional Science Centre in Himachal Pradesh.
 - Support Patent Information Centre for Himachal Pradesh.
 - Science Popularisation & Promotion Programmes in Himachal Pradesh.
 - Ecology and Environment.
 - Conservation of Wetlands and Biodiversity.
 - Integrated Garbage Management Programme.
 - Execution of Bio-Diversity Strategy and Action Plan.
 - Eradication of Weeds Lantana, Parthenium, and Ageratum.
 - Biomass Waste Management in the State.
 - Strengthening of Meteorological Network in the State.

ANNEXURE A-23.1 (a)

**Wheat Acreage and Production Estimates
for the Year 2000-2001***(Using Satellite Data in Respect of 6 Districts of Himachal Pradesh)*

Sr. No.	District	Acreage ('000 ha)	Yield (q/ha)	Production ('000 t)
1.	Kangra	69.029	16.53	114.105
2.	Una	22.593	20.07	45.344
3.	Bilaspur	14.167	17.09	24.353
4.	Hamirpur	13.796	14.38	19.839
5.	Mandi	61.769	15.16	93.642
6.	Solan	19.031	14.64	27.861
Total		200.385	16.226	325.144

Source: State Council for Science, Technology and Environment, Himachal Pradesh.

ANNEXURE A-23.1 (b)

**Wheat Acreage and Production
Estimates for the Year 2001-2002***(Using Satellite Data in Respect of 6 Districts of Himachal Pradesh)*

Sr. No.	District	Acreage ('000 ha)	Yield (q/ha)	Production ('000 t)
1.	Kangra	93.942	17.85	167.686
2.	Una	33.574	21.75	73.023
3.	Bilaspur	27.234	18.25	49.702
4.	Hamirpur	27.772	16.75	46.518
5.	Mandi	77.61	17.65	136.98
6.	Solan	23.528	16.85	39.645
Total		283.66	18.1	513.55

Source: State Council for Science, Technology and Environment, Himachal Pradesh.

ANNEXURE A-23.2 (a)

**Distribution of Glaciers & Snow
Fields in Himachal Pradesh**

Basins	No. of Glaciers	Aerial Extent (Sq. Km.)	No. of Snow Field	Aerial Extent (Sq. Km.)
Satluj	55	154.762	194	110.843
Spiti	71	258.273	597	368.366
Baspa	25	203.3	66	64.964
Beas	6	15.843	47	72.442
Parbati	39	450.627	131	188.188
Saini	9	37.255	59	51.934

ANNEXURE A-23.2 (b)

**Glacial Retreat in Baspa Basin,
Himachal Pradesh from 1962-2001**

Glacier Number	Glacier Number in Data Sheet	Glacier Area (sq. km.)		Loss in Area (%)	Snout Altitude (m)	
		1962	2001		1962	2002
1.	53107001	10.5	8.7	17	4480	4560
2.	53107002	4.6	4.3	6.5	4520	4720
3.	53107003	2.2	2	9	4600	4640
4.	53107004	4.6	4.1	11	4720	4720
5.	53107005	1.7	1.2	29	3920	4360
6.	53111013	3.2	3.2	0	4920	4920
7.	53111014	1.5	0.8	47	5000	5080
8.	53112001	5.9	5.6	5	4760	5000
9.	53112002	38.4	33.5	13	4320	4360
10.	53112003	2.7	2.2	19	4480	4480
11.	53111009	7.1	5	30	4600	4600
12.	53111010	6.9	5.8	16	4640	4640
13.	53111011	8.7	4.5	48	4760	4760
14.	53107006	35.2	30.4	14	4200	4200
15.	53107007	11.6	9.9	15	4240	4240
16.	53107008	5.5	4.1	26	4360	4360
17.	53107009	3.9	1.9	51	4200	4440
18.	53107010	8	7	13	4360	4400
19.	53107011	10.8	6.1	44	4080	4320
Total Area/ Average Altitude		173	140.3	18.9	4482	4570

Source: State Council for Science, Technology and Environment, Himachal Pradesh.

ANNEXURE A-23.3

Hydro Electric Potential in Himachal Pradesh

Basin	Projects Under Operation	MW Generated	Projects Under Construction	MW Generated	Projects Under Investigation	MW Generated
Yamuna	Andhra	16.95	Gumma SHP	3.00	Rupin	39.00
	Yamuna Projects	537.37			Chirgaon-Majhgaon	46.00
	Giri	60.00			Renuka Dam	40.00
	Gumma	3.00			Paudital Lassa	40.00
					Tangnu Romai	44.00
					Shalvi	8.25
					Sawara Kuddu	144.00
					Nerwar	4.70
Satluj	Rongtong	2.00	Bhaba Aug. Scheme	3.00	Thopan Powari	400.00
	S V P Bhaba	120.00	Ghanvi	22.50	Baspa Stage-I	210.00
	Chaba	1.75	Nathpa Jakri	1500.00	Keshang	120.00
	Bhakra Dam	1200.00	Rampur	680.00	Shongtong Karcham	225.00
	Rukti	1.50	Baspa		Rampur	680.00
	Nogli-Stage I	2.50			Nogli Stage-I	3.50
Beas	Beas Satluj Project	990.00	Larji	126.00	Sarvari	12.00
	Uhl Stage-II	60.00	Parbati Stage -II	800.00	Kalath	60.00
	Baner	12.00	Uhl Stage-II	60.00	Parbati Stage I,II & III	2051.00
	Pong Dam	360.00			Patikari	20.00
	Uhl Stage-I	110.00				
	Binwara	6.00				
Ravi	Gaj	10.50				
	Gharola	0.05	Holi	3.00	Bajoli Holi	200.00
	Bhuri Singh P/House	0.45	Chamera Stage -II	300.00	Kutehar	240.00
	Chamera Stage -I	540.00	Sal-II	2.00	Bharmour	40.00
	Bharmaur Micro	0.02			Sal -I	8.25
	Baira Sieul	180.00			Holi	3.00
Chenab					Harsar	60.00
	Sissu	0.10			Chamera Stage-II	300.00
	Shansa	0.20			Siul	7.50
	Killar	0.30				
	Billing	0.20				
	Thirot	4.50				
Total		4219.39		3499.50		5006.20

Source: State Council for Science, Technology and Environment, Himachal Pradesh.

ANNEXURE A-23.4

District Wise Water Resources of Himachal Pradesh

Name of the District	Ground Water	Surface Water	Rain Water	Traditional Resources	Other Conventional Sources
Bilaspur	827	786	0	461	0
Chamba	1717	2433	30	2598	836
Hamirpur	1057	485	0	231	1
Kangra	1602	1317	11	1369	466
Kinnaur	76	217	0	24	2
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
Sirmaur	644	2249	0	535	9
Solan	344	1090	0	1215	316
Una	832	123	1	21	116
Himachal Pradesh	8186	20223	20	10512	2595

Source: Water Resource of Himachal Pradesh by R.G. Arya (Council of Science, Technology and Environment).

ANNEXURE A-23.5

Important Minerals Reported in Himachal Pradesh

District	Minerals
Bilaspur	Limestone, Coal, Quartzite, Glass, Sand, Gold, Pyrites
Chamba	Copper, Coal, Gypsum, Limestone, Magnesium, Phosphate, Pyrites, Sulfur, Slates, Tale
Kangra	Asbestos, Bismuth, Coal, Glass sand, Gold, Copper, Ore, Limestone, Rocksalt, Slate and Neutral Gas.
Kinnaur	Beryl, Copper, Flourspar, Kyanite, Lead, Gypsum, Silver, Stealite
Kullu	Copper, Iron, Lead, Silver-Re, Limestone, Mica, Nickel, Cobalt, Pyrite, Beryl, Kyanite, Uranium
Lahaul-Spiti	Asbestos, Antimony, Gypsum, Copper, Iron-Ore, Lead, Sulfur, Zinc
Solan	Barytes, Coal, Lead, Phosphate, Gypsum, Limestone, Copper
Una	Glass sand, Calctufa
Mandi	Coal, Copper, Gold, Iron Ore, Limestone, Rock Salt, Slates
Hamirpur	Uranium, Calctufa, Glass, and Oil and Natural Gas
Shimla	Asbestos, Coal, Lead, Barytes, Limestone, Glass, Glass sand, Slates and Iron
Sirmaur	Barytes, Bauxite, Lead, Copper, Gold, Silver Ore, Phosphate, Limestone, Gypsum, Zinc, Pyrite

Source: Introduction to Himachal Pradesh-Rajendra Attri.

ANNEXURE A-23.6

Forets Fires, their Causes and Area Burnt (1991 to 1996)

Causes	1991-92		1992-93		1993-94		1994-95		1995-96	
	Number of Cases	Area Burnt (ha)								
Fire caused by accident or through carelessness in burning fire lines	93	2157	96	1732	46	569	16	127	58	4165
Fire entering the forets by cross exterior fire traces	12	744	16	205	5	144	5	160	15	599
Fire originating owing to carelessness or accident	331	2257	127	2597	348	7188	1603	9509	1315	41848
1) By workman employed in forests by purchasers or forest produce										
2) By villagers/travellers etc. passing through the forests										
3) By sparking from Railway engines										
4) By lighting or fire ballons										
Intentional firing										
1) in order to obtain new grass										
2) In order to turn out grass										
3) Maliciously fired										
Causes Unknown	96	1167	86	3245	187	2269	82	1054	281	6562
Total	532	6325	325	7779	586	10170	1706	10850	1669	53174

Source: State Council for Science, Technology and Environment, Himachal Pradesh.

ANNEXURE A-23.7

Productivity of Different Crops in Himachal Pradesh, India and Best in the World (2000-01)

Crop	H.P.	India	World's Best
Food Grains			
Rice	1423	2914	12090 Australia
Wheat	1266	2756	8656 Ireland
Maize	2272	1769	10226 New Zealand
Vegetables			
Tomato	34645	15068	377667 Ukraine
Beans (green)	9921	9600	12471 Israel
Pea (Green)	9574	10000	16010 France
Cabbage	28663	18085	57641 Germany
Cauliflower	18164	15000	45134 New Zealand
Capsicum	9355	9074	49639 Kuwait
Potato	23890	18657	46662 Bosnia

Source: FAO Abstract 2002.

ANNEXURE A-23.8

Geophysical Zones of Himachal Pradesh

Geophysical Zones	Biomes	District
A	Sub-Artic	Kinnaur
	Alpine Cold Temperature	Lahaul & Spiti
B	Alpine Cold Temperature	Kullu
	Warm Temperature	Chamba
C	Cold Temperature	Shimla
	Warm Temperature	Kangra
D	Warm Temperature	Sirmaur
	Sub Tropical	Solan
		Bilaspur
		Una
		Hamirpur
		Mandi

Source: Human Development Report Himachal Pradesh: Section on Environment.

ANNEXURE A-23.9

Rankings of Districts as per Stress Analysis

S. No.	Ranking of Primary Parameters	Ranking of Secondary Parameters	Cumulative Ranking (Primary and Secondary Parameters)
1	Shimla (groundwater dependancy for irrigation, water deficiency, Tourism Hotspots)	Solan (% increase in cultural waste)	Solan
2	Bilaspur (reserve forest as % to total forest, decrease in dense forest area, Increase in Barren land)	Kinnaur (% forest area as compared to geographic area, % agricultural area as compared to geographic area, % increase in cultural waste, % increase in non agriculture)	Shimla
3	Una (fuel wood dependancy hotspots, groundwater dependancy for irrigation)	Shimla (% increase in current fallow, urbanisation)	Blaspur
4	Kangra (forest cover decrease, water deficiency, % distribution of small scale industrial activities)	Bilaspur (gross density, % increase in other fallow, % decrease in pastures)	Kinnaur
5	Kullu (decrease in open forest area, groundwater dependancy for irrigation, tourism hotspots, grazing hotspot, workers engaged in biological resource based activities)	Hamirpur (Gross Density, % decrease in agricultural land, urbanisation)	Kangra
6	Mandi (fuel wood dependancy hotspots, groundwater dependancy for irrigation, % distribution of small scale industrial activities)	Sirmaur (% increase in non-agriculture)	Una
7	Sirmaur (% distribution of large-scale industrial activities, distribution of hazardous waste generating industries, grazing hotspots, workers engaged in biological resource based activities)	Kangra (% decrease in agricultural land, % increase in current fallow, % decrease in pastures)	Sirmaur
8	Solan (% distribution of large-scale industrial activities, distribution of hazardous waste generating industries, increase in cultural waste)	Chamba (growth rate)	Mandi
9	Hamirpur (fuel wood dependancy hotspots, increase in barren land)	Una (% increase in other fallow)	Hamirpur
10	Chamba (forest cover decrease, groundwater dependancy for irrigation)	Mandi	Chamba
11	Kinnaur (decrease in open forest area, groundwater dependancy for irrigation, increase in cultural waste)	Lahaul & Spiti (% forest area as compared to geographic area, % agricultural area as compared to geographic area, % increase in non-agriculture)	Kullu
12	Lahaul & Spiti (reserve forest as % to total forest, decrease in dense forest area, groundwater dependancy for irrigation)	Kullu (growth rate)	Lahaul & Spiti

ANNEXURE A-23.10

Biotechnological Research Institutes of Himachal Pradesh

<i>University/Institution</i>	<i>Biotechnological Area of Research</i>
C.S.K. Krishi Vishvavidyalya, Palampur	Micropropagation DNA fingerprinting of plants and microbes Molecular markers and gene tagging, pyramiding and marker assisted selection Double Haploidy breeding Transgenics
Dr. Y.S. Parmar University of Horticulture & Forestry, Solan	Micropropagation of horticulture and plants forest <i>In Vitro</i> conservation of endangered plants Biofertilisers and bio-pesticides
H.P. University, Shimla	Micro-propagation of ornamental crops Fermentation Technology Biochemicals Bioinformatics
Institute of Himalayan Bioresource Technology, Palampur	Micropropagation of tea and medicinal plants Gene expression and cloning Bioresource conservaton Secondary metabolites Transgenic
Central Potato Research Institute, Shimla	Micropropagation Molecule markers Transgenic