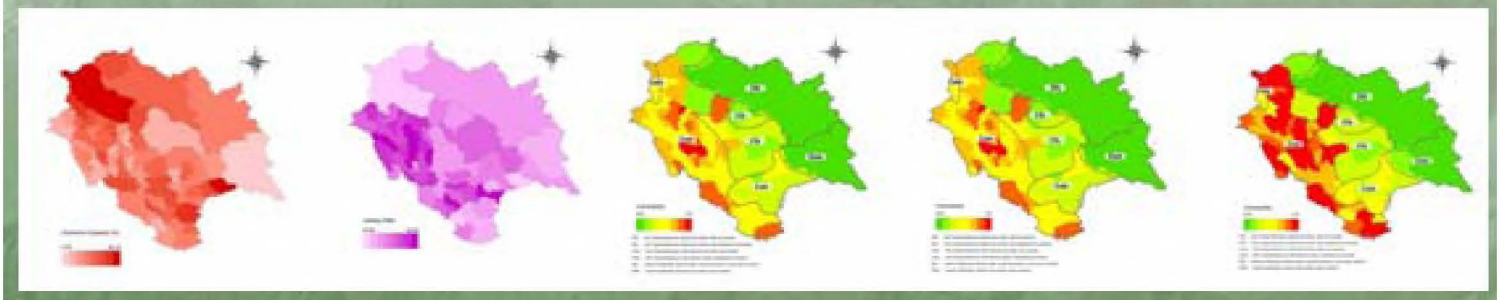
Environment Master Plan
Vulnerability Assessment
Himachal Pradesh





Government of Himachal Pradesh
Department of Environment, Science & Technology

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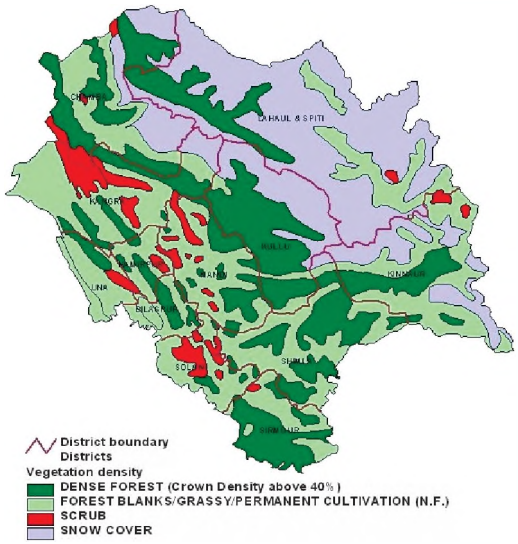
Vulnerability Assessment

Himachal Pradesh

HIMACHAL PRADESH

Introduction

We all know the State Himachal Pradesh, is among one of the ecologically fragile destinations in Himalayan region having immense wealth of natural resources and biodiversity but currently slowly and steadily facing the pressures of development. It is an undisputed fact that the natural resources are the critical engine for accelerating the economic growth and with it, maintains the quality of life of the people, besides livelihoods of millions of people living even in the foothills of the State. Sustainability of economic growth and the resultant



improvement in the quality of life of its people depends largely on the sustainability of its environmental heritage and natural resources.

Himachal Pradesh is situated between latitude 30°22' to 33°12' N and longitude 75°45' to 79°04' E. The State wholly a mountainous region is nestled in the lap of Himalayas. It is surrounded by Jammu and Kashmir in the north, Tibet on north/ north east, Uttaranchal in the east/ south east; Haryana in south and Punjab in south west/ west. There are four agro-climatic zones viz. Shivalik Hill Zone, Mid Hill Zone, High Hill Zone and Cold Dry Zone.

The relative position of the State warrants that it plays proactive role in the National perspective. Himachal Pradesh is located in the western Himalayas covering an area of 55,673 kilometers. Himachal Pradesh is a mountainous state with elevation ranging from about 350 meters (1,148 ft) to 6,000 meters (19,685 ft) above the sea level.

A brief outline of HP's profile:

Total Geographic Area	55,673 KM^2
No. of Districts	12
No. of Towns and cities	57
Population	68,56,509
Population Growth rate	12.81%
Literacy Rate	83.78%
Total Length of Roads	31,512 km
Apple Production	592.57 MT
Total Forest Area	37,033 km^2
Area under Tree cover	14,679 km^2
Dense Forests (Crown density 40%)	8,976 km^2
Unclassed Forests	976 km^2
Deodar	811 km^2
Kail	809 km^2
Chil	1436 km^2
Ban Oak	540 km^2
Fruit Production	712.84 MT
Reserved Forests	1,896 km^2
Sub-Alpine & Alpine Forests	2,512 km^2
Himalayan Moist Temperate Forests	4,064 km^2
Mohru Oak	35 km^2
Kharsu	246 km^2
Flowering Plants	3120 species
Conifers	13 species
Orchids	38 species

Physical Setting

The territory of the state is mountainous, except for a few pockets bordering Punjab and Haryana, which have been sub-mountainous topography. Altitude in different areas ranges from 350 to 7000 metres above the mean sea level. Wide differences in geo-physical features account for different sub-regions of the state. Physiographically, the state is part of the Himalayan system. From south to north it can be topographically divided into three zones:

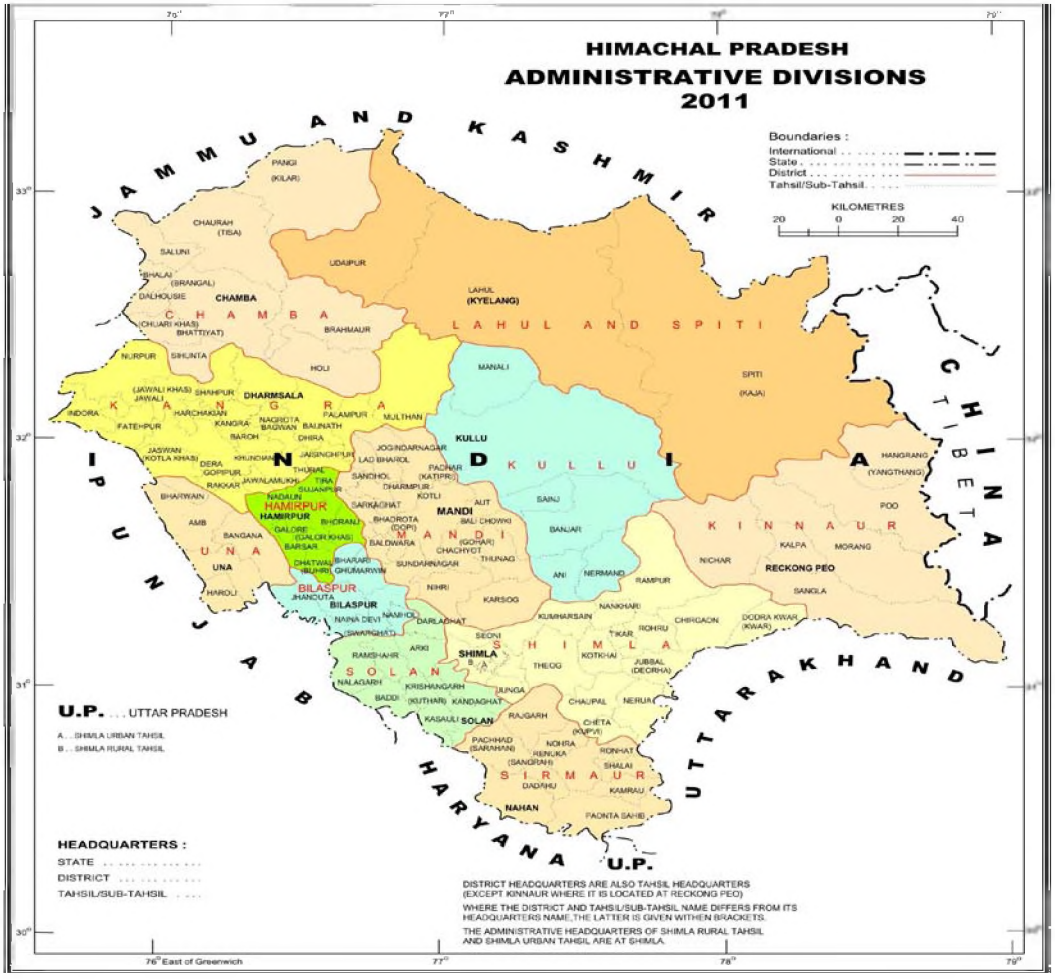
1) The Shivaliks or Outer Himalayas.
2) Inner Himalayas or mid-mountains, and

3) Alpine zone or the greater Himalayas.

The lower hills of Kangra, Hamirpur, Una, Bilaspur and the lower parts of Mandi, Solan and Sirmaur districts are part of the Shivalik range. The altitude of this zone varies from 350 metres to 1500 metres above the mean sea level. The annual rainfall varies from 1500 mm. to 1800 mm. Since it is made up of consolidated deposits, which can erode easily, the zone experiences deforestation and a high rate of soil erosion.

The altitude of the inner Himalayas or the mid-mountains ranges between 1500 metres and 4500 metres above mean sea level. This zone includes areas such as the upper parts of Pachhad and Renuka in Sirmaur district, Chachiot and Karsog tehsil of Chamba district. The quality of soil in these areas is silty.

The greater Himalayas of the Alpine zone has an altitude of 4500 metres above mean sea level. This area comprises Kinnaur district, Pangi tehsil of Chamba district and some areas of Lahaul and Spiti. Rainfall is scanty in this zone. The soil has high texture with variable fertility. From October to March-April, this zone remains cut off from the rest of the world.

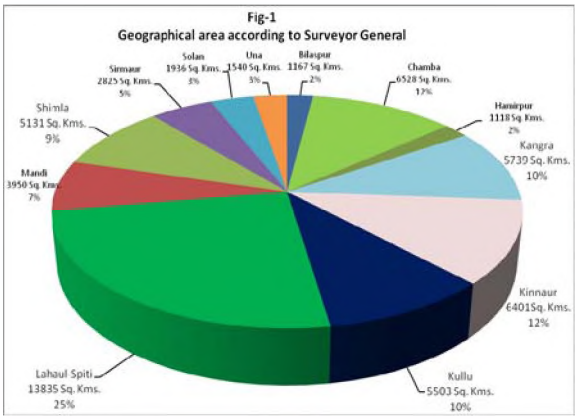


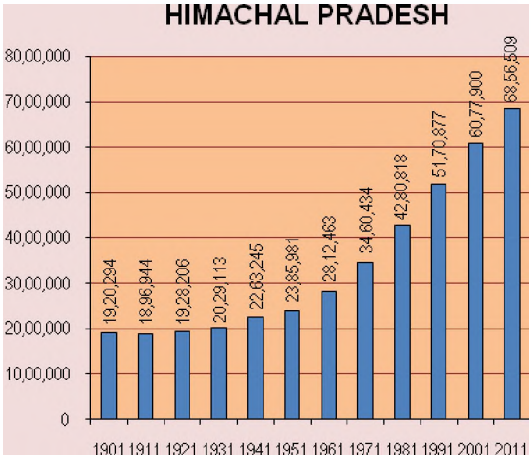
Himachal Pradesh has a total area of 55,673 sq. km. It has 12 districts, 75 tehsils, 52 Sub Divisions, 75 Blocks, 20118 Villages, 57 Towns, 4 Lok Sabha and 3 Rajya Sabha and 68 Assembly Constituencies. Density of Population (per sq. km.) is 123. Females per 1000 Males are 974, Birth Rate (per 1000) is 22.1 and Death Rate (per 1000) is 7.2.

District-Wise Area, Population, Sex Ratio and Density of Population 2011 Census (P)

District	Area (Sq. Kilometers)	population	Sex ratio (Females Per Thousand Males)	Density Per Sq. Kilometer
1.	2.	3.	4.	5.
Bilaspur	1167 (2.10)	382056 (5.61)	981	327
Chamba	6528 (11.72)	518844 (7.58)	989	80
Hamirpur	1118 (2.01)	454293 (6.79)	1096	406
Kangra	5739 (10.31)	1507223 (22.03)	1013	263
Kinnaur	6401 (11.50)	84296 (1.29)	818	13
Kullu	5503 (9.88)	437474 (6.28)	950	79
Lahaul-Spiti	13835 (24.85)	31528 (0.55)	916	2
Mandi	3950 (7.09)	999518 (14.83)	1012	253
Shimla	5131 (9.22)	813384 (11.89)	916	159
Sirmaur	2825 (5.07)	530164 (7.54)	915	188
Solan	1936 (3.48)	576670 (8.24)	884	298
Una	1540 (2.77)	521057 (77.37)	977	338
H.P	**55,673 (100.00)**	**6856509**	**974**	**123**

Decadal Population Growth Trend



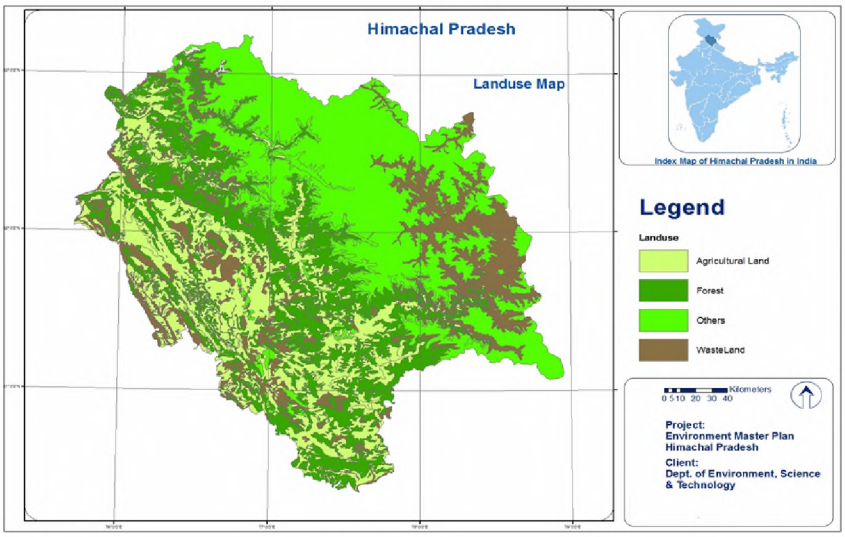


As per 2011 Census, population of Himachal Pradesh is 68, 56, 509 of which males are 34, 73, 892 and females are 34, 73, 892. The percentage share of Himachal Pradesh to India's population is 0.57. Rural population is 89.96% and urban population is 10.04%. The population density is 123 persons per km^2. The scheduled tribes constituting 4.02% of the population are mainly distributed in three districts i.e. Chamba, Lahaul & Spiti and Kinnaur. Decadal growth of population of Himachal Pradesh in 1991-2001 is 9, 07, 023 and 7, 78, 609 in 2001-2011 with a percentage contribution to total growth of India being 0.5 and 0.43 respectively.

The different agro climatic zones represent the diversity in land use as well. The land use pattern of the State is as under:

Land use	Area in '000 ha	Percentage
Total geographical area	5,567	-
Reporting area for land utilization	4,549	100.00
Forest	1,101	24.21
Not available for cultivation	1,129	24.82
Permanent pastures and other grazing lands	1,496	32.89
Land under misc, tree crops and groves	65	1.43
Cultivable wasteland	138	3.03
Follow lands other than current fallows	15	0.33
Current fallows	64	1.41
Net area sown	541	11.90

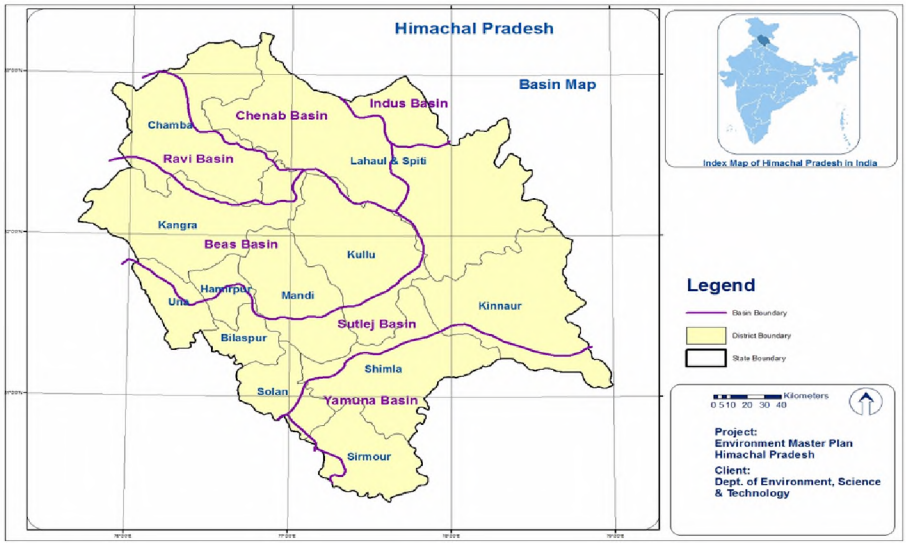
Land use Map of Himachal Pradesh



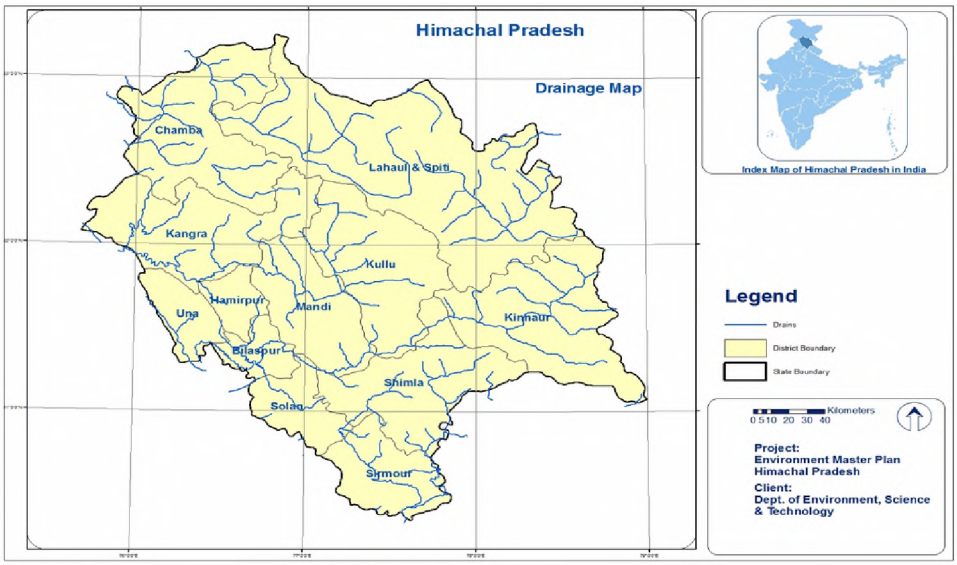
Himachal Pradesh is drained by five major systems, and has five major catchment areas. Satluj the largest among all constitutes 30.69% followed by Beas 24.5%, Chenab 14.2%, Yamuna 10.6% and Ravi 9.9%. These catchment areas are further sub divided into several river subsystems. The major rivers are snow fed and perennial in nature, and supplemented by seasonal rainfalls.

Most of the surface water resource of the Himachal Pradesh flows from Perennial Rivers which originate from glaciers. The flow in these rivers is further augmented by runoff from the catchment area. 90% of State's drainage forms part of Indus River System. The rivers that actually originate from the State and flow through it are the Chenab, the Beas and the Ravi, the Satluj have their origin in Tibet and flows through Himachal Pradesh forming the largest river catchment in the state. The Yamuna crosses only the South eastern border but has some catchment area in the State of Himachal Pradesh.

River basin Map of Himachal Pradesh



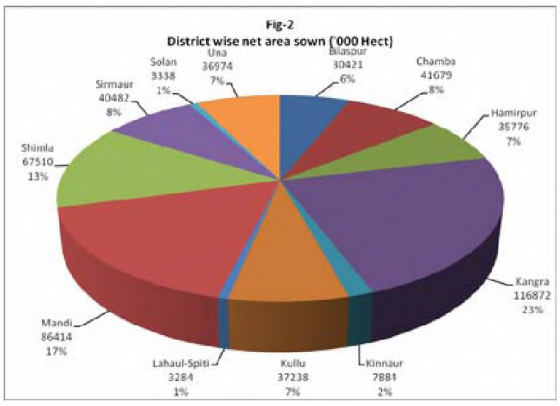
Drainage map of Himachal Pradesh



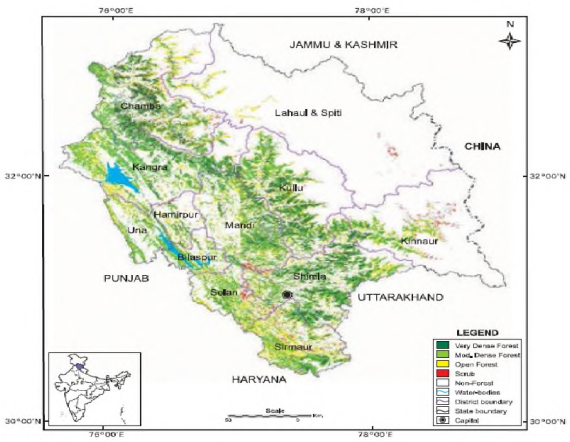
Production of Principal Crops

Crops	2008-09	2009-10	2010-11	2011-12 (Likely)	2012-13 (Target)
1.	2.	3.	4.	5.	6.
FOOD GRAINS:					
A. Cereals:					
1. Rice	118.28	105.90	128.92	106.32	131.00
2. Maize	676.64	543.19	670.90	694.49	735.00
3. Ragi	2.44	2.21	2.11	2.80	3.00
4. Small Millats	4.29	1.85	3.28	3.31	5.50
5. Wheat	381.18	414.41	614.89	690.00	628.50
6. Barley	20.45	22.94	32.17	41.00	36.00
Total- Cereals	1203.28	1090.50	1452.27	1537.92	1539.00
B. Pulses:					
1. Gram	0.29	0.37	0.60	4.50	2.50
2. Other Pulses	23.22	20.29	40.99	16.12	18.50
Total Pulses	23.51	20.66	41.59	20.62	21.00
Total- Food grains	1226.79	1111.16	1493.86	1558.54	1560.00
Commercial Crops					
1. Potato	103.63	184.43	205.97	180.00	185.00
2. Vegetables	1090.33	1206.21	1268.90	1300.00	1350.00
3. Ginger (Dry)	1.88	3.12	1.56	7.00	4.00

Agriculture is the largest occupation and source of livelihood to most people in Himachal Pradesh which is 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 practiced on 5% to over 30% slopes. This also affects soil fertility status and changes in pH values. Cultivation is mainly (80.9%) rain dependent. The size of holdings of less than one or one ha covers 61.5% of the 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 ha to ten ha 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.



Forest Cover map of Himachal Pradesh



The recorded forest area of the state is 37,033 km^2 which is 66.52% of its geographical area. Reserved Forests constitute 5.13%, Protected Forests 89.46% and Unclassed Forests 5.41% of the recorded forest area. About two third of the state's geographical area is under recorded forests but a substantial part of this is not conducive for tree growth, being under permanent snow, glaciers and cold deserts. Himachal Pradesh has two National Parks and 33 Wildlife

Sanctuaries covering 0.76 million ha which constitutes 13.65% of the State's geographical area. The Great Himalayan National Park is famous for snow leopard. The forest cover in the State, based on interpretation of satellite data of October-December 2008, is 14,679 km^2 which is 26.37% of the State's geographical area. In terms of forest canopy density classes, the State has 3,224 km^2 area under very dense forest, 6,381 km^2 area under moderately dense forest and 5,074 km^2 area under open forest.

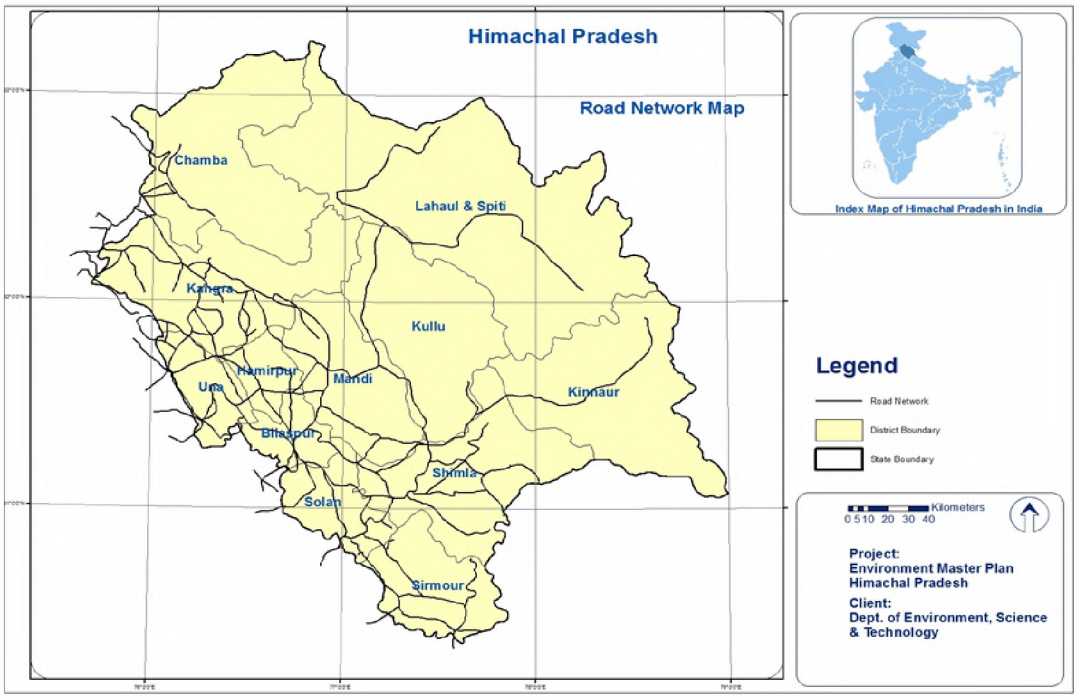
Area Under Forests

Year	Reserved Forests	Protected Forests	Un-Classed Forests	Other Forests	Forest not under the control of Forest Deptt.	Total
1.	2.	3.	4.	5.	6.	7.
1996-97	1896	33004	930	405	751	36986
1997-98	1896	33012	991	369	748	37016
1998-99	1896	33043	977	369	748	37033
1999-00	1896	33.43	977	369	748	37033
2000-01	1896	33043	977	369	748	37033
2001-02	1896	33043	977	369	748	37033
2002-03	1896	33043	977	369	748	37033
2003-04	1896	33043	977	369	748	37033
2004-05	1896	33043	977	369	748	37033
2005-06	1896	33043	97	369	748	37033
2006-07	1898	33060	977	369	729	37033
2007-08	1898	33130	886	369	750	37033
2008-09	1898	33130	886	369	750	37033
2009-10	1898	33130	886	369	750	37033
2010-11	NA	NA	NA	NA	NA	NA

In total about 33, 722 km length road networking is available connecting all sub divisions, the breakup is elaborated as under with map on road network for connecting its cities, important towns, villages, industrial centres, places of tourist importance and other remote areas:

Road Connectivity in Himachal Pradesh

TYPE OF ROAD	2007-08	2008-09	2009-10	2010-11	2011-12 Up to Dec…2011
1.	2.	3.	4.	5.	6.
1. Motorable double lane	2374	2377	2384	2403	2409
2. Motorable single lane	26783	27925	28832	29464	29823
3. Jeepable	365	345	300	290	280
4. Less than Jeep able	1990	1803	1655	1565	1488
Total	**31512**	**32450**	**33171**	**33722**	**34000**



Tourism contributes nearly 2% of Himachal Pradesh State Domestic Product. The State Government's tourism policy was announced in 1991. The business and activity-oriented tourism has entered the scene alongside the more traditional leisure tourism.

There are certain areas of Himachal that attract far greater numbers of tourists than others - and there are certain areas that attract foreigners also, like Lahaul-Spiti where, in comparison to other districts, there is almost a parity of numbers between foreigners and domestic visitors. 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 as shown in following table:

Tourist arrivals (Indian & Foreigner)

District	2010	
	Indian	Foreigner
Bilaspur	695702	18157
Chamba	1035789	18092
Hamirpur	1201482	33557
Kangra	1617416	42339
Kinnaur	1424654	41420
Kullu	1636022	47735
Lahaul & Spiti	887061	62492
Mandi	815169	51152
Shimla	972312	55141
Sirmaur	1172670	39840
Solan	671982	23609
Una	681727	20082
HP	**12811986**	**453616**

Himachal Pradesh provides unmatched contribution to 'national interest' in sustaining life support system, on the basis of which sustainable development can be realized downstream, in the plains of North India. Attention is shifting to environmental services flows provided by the forests. These include critical watershed services, biodiversity conservation, carbon sequestration and of course maintaining landscape beauty.

Ecosystem services, human welfare and economic systems are intrinsically connected. Sustainable forest management, the new mantra, has emerged to meet societal concerns and tackle conservation and land-use issues, providing for multifunctional landscapes and looking to eco-regions rather than boundaries as the unit of analysis and management. It is a movement away from the conventional, commodity production orientation, towards a holistic, people-centered ecosystem-level approach. This shift has been necessary to address Himachal's threat of depleting drinking water, global warming and likely biodiversity losses. Sustainable forest management represents a new look at forests and forest management to meet two major commitments:



Protect and restore the forest ecosystem-improve biological diversity, enhance water supplies, make possible carbon sequestration, meet recreation needs and provide for the forest dependent communities through improved non-wood

- forest produce;
- Encourage profitable enterprises, attracting the investor who sees sustainability as a viable economic venture.

In order to ensure the sustainability of environmental heritage and natural resources do develop a long term perspective of achieving environmentally sustainable development, the Government of Himachal Pradesh undertaken the preparation of Environment Master Plan (EMP) for the State. The key objectives of the Environment Master Plan are to enable the State of Himachal Pradesh to:

1. Simultaneously address issues of ecological and environment restoration and bring convergence along with the development activities taking place in the state;
2. Engage and ensure close coordination with all the concerned development departments, both at the state and Government of India level;
3. Decide future financing of investments for development in a sustainable manner, and
4. Develop suitable institutional arrangements in order to implement the Government of Himachal Pradesh's policies and strategies.

The major tasks to achieve these objectives are as follows:

Task 1: Establish Baseline conditions.
Task 2: Conduct a Spatial Vulnerability Assessment and Formulate Planning Principles.
Task 3: Develop Public Consultation and Communication Strategy for the Department of Environment.
Task 4: Develop Sectoral Guidelines.

Task 5: Develop an institutional mechanism for implementation of the EMP.
Task 6: Establish need for training and capacity enhancement.
Task-7: Develop monitoring and Evaluation Protocols.

The scope of work to achieve the above stated objectives and tasks involved the following:

1. Identification of different eco-zones with specific environment attributes ;
2. Preparation of a detailed resource inventories covering all environment parameters;
3. Inventorization of needs of different sections of the population;
4. Trend analysis of cumulative environment degradation;
5. Vulnerability assessment in the context of air, water and land, to establish differential development zones;
6. Documentation of potential threats and new development policies;
7. Formulation of appropriate development criteria for optimization of resource use;
8. Establishing inter linkages between different sectors and points of integration between them;
9. Preparation of sectoral guidelines to mainstream environment parameters in development activities;
10. Forecasting for externalities and planning for corrective measures such as those arising from climatic changes
11. Finalization of a comprehensive integrated EMP.

Overall, the Environment Master Plan has been envisioned as guide tool to provide strategic direction with respect to all encompassing environmental issues. It would be a platform for engagement among implementing agencies, developmental agencies and the local government, to take action w.r.t. environmental issues of local concern on priority. It would also act as a tool for monitoring environmental performance and progress.

Sectors Covered under EMP for Himachal Pradesh

Infrastructure	Natural Resource Management (NRM)	Services
1 Roads, highways, rural roads and Transport	10 Agriculture	15 Education, and Vocational training
2 Hydropower (generation transmission, and distribution)	11 Horticulture	16 IT and Telecom
3 Tourism, Ecotourism + Art, Architecture and cultural heritage	12 Animal Husbandry Livestock	17 Livelihoods
4 Industry	13 Forests, Wildlife and Wetlands	18 Waste disposal.
5 Mining and Geology	14 Fisheries	
6 Irrigation and Public Health		
7 Health		
8 Market Infrastructure (including horticulture and agriculture)		
9 Rural and Urban Planning		

The assessment of vulnerability in the context of natural systems and quality of life is an important and integral part of the Environment Master Plan, which act as a nerve center. A spatial vulnerability assessment has been carried out and accordingly the planning principles have been formulated.

The objective of vulnerability assessment through this exercise was to correlate baseline data and information and identify critical and vulnerable areas / issues related to the sectors viz; infrastructure, natural resource management and services and

associated sub sectors through following steps:

a. Establish criteria of vulnerability based on baseline collected.
b. A key criterion to be related to environmental health and its associated impact on quality of life.
c. Set priorities for optimal decision-making.
d. Identify vulnerable areas i.e. physical areas or hotspots; and policies which exacerbate environment deterioration in these areas.
e. Map hot spots and identify trade offs
f. Categorize areas based on impacts and associated environmental risks and establish criteria for the same.
g. Formulate planning approach, as an optimal combination of "bottom up" (inclusive of community inputs) and "top down".
h. Develop criteria for carrying out an Environment Impact Assessment and guidelines for the 3 broad categories of sectors stated in Section above. Additionally identify sectors/ activities where EIA would be mandatory based on their vulnerability. (This is to help raise the bar in activities to be carried out in vulnerable areas).

The abovementioned steps have been covered in the Vulnerability Assessment report and are described below:

1. Establish criteria of vulnerability based on baseline collected.

a. Identification of variables that define the entity, the natural systems or State.
b. Identification of the variables of the stressor, or the pressure.
c. Inter-linking the State (natural systems) variables and the Pressure variables (Infrastructural related).
d. Assessment of Vulnerability for the Tehsil.
e. Identification of the ability, or Response variables to resist and mitigate the stress.

'Pressure' and 'State' have been identified and its variables when analysed together gives a level of understanding as 'how' and 'where' a particular system is exposed and hence vulnerable at different degrees.

Pressure Variables:

Pressure variables are those which create stress on "State" i.e. natural and manmade systems. These variables are selected based on the importance and impact these variables make on the "State" and for which data /information is available for vulnerability assessment at District/ Tehsil/ Sub tehsil level. Based on these attributes, 13 pressure variables have been identified namely Utilities & Infrastructure, Irrigation, Agriculture, Forestry, Fisheries, Tourism, Industry, Mining, Roads, Railway, Transportation, Hydel Power and Demography.

State Variables:

State variables are those which define the natural and manmade systems and which are stressed by pressure variables as described above. For the purposes of the vulnerability assessment and based on the availability of data/ information at District/ Tehsil/ Sub tehsil level, 10 state variables have been identified namely Water, Air, Land, Critical Habitat (Natural), Critical Habitat (Manmade, Climate Change, Hazard Susceptibility, Spatial Analysis, Quality of Life (Health) and Quality of Life (Education).

2. A key criterion would be related to environmental health and its associated impact on quality of life

Among the State variables, Health has been taken as a key criteria as Quality of Life (Health). The quality of life parameters for health include accessibility to a Primary

Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometers and a Hospital within a distance of 10 Kilometers. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/norms and hence require intervention. Baseline data on access to Health services has been factored in for computing the Vulnerability Index (VI) which denotes the vulnerability at tehsil/district and sectoral level.

3. Set priorities of optimal decision – making.

Predicated on the baseline data, their collation as per the identified "State" and "Pressure" variables and computation of VI, data analysis has been done. The observations and concerns emerging from this analysis is required to be addressed as a response in terms of policy, plans, programmes and projects interventions. This planning approach has been adopted as it reflects optimal combination of "bottom up" (inclusive of community inputs) and "top down".

As per the "State" and "Pressure" parameters, recommendations have been framed and priority tehsils have been identified for undertaking development activities. This has been summarized in the Response Matrix which is based on inferences and data analysis. It maps the "State" & "Pressure" variables with the suggested intervention which are required to be made to reduce the vulnerability. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response. The suggested intervention shall partly act as response mechanism of the State Government which factors in both bottom up" (inclusive of community inputs) and "top down" approach to development planning.

Vulnerability levels in regional context have been analysed to understand the vulnerability in regional context. Vulnerability in regional context gives an understanding of how the levels of vulnerability of adjoining areas/tehsil/sub- tehsil within the district or other districts are impacting the levels of vulnerability of current areas/tehsil/sub-tehsil. This understanding is helpful in consideration of the intervention prioritization.

Further, vulnerability scenario projection has been done. While analyzing the future scenarios, except demographic variables, no other variable is scientifically projectable in present context. In view of such limitations, the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The Vulnerability Index and the population have been interlinked by evolving a per capita share of vulnerability index.

4. Identify vulnerable areas i.e. physical areas or hotspots; and policies which exacerbate environment deterioration in these areas.

Based on the database for "State" variables, computation of "State" variables has been done at the district level. Based on computation, "State" variables have been assessed and described w.r.t vulnerability. On the basis of quantification of variables under "State" component, the Vulnerability Index has been derived for all tehsil/sub-tehsils of all 12 districts of Himachal Pradesh. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor (NF 'State'). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability (V State Sector) as a total for that particular system.

Similarly, based on the database for "Pressure" variable, computation of "Pressure" variables have been done at the district level. Based on computation, "Pressure" variables have been assessed and described w.r.t vulnerability. On the basis of quantification of variables under "Pressure" component, the vulnerability index has been derived for all tehsil/ sub-tehsils for all 12 districts of Himachal Pradesh. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor (NF 'Pressure'). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability (V "Pressure" Sector) as a total for that particular system.

Identification and mapping of vulnerable areas i.e. physical areas or hotspots has been done based on the values of VI. The value of VIs of tehsils represents the vulnerability and is represented both spatially and temporally (including projected vulnerability (for the period 2011-2041). The mapping of tehsils is based on the VI values based on criteria, defined above as "Pressure" and "State" variables. The VI values of an area denote area which are being impacted and are likely to be threatened by associated environmental risks in the future and represented as projected vulnerability (2011-2041).

Vulnerability levels in regional context have been done to understand the vulnerability in regional context. Vulnerability in regional context gives an understanding of how the levels of vulnerability of adjoining areas/tehsil/sub- tehsil within the district or other districts are impacting the levels of vulnerability of current areas/tehsil/sub-tehsil.

Sectoral Acts, Rules, policies, programmes/projects at the National/State level have been identified and given in Environment and Social Sectoral Guidelines (Task 4). These Sectoral Guidelines contain criteria for carrying out an Environment Impact Assessment and guidelines for the three broad categories of sectors stated above. Besides, sectors/activities where Environment Impact Assessment (EIA would be mandatory based on their vulnerability has been identified to help raise the bar in activities to be carried out in vulnerable areas identified in Task 2.

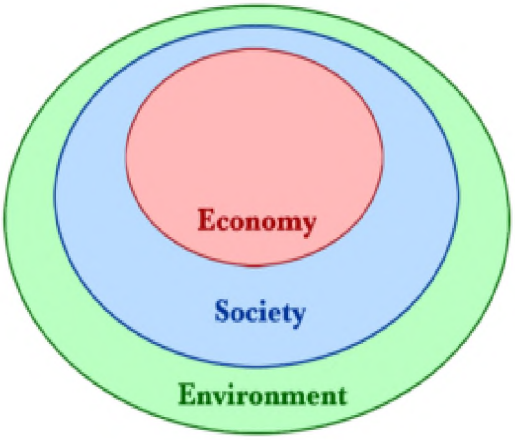
Vulnerability – a Concept

The 'vulnerability' of any system to ongoing environmental variability and future environmental changes depend on the level of anticipated and unanticipated risks and the ability of the system to adapt/ respond effectively to such risks both in short and long term.

Healthy, productive and protective environment, social systems and economies are the basis of '***sustainable development'**** and human welfare. The environment is the source of all raw materials and absorbs the pollution from human activities. In turn, for social and economic development activities, humans use the environment and convert its resources and natural services into those that directly support us. The problem is that all of these systems can be damaged, overloaded, or prevented from meeting our needs. By our own choices we can to a large extent determine our own quality of life, the condition of our lands and opportunities for future generations.

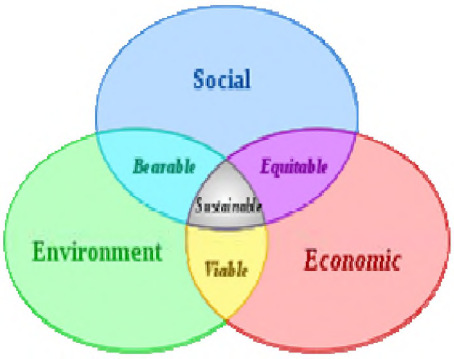
** **Sustainable development** has been defined in many ways, but the most frequently quoted definition is from Our Common Future, also known as the Brundtland Report:*
"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- *the concept of **needs**, in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of **limitations** imposed by the state of technology and social organization on the environment's ability to meet present and future needs."*



According to Hasna Vancock, sustainability is a process which tells of a development of all aspects of human life affecting sustenance. It means resolving the conflict between the various competing goals, and involves the simultaneous pursuit of economic prosperity, environmental quality and social equity famously known as three dimensions with the resultant vector being technology, hence it is a continually evolving process; the 'journey' (the process of achieving sustainability) is of course vitally important, but only as a means of getting to the destination (the desired future state).

The figure above is a graphic representation of sustainability showing how both economic and societal values are constrained by environmental limits. It has to be understood that quality of life is a system, too. It's good to be physically healthy, but what if you are poor and don't have access to education? It's good to have a secure income, but what if the air in your part of the world is unclean? And it's good to have freedom of religious expression, but what if you can't feed your family?



The concept of sustainable development is rooted is this sort of systems thinking. It helps to understand ourselves and our world. The problems faced are complex and serious—and they can't be addressed in the same way as they were created, But they can be addressed
The United Nations 2005 World Summit Outcome Document refers to the "interdependent and mutually reinforcing pillars" of sustainable development as economic development, social development, and environmental protection.

We understand that 'vulnerability' is a new way of looking at an age-old problem. Instead of focusing just on what has been going wrong in the past and the effects of hazards, vulnerability gives us the opportunity to focus on getting things right for the future. As a future-focused approach, vulnerability is a way of using strengths and strategically improving weaknesses.

Vulnerability refers to the tendency of something to be damaged. The opposite of this is 'resilience', or the ability to resist and/or recover from damage. When we talk about vulnerability, we are automatically also talking about resilience because the two are opposite sides of a single coin. That is, something is vulnerable to the extent that it is not resilient, and vice versa.

For development to be sustainable, or we say 'sustainable development' we clearly need to learn to know level of vulnerability and then manage our 'vulnerabilities'. We need to be able to understand and/ or manage hazards, natural resilience and acquired resilience. This understanding opens up opportunities for improving our overall vulnerability because it forces us to examine the problem from all angles, instead of just focusing on the risk of disasters. Vulnerability management is emerging as a critical part of any sustainable development strategy. Therefore, it is quite essential to find out the current levels of vulnerability of our system and set planning principles accordingly.

The interesting thing about vulnerability is that it can be examined at different levels for different issues. That is, it can be used to look at a single issue, or to assess a complex entity such as a region.

"Vulnerability is defined as the degree to which a system is susceptible. To address the concept of

vulnerability to a stressor in its entirety, it is essential to cover the possible impacts of the stressor on human and natural systems. Such a framework would span three elements: the 'stressor', which triggers the impacts and consequent response, 'vulnerability' of the entity exposed to the stressor and the 'ability' of the exposed entity to cope or respond to the stressor" (Noronha, 2003)

As a normal course of action, though, the human being is one which experiences the stresses and is therefore part of the entity exposed to the stressor, it also happens to be the stressor either directly or indirectly. It is also the human being which is a major medium to create the ability of the exposed entity, i.e. it and its environs, to cope or respond to the stressor, on the entity which is stressed and of which he himself is a part. It is based on these principal that this analysis and assessment is primarily human and specifically the quality of life-centric. Vulnerability assessment is a valuable tool for policy makers and practitioners. It also graphically illustrates spatial vulnerability. It shows where there is uneven capacity for preparedness and response and where resources might be used most effectively to reduce the pre-existing vulnerability. It is also a useful in identifying the response to reduce vulnerability and thus contribute to strengthen State's capacity to prepare for, respond to, and recover from vulnerability. For assessing the vulnerability of a system various indicators components can be used based on requirement of derivation. There is hardly any set standard methodology or set of indicators which can be used to measure vulnerability. While deriving the composite of multiple quantitative indicators via some formula, delivers a single numerical result is normally termed as 'Vulnerability Index'. The vulnerability index so calculated for any system whether social, biophysical or environmental determine the level of susceptibility of that system in particular. The brief regarding the criteria, variables, approach and methodology for present study/ analysis follows.

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Approach and Methodology

Approach

Assessing vulnerability with respect to environmental and social parameters has several approaches and various kinds of methodologies have been used for carrying out such studies. But, there is no standard methodology or set of indicators which can be used to measure vulnerability uniformly, neither at macro nor at micro level, globally, regionally or locally there is no set ready reckoner available to derive vulnerability levels. Empirical data analysis of environmental – social variability hardly permits to reach at a particular result at a particular time.

While carrying out this study an attempt has been made to review different methodologies used in several studies, which demonstrates a wide spectrum of vulnerability assessments with different focal groups and areas. It has been observed that the basic framework of vulnerability assessment is almost similar but the approach made is to suit the scope and spread of assessment. For the Himalayan region like Himachal Pradesh, where the geographic, biological diversity is quite heterogeneous in every possible terms, it is found to have relevance to derive vulnerability in terms of stress and stressors.

As a normal course of action, though, the human being is one which experiences the stresses and is therefore part of the entity exposed to the ***stressor***, it also happens to be the stressor either directly or indirectly. It is also the human being which is a major medium to create the ability of the exposed entity, i.e. it and its environs, to cope or respond to the stressor, on the entity which is ***stressed*** and of which he himself is a part. It is based on these principal that this analysis and assessment is primarily human and specifically the quality of life-centric.

It is not rational to deal at the scale of the entire state in view of the above stated fact. Even at the scale of district, the variations are frequent, to which some of the districts are substantially, diverse and it is not considered appropriate that the district is taken as a homogenous unit for representing the issues at one scale and level.

It is for these reasons, the smallest administrative unit, the Tehsil or Sub- Tehsil have been taken as the lowest denominator of spatial unit. Though even with unit as Tehsil not sufficient to draw a conclusion at micro level, local level but in view of the limitation of availability of data base etc. it is not easy to scale down to local level. Therefore, the entire approach is based on a rational and objective assessment of the data base available, which, in-turn makes the system inter-active and subject to up-dating, without any involvement of subjective interpretation. Subjectivity in any process carries a heavy personalized bias, which has to be assiduously avoided, and thus the approach and process has been designed to work within a rational, realistic and objective framework.

Accordingly the approach adopted, the following steps define methodology for vulnerability assessment:

a. Identification of variables that define the entity, the natural systems or State.
b. Identification of the variables of the stressor, or the pressure.
c. Inter-linking the **State** (natural systems) variables and the **Pressure** variables (Infrastructural related).
d. Assessment of Vulnerability for the Tehsil.
e. Identification of the ability, or Response variables to resist and mitigate the stress.

'*Pressure*' and '*State*' variables together when analysed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees.

Pressure Variable

Pressure variables are those which create stress on "State"i.e. natural and manmade systems. These variables are selected based on the importance and impact these variables make on the "State" and for which data /information is available for vulnerability assessment at District/ Tehsil/ Sub tehsil level. Based on these attributes, 13 pressure variables have been identified namely Utilities & Infrastructure, Irrigation, Agriculture, Forestry, Fisheries, Tourism, Industry, Mining, Roads, Railway, Transportation, Hydel Power and Demography.

State Variables

State variables are those which define the natural and manmade systems and which are stressed by pressure variables as described above. For the purposes of the vulnerability assessment and based on the availability of data/ information at District/ Tehsil/ Sub tehsil level, 10 state variables have been identified namely Water, Air, Land, Critical Habitat (Natural), Critical Habitat (Manmade, Climate Change, Hazard Susceptibility, Spatial Analysis, Quality of Life (Health) and Quality of Life (Education).

State Parameters

Indicator	Variable
Water	No. of Perennial Rivers/Khuds
	No. of Non-Perennial Rivers/Khuds
	Surface Water Quality
	Area under high surface water pollution sensitivity (%)
	No. of Lakes
	No. of Reservoirs
	Ground Water Quality
	No. of tube wells for irrigation
	No. of tube wells for drinking Water
	No. of tube wells for industries
	Area under Ground Water Recharge
	Bird Sanctuary/Important Bird Areas

Indicator	Variable
Air	Ramsar Sites/Wetlands
	Air Quality
	Area Sensitive to Air Pollution
	Probable Emission due to transport
Land	Fallow Land
	Land under forest cover
Critical Habitat (Natural)	Reserve Forest
	Protected Forest
	Sulphur Springs
	National Parks
	Wild Life Sanctuaries
	Bird Sanctuary/Important Bird Areas
	Ramsar Sites/Wetlands
Critical Habitat (Manmade)	Cultural Heritage Structure/areas
Climate Change	Change in Maximum Temperature
	Change in Minimum Temperature
	Change in Rainfall Pattern
Hazard Susceptibility	Proportion of Flood Prone Area (%)
	Proportion of Seismic Hazard Prone Area (%)
	Proportion of Landslide Prone Area (%)
	Proportion of High Wind Speed Area (%)
Spatial Analysis	Areas under Conflict reference to water-No
	Areas under Conflict reference to land –No
	Areas under Conflict reference to air –No
	Areas under Conflict reference to forest –No
	Areas under Conflict reference to green cover -No
Quality of Life-Health	Villages with non availability of primary health center within 3 kms-%
	Villages with non availability of community health centre within 6 kms-%
	Villages with non availability of hospital within 10 kms-%
Quality of Life-Education	Villages with non availability of primary school within 2 kms-%
	Villages with non availability of secondary school within 6 kms-%
	Villages with non availability of colleges within 15 kms-%
	Villages with non availability of vocational institute within 25 kms-%

Pressure Parameters

Indicator	Variable
Utilities & Infrastructure	Gap in Potable Water Supply-lpcd
	Gap in sewerage collection/ treatment-lpcd
	Gap in Solid Waste Collection/ treatment
	Villages with no access through pucca roads (%)
	Villages with no access to public transport (%)
	Villages with no electricity (%)
	Villages with no Telecom facility (%)
Irrigation	Existing area under Irrigation (%)
	Proposed area under Irrigation (%)
Agriculture	Change in area under Agriculture (%)
	Cropping Pattern (Single, double or three crops)
	Change in Agricultural Yield (%)
	Change in area under horticulture (%)
	Change in Horticultural Yield (%)
	Change in use of Fertilizers & Pesticides (%)
	Change in Livestock-Poultry (%)
	Change in Livestock-Milch Animals (%)
	Change in Livestock-Others (%)
Forestry	Change in Forest Produce Production (%)
	Change in Timber Production (%)
	Demand for fuel wood (%)
	Change in Density of Forest (%)
	Change in Species for Plantation (%)

Indicator	Variable
Fisheries	Change in Harvest from Rivers (%)
	Change in Harvest from Lakes/Reservoirs (%)
Tourism	Growth of Tourism Total (%)
	Growth of Tourism Domestic (%)
	Growth of Tourism Foreign (%)
	Number of Tourist Destinations
	Number of Fairs & Melas
	Peak Season Density of Tourist
	Gap in number of beds available for tourist (%)
Industry	Growth of Industries-(Large & Medium) (%)
	Growth of Industries-(Small) (%)
	Growth of Industries-Household & Cottage (%)
Mining	Number of Mining (minor minerals) leases
	Number of Mining (major minerals) leases
	Growth in extraction of major minerals (%)
Roads	Increase in road length- (National Highways) (%)
	Increase in road length- (State Highways) (%)
	Increase in road length- (Major District Roads) (%)
	Increase in road length- (Other Metalled Roads) (%)
	Increase in other roads (%)
	New Roads (NH) (constr. Ongoing/proposed) km
	New Roads (SH) (constr. Ongoing/proposed) km
	New Roads (MDR) (constr. Ongoing/proposed) km
	New Roads (Other Metalled) (constr. Ongoing/proposed) km
Railway Transportation	Increase in rail length-kms
	Increase in number of vehicles registered (%)
Hydel Power	No. of Hydel Power Projects in Operation
	No. of Hydel Power Projects under construction
	No. of Hydel Power Projects approved but not under construction
	No. of Hydel Power Projects under approval
Demography	Growth in Rural Population (%)
	Growth in Urban Population (%)
	Population Density (Persons/Sq.Km)
	Literacy (%)

Vulnerability Index

As stated above *Vulnerability index* is a measure of the exposure of a population to the vulnerability on account of pressure on natural environment which determines the quality of life. The vulnerability Index is a composite of multiple quantitative indicators that via some formula, delivers a single numerical result.

Here the '*index*' is designed to be used with economic and social vulnerability indices to provide insights into the processes that can negatively influence the '*sustainable development*'.
The reason for using indices for this purpose is to provide a rapid and standardized method for characterizing vulnerability in an overall sense, and identifying issues that may need to be addressed within each of the three pillars of sustainability, namely environmental, economic and social aspects of a region's development.

Through this study the vulnerability index has been derived for each administrative sub division (Tehsil/ sub-Tehsil) is an objective number with reference to similar numbers for other Tehsil/ sub-Tehsils it helps in prioritization on a rational basis. The brief regarding the criteria, variables, approach and methodology follows.

Range of Vulnerability Index

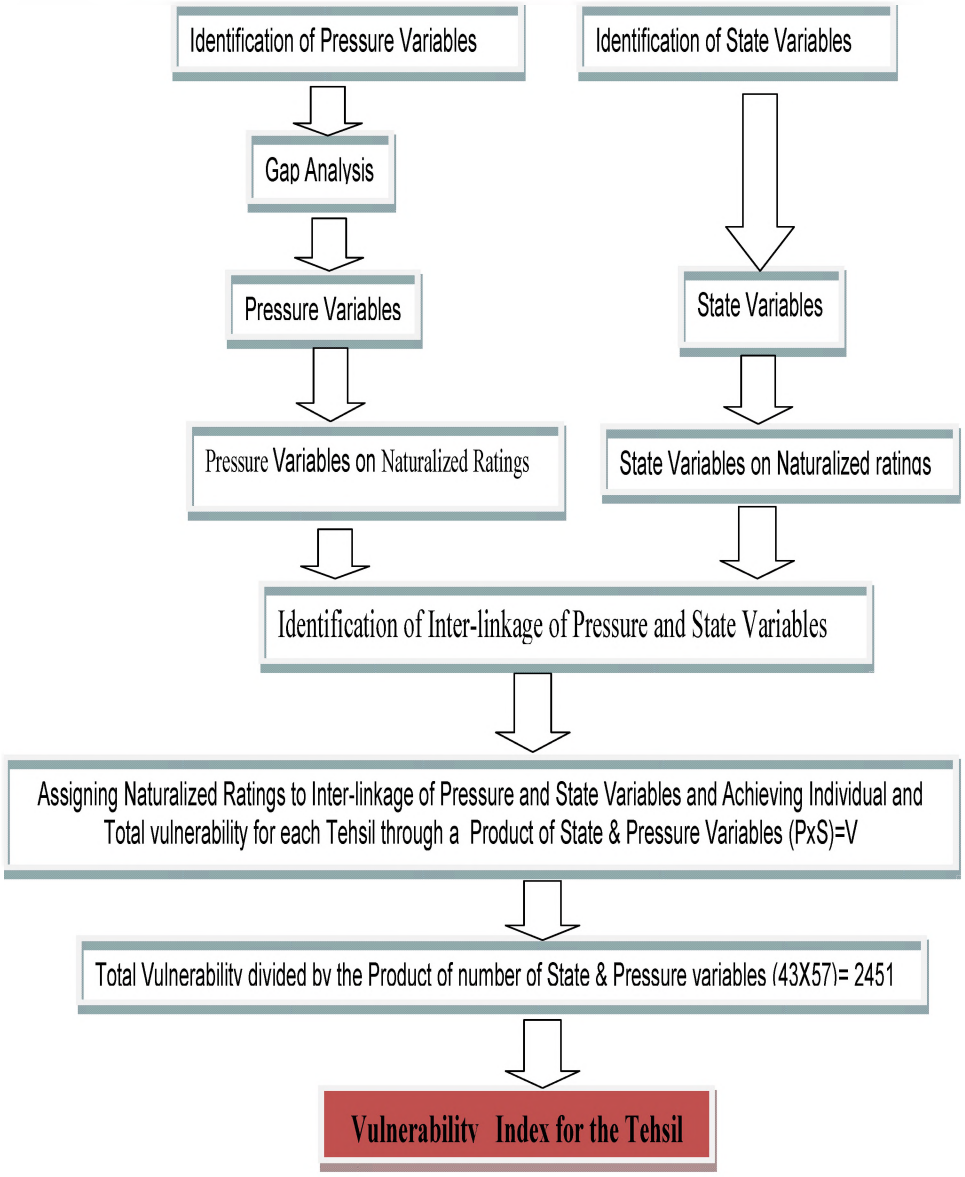
The Vulnerability Index has been categorized in six categories as under

Vulnerability Index Range	Vulnerability Index Category	Color Code
Up-to 1.5	Very low vulnerability	
1.51- 2.5	Low vulnerability	

Vulnerability Index Range	Vulnerability Index Category	Color Code
2.51- 3.5	Moderate low vulnerability	
3.51-4.5	Moderate high vulnerability	

Vulnerability Index Range	Vulnerability Index Category	Color Code
4.51-5.5	High vulnerability	
≥5.51	Very High Vulnerability	

Flow Diagram of Steps followed for Vulnerability Assessment



Methodology

Step 1: Data base for all the variables (Pressure & State) are tabulated for all the Tehsils. These data, for each of the variables carry a value expressed in the designated units (i.e. %, lpcd, ha etc). The values are expressed as V_1, V_2 etc.

Since each value is in separate units, they have to be naturalized on the same scale and in same manner of expression

Step 2: These values are now rationalized in the following manner-

(i) For any given variable, across all the Tehsils of the District, the highest value and the lowest value is selected and designated as V_H and V_L. The highest value is assigned a rating of 10 while the lowest value is assigned a rating of 1.

(ii) The intermediate values are interpolated based on the formula
$V_H - V_L/9$ = Naturalization Factor= N_F
($N_{F\ State}$ or $N_{F\ Pressure}$ as the case may be)
$V_{Naturalized} = 1+(V_{1,2,3\ldots}-V_L)\ X\ N_F$

(iii) Thus all the interim naturalized values for all the Pressure and State variables for all the Tehsils in the District are tabulated. In this manner, the difference in units is eliminated

Step 3: A matrix with the State variable sectors (e.g. water, land, air, etc) on the x-axis and the Pressure variable sectors (e.g. Utilities and Infrastructure, roads, Industry etc) on the y-axis is plotted with the relationship of each sub-sector variable ascertained. Wherever a relationship exists, e.g. source of perennial water has a relationship with gap in potable water supply as the effort to bridge the gap is going to influence the perennial source of water. Or for that matter, the gap in sewerage is bound to impact the perennial source of water through pollution and thus has a relationship. Such relationship grids are assigned a value of 1 while those grids which do not display a relationship are assigned a value of 0.

Step 4: Now for each Tehsil, the Naturalization Factor for each variable is applied in the inter-relationship matrix which has been prepared in Step 3. In the grids where an inter-relationship exists, the assigned value of 1 gets multiplied both by $N_{F\ State}$ and $N_{F\ Pressure}$, giving a grid value of G_{vuln} for each grid. Thus, we have $G_{vuln}= 1\ X\ N_{F\ State}\ X\ N_{F\ Pressure}$. The grids, which do not represent an inter-relationship, gets both the values of $N_{F\ State}$ and $N_{F\ Pressure}$ multiplied by 0 and thus result in the Grid value of 0.

Step 5: The grid value totaled up in the row format gives the vulnerability of the sub sector. So in the Utilities & Infrastructure Sector, the grids in the row of Gaps in potable water supply give a total vulnerability of the gaps in potable water, $V_{U\&I(Pot.Wat_r)}$. Similarly, the total vulnerability scores for other variables such as gaps in sewerage $V_{U\&I(Sewerage_r)}$, and gaps in solid waste collection $V_{U\&I(Solid\ waste)}$, are determined. The sum total of all the vulnerability scores in the Utilities & Infrastructure sector gives the sum total score of vulnerability in the sector as $V_{\mathbf{U\&I}}$. Similar exercise is carried out for all the sub-sector variables in all the Pressure Sectors. This Results in $\sum V_{Pressure\ Sectors}$, a sum total of all the vulnerability scores in the Pressure Sector.

Step 6: A similar exercise is carried out for the State Sectors also, the difference being that in place of rows, the sum total is arrived at in columns. This results in various sub sector vulnerability scores and the sectoral vulnerability score a sum total of which is $\sum V_{State\ \ Sectors}$, a sum total of all the vulnerability scores in the State Sector.

Step 7: To arrive at the Vulnerability Index the formula that is used is

$\sum V_{Pressure\ Sectors}\ X\ V_{State\ Sectors}$ / Total no. of State variables X total no. of Pressure variables

Or

$$VI = \frac{\sum V\ Pressure\ Sectors\ X\ V\ State\ Sectors}{53\ X\ 47}$$

$$VI = \frac{\sum V\ Pressure\ Sectors\ X\ V\ State\ Sectors}{2451}$$

Step 7: In this manner Vulnerability Index for each Tehsil is determined and the tabulated District wise

Step 8: In order to calculate the Vulnerability Index of each sector, the Sum total of the Sector, such as $V_{\mathbf{U\&I}}$ or $\mathbf{V}_{Water}$ is divided by the no. of variables in the State or Pressure themes. Thus, for example, water sector in the State theme is represented by say 11 variables, the dividing figure is 11 X 53, the latter number, 53 being the number of variables in the Pressure theme. Thus the

dividing figure in this case is 583 and the $VI_{water} = \mathbf{V}_{Water} / 583$.

Similarly, the number of variables in Industry Sector may be 3 in Pressure Sector, and that multiplied with the 47 variables in the State theme gives us the dividing factor of 141. Thus the $VI_{Industry} = V_{Industry}/141$.

With this methodology the Vulnerability

Illustration of calculations for deriving Vulnerability Assessment

Gaps Analysis in Infrastructure

A	**Potable Water Supply -**	**National Standards**	**Present Status**
	Rural Areas	70 lit/ capita/day	32 lit/ capita/day
	Urban Areas	135 lit/ capita/day	72 lit/ capita/day
B	Sewerage Generation – 80% of the water supply		
C	Municipal Solid Waste Generation –		
	Rural Areas – 130 gms per capita per day		

			Potable Water			Sewerage			Solid waste		
	Tehsil	Population	Demand in Kiloliters	Supply in Kiloliters	Gap in Kiloliters	Generation in Kiloliters	Collection and Treatment in Kiloliters	Gap in Kiloliters	Generation in Tonnes	Collection & Treatment in Tonnes	Gap in Tonnes
1	Arki (Rural)	80353	5625	2571	3053	2057	0	2057	10	0	10
2	Arki (Urban)	2877	388.4	207.1	181.35	165.7	0	165.7	0.633	0	0.63
3	Arki (Total)	83230			3235			2223			11

Urban Areas – 220 gms per capita per day

DERIVING RATIONALIZED RATINGS

Data base for all the variables (Pressure & State) are tabulated for all the Tehsils. These data, fpr each of the variables carry a value expressed in the designated units(i.e, %, lpd,ha etc). The values are expressed as V_1, V_2 etc.

Since each value is in separate units, they have to be rationalized on the same scale and in same manner of expression

These values are now rationalized in the following manner-

For any given variable, across all the Tehsils of the District, the highest value and the lowest value is selected and designated as V_{MAX} and V_{MIN}.

The highest value is assigned a rating of 10 while the lowest value is assigned a rating of 1

The intermediate values are interpolated based on the formula

V_{MAX}- V_{MIN}/10-1 = Rationalization Factor= R_F

($R_{F\ State}$ or $R_{F\ Pressure}$ as the case may be)

$V_{Natucalized} = 1+(V_{1,2,3} - V_L) \times R_F$

Thus, all the interim rationalized values for all the Pressure and State variables for all the Tehsils in the District are tabulated. In this manner, the difference in units is eliminated

Example

Solan - Pressure Variables

Gap in Potable Water Supply

Variable	Tehsil Name						
	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat
Gap in Potable Water Supply-Klpd	3235	1129	5914	982	2707	18380	1335

Rationalized Rating

The maximum Value is of Solan @ 18380 Klpd (V_{max}) and
the Lowest is Krishangarh @ 982 Klpd (V_{min})
V_{max} being the highest value is assigned the value of 10
whlie V_{min}, the lowest is assigned the value of 1
Thus V_{max}-V_{min}= 18380-982 =17398.
This is divided in 10-1=9 equal parts to get the scale.
One rating on the scale = 17398/9 = 1933.1

Thus, the next value from the bottom is Ramshehar with 1129.
The difference between this value and the lowest for Krishangarh at 982 is 147,
which in the rating scale means a value of 147/1933= 0.076 or say 0.08.
Thus, the Value for Ramshehar is 1(which is the lowest value on scale)+ 0.08 =1.08

Similarly, the difference between Kandaghat & Ramshehar is 1335-1129 =207
and the rationalized difference is 207/1933.1=0.107 say 0.11.

Thus, the rationalized value for Kandaghat is Value for Ramshahar+ difference = 1.08+0.11= 1.19

So on for all the values

Thus, the rationalized ratings are

Variable	Tehsil Name						
	Arki	**Ramshahar**	**Nalagarh**	**Krishangarh**	**Kasauli**	**Solan**	**Kandaghat**
Gap in Potable Water Supply-lpcd	2.14	1.08	3.56	1	1.9	10	1.19

Similarly, the rationalized ratings for State Variables are

Variable	**Arki**	**Ramshahar**	**Nalagarh**	**Krishangarh**	**Kasauli**	**Solan**	**Kandaghat**
No. of Perennial Rivers/Khuds	3.27	7.81	10	5.54	1	3.27	7.81

Now on the inter-relation matrix, gap in potable water supply has a direct relation with the perennial source of water as this is the only source and that efforts to close the gap would mean extracting water from these sources.

Thus to calculate relative vulnerability, both these values are multiplied to obtain a figure of 2.14X3.27 =6.9978 say 7.0 for Arki Tehsil and only for the inter relation between potable water supply and perennial source of water.

The sum of all the inter-relationships in a Tehsil totals the relative Vulnerability score and divided by the total number of variables (57 of the Pressure themeX43 of the State theme=57X43= 2451).

This gives the Vulnerability Index for the Tehsil.
(For Arki, the Sum total of all the inter related variable matrix is 2600.4 which when divided by 2451 gives a vulnerability index of 1.06
Similar calculations are done for all the variables of the pressure and the state themes and for all individual Tehsils.
Sectoral Vulnerability Index

In order to calculate the Individual Vulnerability Index for each of the groups of Pressure Theme variables such as Utilities & Infrastructure, Industry etc. and the State Theme variables such as Water, Air Land etc., the following method is adopted.
Example Arki Tehsil

The variables under the Group Utilities and Infrastructure number 7 in the Pressure theme and they interact with 43 variables in the pressure theme. Wherever interaction exists the relationship matrix gets a value of 1 with the rationalized values multiplication being multiplied by 1. Where no relation exists, the multiplying value is 0 and results in a 0. Thus the total score of all the inter relations for the seven variable sum up to 443.49 (for Arki – Utilities and Infrastructure). Thus the Vulnerability Index for this Sector – Utilities & Infrastructure = 443.49/7X43 = 443.49/301 =1.47.

Similarly, in the Water Sector, there are 11 variables and they interact with 57 variables thus the dividing factor here becomes 11 X57 = 627. The Total score of water sector for Arki is 1288.85 and therefore, the VI of water sector is = 1288.85/627 = 2.055.
In this manner, the VI for all the sectors are calculated.

Index at the Tehsil Level and at the Sector Level is determined.

Vulnerability Assessment

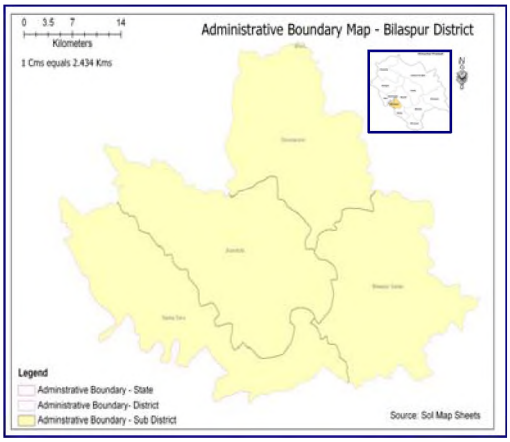
District wise at Tehsil Level

BILASPUR

General Background:

Bilaspur district is located between 31°12' 30" and 31°35' 45" north latitude and between 76°23' 45" and 76°55' 4" east longitudes. It is bounded by Punjab in south west, Bangana Tehsil of Una district in the north west, Tehsils Barsar, Dhatiwal, Hamirpur and Bhoranj of Hamirpur district in north, Sundernagar, Baldwara Tehsils of Mandi district in east and Arki, Ramshehr and Nalagarh Tehsils of Solan district in the south. The district is one of the smallest districts in the State and covers an area of 1167 Sq.Km. which accounts for 2.1% of total area of state and ranks 11th amongst 12 districts of the State.

Initially there were only two Tehsils, in the district, namely, Ghumarwin & Bilaspur Sadar. In 1980, another Tehsil Naina Devi was created by State government with headquarters at Swarghat. In 1984, a new sub Tehsil Jhanduta was carved out of the Ghumarwin Tehsil. Administratively the district is divided into 3 Tehsils and, one Sub-Tehsil.



Sr. No.	Tehsil	Area in Sq. Kms.
1	Ghumarwain	424.49
2	Bilaspur Sadar	287.33
3	Naina Devi	233.24
4	Jhanduta	182.11

Physiography

Bilaspur district is a fertile area bounded by low hills, forests, grazing lands, rivers, rivulets and streams. District is entirely hilly located at an altitude ranging between 560m & 1879m above mean sea level. *Bahadurpur Dhar* attains a maximum height of 1,879 meters in this region. The region has many low hill ranges known as *Dhars* viz. *Dhar Naina Devi*, *Dhar Kot*, *Dhar Tuini*, *Dhar Bandla*, *Dhar Jhinjiar*, *Dhar Ratanpur and Dhar Bahadurpur*. District has been divided into two sub-micro regions on the basis of physiography, climate, soils, natural vegetation and geology, which are as follows:

Sutlej Basin

This is situated in southern part of district covering whole of Bilaspur Sadar, Naina Devi western and eastern part of Jhanduta and southern tip of Ghumarwin. This region covers more than two-third of total area of district.

Sutlej Basin is formed by Sutlej River and various tributaries which join it. Areas adjoining banks of these rivers are plain and contain fertile alluvial soil. The slope of the region is from north-east to south-west and



varies in elevation between 560 meters and 1,879 meters above the mean sea level. *Bahadurpur Dhar* attains a maximum height of 1,879 meters in the region. The Chir forests

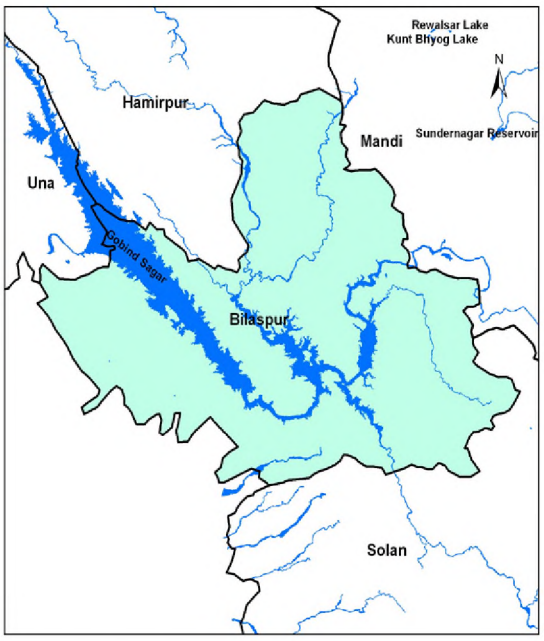
are found in upper areas of *Dhars* on north-eastern part. The scrub forests contain many species like *Sheesham* and *Tun* growing at lower elevation near the cultivated land and also on the banks of the Sutlej River. The Bamboo forests are mainly found in *Naina Devi ki Dhar*.

The geological structure of the region predominantly pertains to Siwalik formations. In the eastern portion, it has *Shali-Deoban* and *Largi Groups* and *Murree* Series formations. The soil cover *Udalfs-Ochrepts* (24) cover the eastern part and *Ochrepts-Orthents* (72) and *Ochrepts-Psamments* (73) the western part of this region.

Bilaspur Shiwalik

This region is situated in the northern part of the district. This region is comparatively low, hilly and have plain and fertile valleys. Elevation in this region varies between 614 meters and 1,239 meters above the mean sea level. *Tuini Dhar* and *Jhanjhiar Dhar* are the main hill ranges. *Tuini Dhar* lying in north-east direction separates this region from Mandi district. The lower ridge of *Tuini Dhar* also forms the eastern boundary of this region and attains maximum height of 1,239 meters. The *Jhanjhiar Dhar* is located in between *Sir Khad* and *Sukar Khad* serve as a main drainage system of this region. In this region, *Sir Khad* flows almost in the centre from north-east to south-west direction. *Sir Khad* rises in Sarkaghat area of Mandi district and traverses whole of Siwalik region and joins Satluj River at *Serimatla*, a few kilometers downwards from Bilaspur town. *Sukar Khad* rises in Hamirpur district and after flowing from north to south direction, it joins *Sir Khad* at *Bagla*.

Drainage Map, District Bilaspur



Culture and Social Brief

Fairs & Festivals

Various fairs and festivals are traditional means of amusement and recreation for the people. It is rather a cultural heritage of the people. Various types of fairs and festivals are celebrated almost around the year such as *Lohri (Maker Sakami), Basant Panchami, Shivratri, Holi, Nalwari Fair, Baisakhi, Shahtalai Fair, Bag Fair, Gugga Fair, Navratri fair* etc.

Places of Religious, Historical, Archaeological importance and Tourist Interest:

There are several places of religious interest such as *Markand, Shri Naina Devi, Jhanda* temple at village *Bolu, Googa peer* at *Gehrwin, Devat Sidh* etc. The district also represents places having historical importance such as *Fort of Kotkahlur*, which is situated at a distance of few kms from Ganguwal Hydro Electric Station. Amongst the places of historical interest, the Fort of Kotkahlur occupies the 1st position.

There are seven small ancient fortresses in the district at *Bacchretur Bahadurpur, Basseh, Fatehpur, Sariyun, Swarghat* and *Tuini. Sunhani* a small village on the bank of Seer Khad is yet another place which claims the distinction of being a state headquarters for some period.



Besides this, the district also have places of tourist attraction such as *Bhakra Dam*, the highest straight gravity dam in the world situated in Naina Devi Sub-Tehsil about 14 kms from Nangal town occupies the predominant position amongst the places of tourist interest. The height of dam is 226 meters; length at the top is 518 meters and width 9 meters. It has a length of 99 meters at the bottom and width 402 meters. The project derives its name from two villages Bhakra and Nangal situated on the foot hills of the low Himalayan ranges. The back waters of *Bhakhra* dam is also termed as *Gobind Sagar Lake which* is a big manmade lake behind the Dam. The area of the lake is 96.5 Sq. kms. with storage capacity of 7.80 million cubic ft. The water which once caused havoc through floods have proved boon for the agriculture and industrial development of Punjab, Haryana and Rajasthan. It moves the wheels of four hydro electric power houses of Bhakra, Ganguwal and Kotla Power Plants with installed capacity of 1200 MW of electric power and brings under irrigation 26 lakhs hectares of land in the state of Punjab, Haryana, and Rajasthan. The lake is very useful for the development of fisheries within Himachal Pradesh.

After submerging the old Bilaspur town which was set up in about 1650 A.D., the new planned township has come up which is the seat of District headquarters. The places of interest where fairs are held are the temple of Raghu Nath Ji, Gopal Ji, Khanmukheshwar and Deomati.

There is a bridge over Satluj River known as *Kandror Bridge*, the construction of the bridge the second highest in Asia was started in April, 1959 and after completion in 1965 it has provided a link between Bilaspur, Ghumarwin and Hamirpur district. It is built across River Sutlej. The span of the bridge is about 280 meters with breadth of about 7 meters.

The *Deoli* village is situated at a distance of 15 kms from New Bilaspur Township towards Mandi just below the Shimla-Mandi road. There are 2 tanks and hatchery of the nursery ponds, built at a cost of Rs.3.68 lakhs. Apart from exporting mirror carp, finger lings out of the state, the main function of this hatchery is to keep a constant supply of finger lings to Gobind Sagar.

Namhol is a place in the district located at about 24 kms from Bilaspur on the Bilaspur-Shimla road. There is a Thakurdwara which was built by Raja Amar Chand in 1883 A.D. brass idols of Ram, Lakshman, Sita and Hanuman is installed in the temple. The place is the main centre of ginger trade. At an elevation of 1,128 meters from the sea level, Swarghat is situated at a distance of about 42 kms from Bilaspur on the Bilaspur-Kiratpur Road. Surrounded by pine trees, it is a beautiful place and is elevated to the status of a sub-Tehsil headquarters of Naina Devi. There is Lakshmi Narain temple in the village.

Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analysed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence

vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analysed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

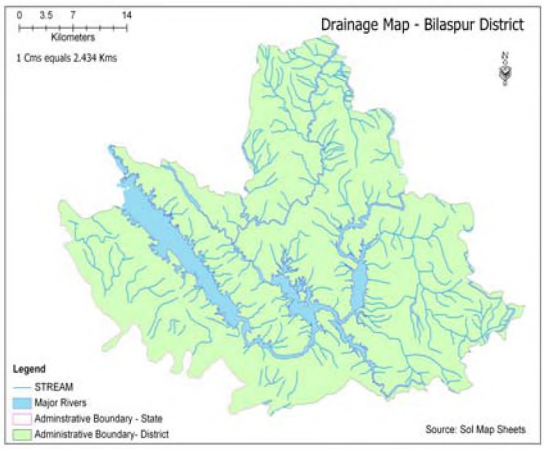
Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Bilaspur district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

Only major river Sutlej passes through the district. It enters the district near Kasol village in the north-east.

The Sutlej is joined by several tributaries from both sides. The main three tributaries are *Ali Khad*, *Gamrola Khad* and *Seer Khad*. The length of *Ali Khad* is about 26 kms. It originates in the Shimla district and after passing through *Bahadpur Dhar* joins the River Satluj at Bilaspur. Its water is utilized for irrigation and running *gharats* at various places. *Gamrola Khad* also traces its origin in the Shimla district and after draining the *Rattanpur Dhar* joins the river about 5 kms from Bilaspur town. *Seer Khad* takes its origin at *Awah Devi* 12 kms from Sarkaghat in Mandi district. After draining *Kot-ki-Dhar* and a greater portion of Ghumarwin Tehsil it joins Sutlej River at village Semimetal 15 kms from Bilaspur town. Two other *Khads Sukar* and *Saryali* rise in the Hamirpur district and join the River at village *Balgar* after draining the western portion of the district. *Mani Khad* and *Gambhar khad*, are also tributaries of the river. *Mani Khad* chiefly flows in Mandi district and joins the river at a place in Mandi. It only touches the district at village Palaila, where the water is used for irrigation. *Gambhar Khad* originates in Solan district. The river bed is deep and is not used for irrigation.



Climate

The climate of this district is generally temperate with summers being hot sometimes. The terrain is mountainous particularly in the south-west of the Sutlej. The portion to the north and west of the Sutlej is slightly hilly with elevations generally varies between 500 and 700 meters with some well-defined ridges going up to higher elevations. The year may be divided into four seasons. The summer is from March to the end of June. The south-west monsoon starts thereafter and last till about the third week of September, October and November constitute the post-monsoon season and the period from December to February is the cold season.

Precipitation/ Rainfall

The rainfall is unevenly distributed. The rain starts in the middle of June and continues nearly three-four months of the monsoon which occurs in July, August and September, while the retreating monsoon extends up to

the winter months of December and January as post monsoon rains.

Particulars	Maximum	Minimum
Rainfall	62 mm	1.5 mm
Temperature	37° C	5° C

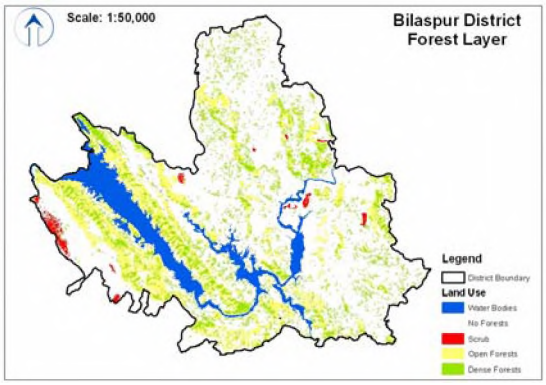
Forest

The forests of the district are neither very rich nor extensive, as it lies in the sub-topical zone. Topographically forested areas lie in inner Shiwaliks and outer Himalayas. The *Chil and Bamboo* forests are found mainly on the Shiwalik formation. Scrub forests situated on the Shiwalik formation are superior to scrub forest growing on other formations such as Karol series. *Chil* forests are mainly restricted to the northern and eastern slopes, while southern and western slopes are occupied by scrub forest. According to the annual report of the State Forest Department, the total area under forests is 428 km^2 which constitutes 36.7 per cent of the total geographical area of the district (1999).

Forests have been classified as reserve, un-demarcated protected and demarcated forest. Excluding *Bahadurpur* forest, which contains *ban and Deodar*, the remaining forests may be divided into three classes:

Chil Forest:. These are found at an elevation of 610 to 1,524 meters on the north and north-east slopes of the main ridges.

Scrub Forests. These contain valuable species of which the most important are *Sheesham and Tun*. These occur at low elevations generally in or near cultivated lands and on the banks of the Sutlej.



Bamboo Forests. The bamboo - forests are found at an elevation of 366 to 914 meters. Mostly these forests cover a large portion of the northern slope of *Naina Devi Dhar*. There are two main varieties of the bamboo- the small, khinj and the large-bans. A third species is called '*nal*' *bans* which are extensively cultivated by the *Zamindars*. A few clumps of *nal bans* are found near the most of the villages.

The district has 385.56 sq. kms of Forest comprising of 0.89 sq. kms of Reserve Forest, 162.50 sq. kms of Protected Forests, Unclassified Forests over 159.98 sq. kms, other forests over 16.04 sq. kms and 46.14 sq. kms of Private forests. It is also interesting to note that under Land Utilization classification, the land under Forests is 428 sq. kms while detailed forest classification says 385.56 sq. km. That means there is a gap between Forest Land and Forest cover.
The principal marketable forest products are *Chil timber, bamboo, resin, Bhabar grass (found in Naina Devi Dhar) and Katha.*

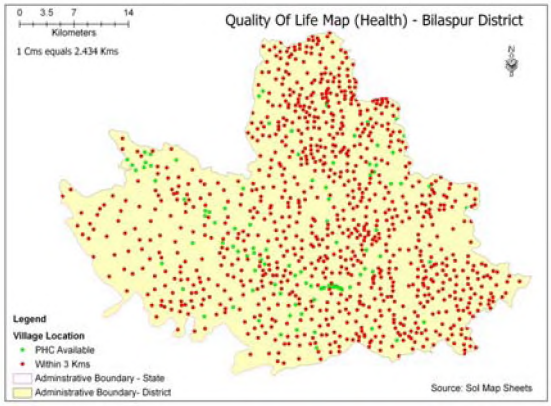
Quality of Life (health)

Availability of health facilities is one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector.

In fact, to summarize, according to 2001(census, on an average 54.50% of villages in the district do not have access to a

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 kms distance in a day and cover the scattered population.

Primary Health Centre within a distance of 3 kms. 60.77 % of the villages do not have access to Community Health Centre within a distance of 6 kms. and, 59.16% of the villages do not have access to a Hospital within a distance of 10 kms.

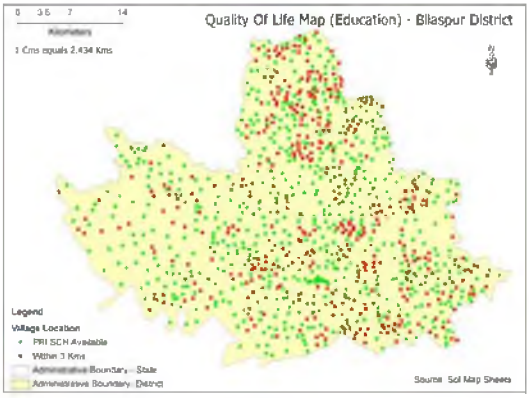


Quality of Life (Education)

Out of 965 inhabited villages 421 are deprived of primary School, 797 are without middle school and 964 are without colleges. 807 villages have college facility at distance of 10+ kms. 415 villages have primary schools at less than 5 kms and 6 villages have it at 5-10 kms. With regard to middle school 694 villages have it at less than 5 kms; 99 villages have it at 5-10 kms and 4 villages have it at 10+ kms. Only 67 villages have the college at less than 5 kms; 90 villages have it between 5-10 kms; while 807 villages have it at 10+ kms.

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

To summarize, according to 2001 Census, on an average 42.75% of villages in the district do not have access to a Primary School within a distance of 2 kms, 69 % of the villages do not have access to a Secondary School within a distance of 6 kms, 50.65% of the villages do not have access to a College within a distance of 10 kms, and, 82.90% of the villages do not have access to a Vocational Institute within a distance of 25 kms.



The map above amply demonstrates the higher accessibility to Primary Schools in the district. It is also interesting to note that Bilaspur Sadar and Ghumarwain Tehsils have a lower accessibility than Jhanduta and Naina Devi Tehsils.

Description of Pressure Theme Variables:

Pressure variable which are relevant in context of District Bilaspur such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Bilaspur district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to 2001 Census, the total population of Bilaspur district is 340,885 comprising 171,263 males and 169,622 females. This population of the district forms 5.61 per cent of the State population and ranks at 10th place among the districts. Out of total population of the district, 93.6 % is distributed in rural areas while 6.4 % lives in urban areas. The rural population of the district is distributed among 4 Tehsil and urban population is spread over in 4 towns. The total urban population in the district is 21,951 persons constituting 11,775 males and 10,176 females. The total population of rural areas in the district is 318,934 persons with 159,488 males and 159,446 females. This rural population is spread over in 965 villages. Out of total 1,061 villages in the district, 965 are inhabited villages while 96 are uninhabited villages.

Population Growth

According to the 1991 Census the total population of the district was 295,387 persons which rose to 340,885 persons in 2001 Census showing net addition of 45,498 persons during 1991-2001. The decadal growth rate of the district comes to 15.4 % during this decade. The growth rate in the rural population is 14.5 % while the urban population has grown by 31.2 % during 1991-2001.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSIL BY RESIDENCE, 1991-2001

S. No.	Tehsil/Sub-Tehsil	Population						Percentage decadal variation 1991-2001			Percentage urban population	
		1991			2001							
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Ghumarwain	105,695	101,987	3,708	120,442	114,721	5,721	14.0	12.5	54.3	3.5	4.8
2	Jhanduta	71,048	69,498	1,550	81,499	79,488	2,011	14.7	14.4	29.7	2.2	2.5
3	Naina Devi	35,131	34,263	868	41,322	40,161	1,161	17.6	17.2	33.8	2.5	2.8
4	Bilaspur Sadar	83,513	72,904	10,609	97,622	84,564	13,058	16.9	16.0	23.1	12.7	13.4
	District Total	**295,387**	**278,652**	**16,735**	**340,885**	**318,934**	**21,951**	**15.4**	**14.5**	**31.2**	**5.7**	**6.4**

The district is displaying an increase in the urban content of the population. While the percentile increase in Jhanduta and Naina Devi Tehsils are marginal, yet, there has been noticeable growth of urban population in these Tehsils. The percentile increase in the urban content of the population is noticeable in Ghumarwain which recorded a 54% increase in its urban population and Bilaspur Sadar which recorded a steady 23% increase in urban population.

Density

The density of population in Bilaspur district is 292 persons per sq. km. against the State average of 109 persons. At Tehsil/ sub-Tehsil level, the density of population varies between 426 persons in Ghumarwin Tehsil and 155 persons in Naina Devi sub-Tehsil. In rural areas, the density of population works out to 277 persons per sq. km. while the density of 1,262 persons per sq. km. has been worked out in urban areas.

Sex Ratio

There are 990 females per 1,000 males in Bilaspur district. The sex-ratio figures for rural and urban areas of the district are 1,000 and 864 females per 1,000 males respectively. It is also seen that the proportion of females in rural areas is higher than that of urban areas. sex-ratio in age-group 0-6 comes to 882 females per 1,000 males in the district, as a whole. In rural areas this proportion is 884 females while in urban areas the sex-ratio of child population comes to 837 females per 1,000 males.

Work Participation Rate

The work participation rate is defined as percentage of total workers to total population. In the same way it is defined for main workers and marginal workers. According to 2001 Census the total workers including main & marginal workers comes to

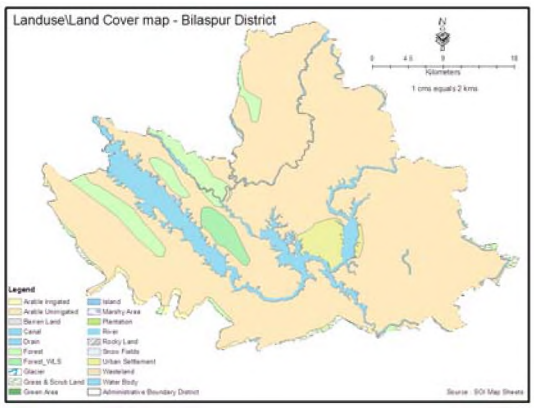
48.9 % of the total population of the district. Of the total workers 32.5 and 16.4 % is shared by the main and marginal workers respectively. The remaining 51.1 % of total population is occupied by the category of non-workers. As per 2001 Census the main workers participation among male is 40.5 and for females is 24.4 %. Males and females have 11.7 and 21.2 % in the category of marginal workers. The proportion of female marginal workers is substantially higher than that of males as the females are attending to one or more economic chores in addition to their household duties to increase the family income. It is observed that the proportion of male main workers is higher than that of female workers in the district.

Urban Population

There are four urban centres in the district. The names, class of town and the 2001 Census population are:

Name & civic Status of town	Size-Class of town	Urban Population
Bilaspur (Municipal Council)	IV	13058
Ghumarwin (Nagar Panchayat)	V	5721
Naina Devi (Municipal Council)	VI	1161
Talai (Nagar Panchayat)	VI	2011

It is very interesting to note that with a population of just 1161 persons, Naina Devi merits a Municipal Council as compared to Ghumarwain which is a Nagar Panchayat. This is due to the reason that Naina Devi is a major pilgrimage Center and a large floating population comes in the consideration, which essentially warrants a Municipal Council.



Literacy

A person who can read and write in any language is considered as literate in Census. All the children of age-group 0-6 years have been recorded as illiterate. As per 2001 Census, Bilaspur district reported 231,733 persons as literates constituting 77.8% of the total population. The proportion of male and female literates in the district is 86.0 and 69.6 % respectively. The literacy rate of males is higher than females in the district. The total literacy rates of rural and urban areas are 77.0 and 89.1 %. The proportion of male & female literates in rural areas is 85.6 and 68.5 % respectively. The proportion of male & female in urban areas is 92.3 and 85.4 %. Females are better educated in urban areas than that of rural areas.

Land Use

Land use Classification of Bilaspur District	Land utilization (Sq.Km)
Total Geographical Area	1167.00
Forest	428.00
Total cropped area	567.14
Area Sown more than once	263.05
Net Cropped Area	304.09

Agriculture

Agriculture is the mainstay of the people and 80% of the total population depends on it. The soil is mostly rausli- a light and somewhat sandy soil. This is intermixed with patches of stiff clay. The land is only moderately fertile. Kharif is the principal harvest and maize the chief crop, and the

staple food. Rice is produced both on irrigated and un-irrigated lands. Kulth is grown on inferior lands. Wheat and grams are the Rabi crops. These are mixed together and sown. The main cash crops are ginger and peas. Amongst the vegetables grown during the Kharif season are Tomato, Shimla Mirch, Brinjal and Ladyfinger.

Tehsil-Wise Area Under Principal Crops*

Name of Tehsil	Area under Principal Crops (Sq.Km)
Bilaspur Sadar	139.46
Ghumarwin	217.20
Jhanduta	138.93
Naina Devi	68.49

** Principal crops: maize, rice, wheat and grams, ginger, tomatoes.*

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square meters in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

Irrigation

The traditional *kuhls* constitute the major source of irrigation in the district which accounted for 72.41 per cent of the net irrigated area These small water channels called *kuhls* are made by making notches on the river and other water sources and water is thus led to the fields for irrigation. The irrigation by wells and tube wells was available to 1.94 Sq. Km and 6.79 Sq. Km of irrigated land was irrigated by other sources of irrigation.

TEHSIL-WISE POSITION OF IRRIGATED AREA (Sq.Km)

Name of Tehsil/Sub-tehsil	Kuhls/Canals	Well/Tube well	Other sources	Total	Percentage of net irrigated area to total net area sown
Bilaspur Sadar	11.55	0.06	0.15	13.14	17.4
Ghumarwin	8.70	0.84	4.84	14.38	11.8
Jhanduta	0.23	-	0.30	0.53	0.7
Naina Devi	2.43	1.04	0.12	3.59	9.9
Total	**22.91**	**1.94**	**6.79**	**31.64**	**10.4**

Livestock

The cattle wealth of the people consists of cows, bullocks, buffaloes and goats and sheep. Livestock is the main wealth next to agriculture of a large chunk of rural population. Livestock plays an important role in the economy of the district which is agrarian. Animal husbandry constitutes subsidiary occupation of 90 % of the rural population. Every household in rural areas keeps a few cows or buffaloes, sheep, goats, pig and poultry birds for milk as well as for other purposes in addition to provide manure for the fields. According to 1992 cattle census the total live stocks in the district were 236,617- out of which there were 60,461 cattle, 86,858 buffaloes, 24,615 sheep, 63,372 goats and 1131 other types of livestock. The total poultry birds in the district were 59,654.

The Animal Husbandry Department has taken up various schemes to develop better breeds of cattle, poultry farms in the district. During the year 2000-01 there were 20 veterinary hospitals and 88 dispensaries functioning in the district. During the period, 31,145 cattle were inseminated.

Horticulture

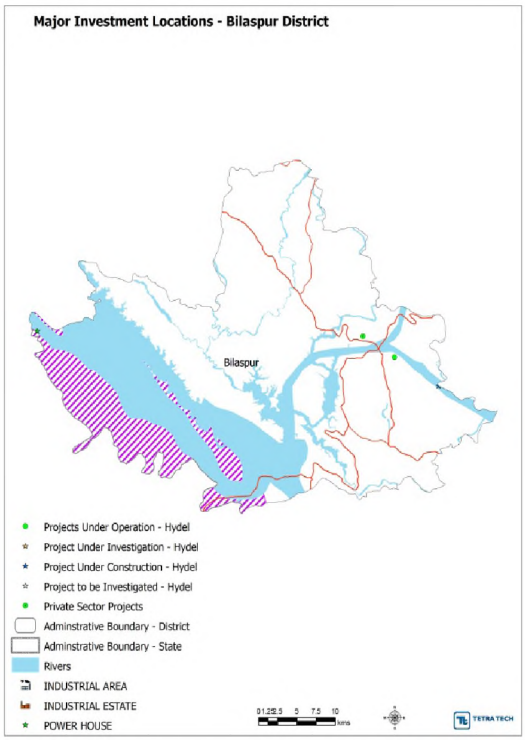
Bilaspur falls in sub tropical zone and fruits like Mango, Citrus, Grapes, Litchi, Pear, Peach and Plum can be grown successfully.

Fisheries

Bilaspur district with its network of rivers and streams has vast potential for the development of riverine fisheries. These rivers and streams are rich in fish fauna. Gobind Sagar Lake with an area of 16,000 hectares and various other khads provide vast breeding place for fishes in the district. Important fishing grounds along the river Sutlej are Bilaspur, Dehar, Auhar, Berighat, Serimatla and Gah. Besides Govind Sagar, fishing is also carried out along Sir Khad, Alikhad, Gambhar and Gambhrola streams. The species found in Gobind Sagar are Katla, Rohu, Mirgal, Singhara, Silver Carp, Mahseer, Gid, Bata, Grass Carp, Kalwasu etc.

Industries

The economic development of the place is directly related with the industrialization of that area. Presently, the economy of the district is confined mainly to agriculture. There is only one large scale industry at Barmana engaged in production of cement. Due to availability of raw material, Associated Cement Company has set up a cement factory on a large scale in private sector at Barmana. Another medium scale industrial unit producing flexible packaging material is located in industrial area of Bilaspur. During 1999, 90 industrial units on small scale were registered in the district.



These are such as match splint unit, hosiery, Ayurvedic drug manufacturing units, tire retreading, paint and varnish making unit, stone crushers etc. A resin and turpentine factory is also functioning in the public sector near Bilaspur Town as also a Furniture factory. The cottage industries like weaving, basketry, rope making, mat making, earthen-ware, black smithy, carpentry, rice mills, oil mills, seed crushing, leather work, gold and silver smithy which are essential for the self sufficiency of rural area are scattered all over the district.

As can be seen from the map the south western portion of the district covering almost the entire Naina Devi Tehsil is earmarked for the Proposed Industrial Corridor. This may be a cause for concern and suitable measures shall have to be taken.

Sericulture

Sericulture is an agro-based labor intensive industry. The climatic conditions are also congenial for the growth of this industry. Bilaspur district has eight sericulture farms/ centres through which sericulture related

activities are being disseminated/propagated. These farms/centres are located at Kothi majher Barthi, Aur, Ghumarwin, Ledda, Panjgain, Harlog and Kandarur.

Roads & Transport

Road Transport is the life line of the economy of the district which is connected by all weather roads as well fair weather roads with all important cities and towns of the State and the nation. National Highway No. 21 passes through the district.



There is net work of roads providing the accessibility to all important places within and out side the district. The total length of both metalled and unmetalled roads in the district is 1176 kms in 2001 against 946 km in 1991. The density of roads was 81.03 kms per 100 Sq. kms in 1991 which rose to 100.76 kms per 100 Sq. kms in 2001 in the district. Besides, the Bilaspur town and the area falling across the Gobind Sagar Lake is linked by ferry service. The total number of bridges across the rivers/khads was 32 in 1991 and their number rose to 54 in 2001. Out of 376 villages having population more than 250 persons (as per 1991 Census) 184 villages have already been linked by roads.

Length of Roads in Kms. Including National Highways

Type of Road	Length as on 3/ 1991	Length as on 3/ 2001
Un-metalled	532.88	498.94
Metalled	412.76	676.90
Total	945.64	1,175.84
Density of Roads	81.03 kms. per 100 Sq. km.	100.76 kms. per 100 Sq. km.

Of the total length of roads in 2001,156 kms double lane motorable roads in the district while remaining motorable roads are in the category of single lane.

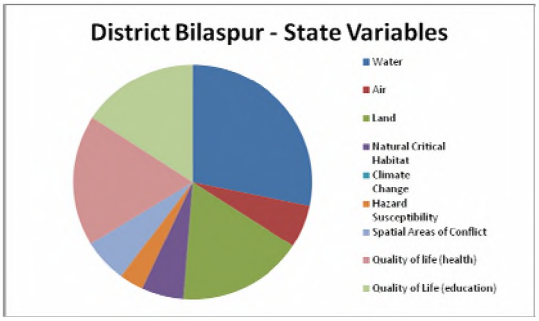
There is no rail link in the district. The nearest railway station is at Kirtpur Sahib in Ropar district of Punjab which is about 84 kms from Bilaspur. This district have transport depot at Bilaspur and ply buses on 90 routes in the state and inter-state routs. Out of these routes 18 are inter-state routes which remaining operates with in the state. This depot has fleet of 84 buses which covered distance of 38.37 lakhs kms during 1999-2000.

During the decade there has been sharp increase in registration of vehicles in this district. The various type of vehicles registered during 1991 were 579 while their number was 1244 vehicles during 1999-2000.

Electricity and Hydro Power

The development of agriculture and industry can hardly be accelerated without the availability of power. In addition to it the use of electricity has became indispensable in the modern times. Bhakra Dam has two power plants on the left and right bank of Sutlej River. The entire district meets its power requirement from Ganghwal Hydro Electric Power House and Dehar Power House of Northern Power Grid. All inhabited villages are electrified.

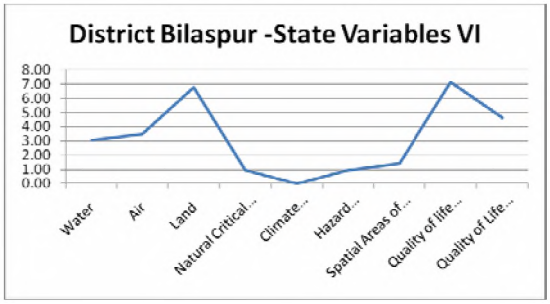
Summary of State Variables at District Level



Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Bilaspur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Bilaspur	
Variable Sector	**Vulnerability of State Sector $V_{\text{State Sector}}$**
Water	7626.47
Air	1598.06
Land	4612.76
Natural Critical Habitat	1526.72
Climate Change	0.00
Hazard Susceptibility	882.03
Spatial Areas of Conflict	1628.78
Quality of life (health)	4879.64
Quality of Life (education)	4252.21

Water as a variable shows a remarkable presence followed by land and Quality of Life Variables in terms of Health & Education as can be seen from the VI graph for State variables, on a District scale, it is land which is critically vulnerable. The critical level of vulnerability of Quality of Life (Health) is a cause of concern which could be addressed.



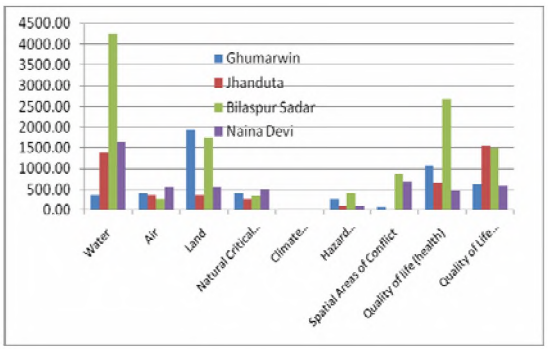
State Variables at Tehsil Level

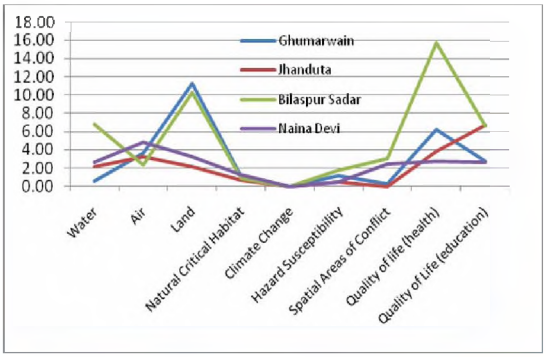
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level

	Ghumarwin	Jhanduta	Bilaspur Sadar	Naina Devi	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	372.00	1373.90	4240.57	1640.01	7626.48
Air	409.19	374.20	270.02	544.64	1598.06
Land	1927.07	371.63	1758.65	555.40	4612.76
Natural Critical Habitat	415.14	272.36	348.62	490.6	1526.72
Climate Change	0.00	0.00	0.00	0.00	0.00
Hazard Susceptibility	274.2	103.65	404.42	99.76	882.03
Spatial Areas of Conflict	68.35	0.00	865.80	694.63	1628.78
Quality of life (health)	1056.14	661.536	2687.62	474.34	4879.64
Quality of Life (education)	627.28	1531.99	1494.66	598.28	4252.21

State Variables vulnerability at Tehsil level in District Bilaspur





Summary of Pressure Variables at District Level:

Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Bilaspur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

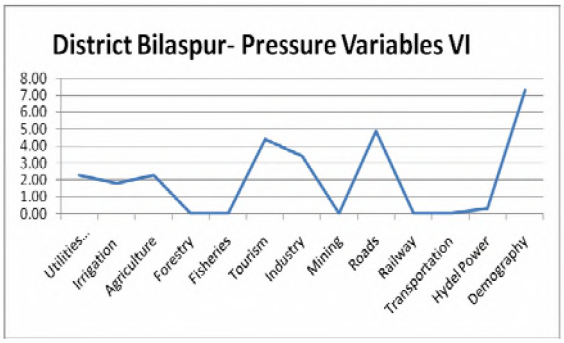
Bilaspur	
Variable Sector	**Vulnerability of Pressure Sector $\mathbf{V}_{\text{Pressure Sector}}$**
Utilities and Infrastructure	2766.76
Irrigation	622.41
Agriculture	3563.60
Forestry	0.00
Fisheries	0.00
Tourism	5303.95
Industry	1772.00
Mining	0.00

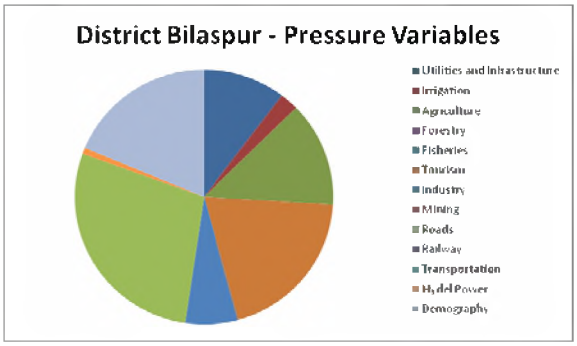
Bilaspur	
Variable Sector	**Vulnerability of Pressure Sector $\mathbf{V}_{\text{Pressure Sector}}$**
Roads	7546.98
Railway	0.00
Transportation	0.00
Hydel Power	211.00
Demography	5008.11

As can be seen from the diagram below, Roads constitute a major pressure as a lot of work has been done in the sector and newer areas opened up. Tourism follows which is obvious due to Naina Devi.

As can be observed from the Vulnerability Index variation graph below, Demography has crossed the critical stage and with a lot of work having been done in the road sector, new areas have been opened up and liable to be exposed to demographic pressures in the future.

Water scores the maximum in Bilaspur Sadar, to a much smaller extent in Naina Devi and a miniscule score in Jhanduta, all due to the existence of Govind Sagar Reservoir. Land shows a good score in Ghumarwain and Bilaspur Sadar while it is of miniscule proportions in Jhanduta and Naina Devi.





It is the Quality of Life (Health) variable in Bilaspur Sadar which shows a high score while in Jhanduta and Bilaspur Sadar, the Quality of Life (Education) show some presence.

As can be seen from the Vulnerability Indices for various variables Tehsil wise, Bilaspur Sadar and Ghumarwain have already crossed the critical stage in Land and Quality of Life (Health).

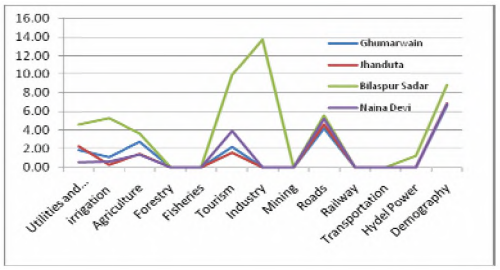
Pressure Variables at Tehsil Level

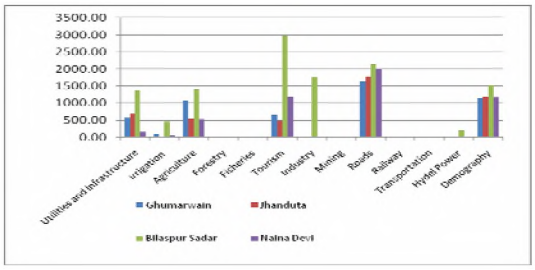
Similarly, the pressure variables computed at Tehsil level for comparison is given below.

Comparison of Pressure variables at Tehsil level:

Pressure Variables	Ghumarwain	Jhanduta	Bilaspur Sadar	Naina Devi	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	557.47	678.37	1370.21	160.71	2766.76
irrigation	93.35	22.56	452.60	53.90	622.41
Agriculture	1069.47	550.34	1409.39	534.39	3563.60
Forestry	0.00	0.00	0.00	0.00	0.00
Fisheries	0.00	0.00	0.00	0.00	0.00
Tourism	666.46	480.89	2980.25	1176.35	5303.95
Industry	0.00	0.00	1772.00	0.00	1772.00
Mining	0.00	0.00	0.00	0.00	0.00
Roads	1616.92	1780.17	2140.76	2009.13	7546.98
Railway	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00
Hydel Power	0.00	0.00	211.00	0.00	211.00
Demography	1145.70	1176.93	1522.28	1163.19	5008.11

Pressure Variables vulnerability at Tehsil level in District Bilaspur





Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Bilaspur. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

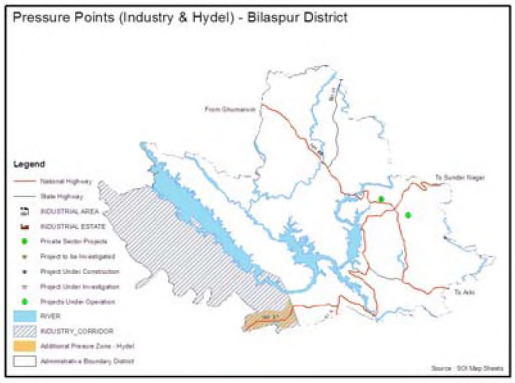
Vulnerability Index

	Ghumarwin	Jhanduta	Bilaspur Sadar	Naina Devi
VI	5149.37	4689.27	12070.36	5097.67
Denominator = 57x43		**2451**		
Normalized VI	**2.10**	**1.91**	**4.92**	**2.08**



As can be seen from the map, all the Tehsils of District Bilaspur, are having the low vulnerability levels in comparison to tehsil Bilaspur Sadar, which is significantly industrialized Tehsil and has higher vulnerability. While analysed with other districts, the border Tehsil having higher vulnerability phenomenon has been observed markedly in this Tehsil, though, Bilaspur Sadar is a Tehsil with adjoining borders of other districts, yet, another Tehsil, that is Naina Devi does not substantiate the trend. This may probably be due to the fact that the Tehsil is literally insulated because of the existence of the Govind Sagar Reservoir on two sides.





Detailed description and analysis of the State and Pressure components divulge the reasons behind the variations in the Index among different Tehsil/ Sub tehsils in the District. The vulnerability index for tourism and industry has already crossed the critical segment in Bilaspur Sadar. The Tehsil Bilaspur Sadar scores the maximum in almost all the variables, with tourism as the

highest score, understandable as the Tehsil also houses the District Headquarters. Bilaspur Sadar is the lone scorer in industry and thus represents the pressure/ stress due to industrial development besides requirement of tourism infrastructure. The demographic pressures are also very discernible as they have reached the criticality in all the Tehsils.

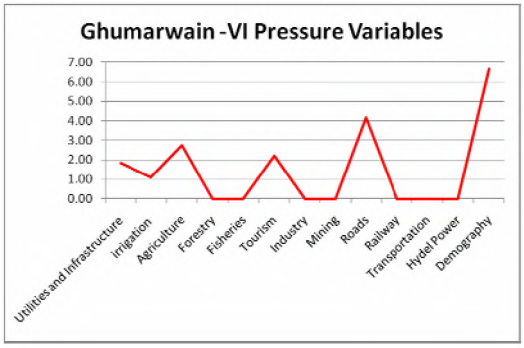
The Tehsil Naina devi is emerging as air pollution intensive segment and therefore any industrial development in this area needs to take into account the pressure already existing in the region.

A lot of work in the road sector has been done in all the Tehsils. Demography, Utilities & Agriculture also shows a presence.

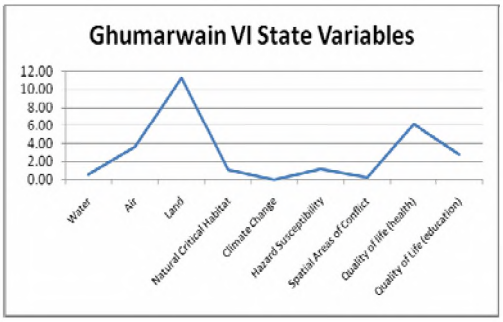
Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables have been presented here at Tehsil level as to analyse the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Ghumarwin: Overall Vulnerability Index - 2.1



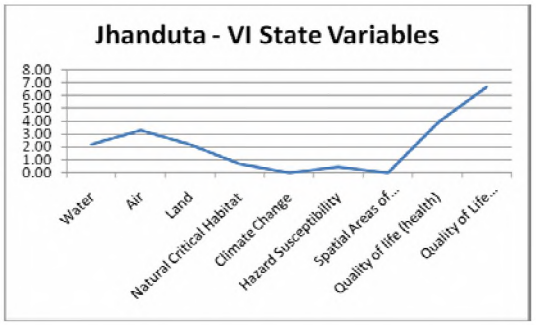
It is observed from this analysis that, primarily the land use change under State Variable is the critical factor besides the quality of life in terms of health services. Probably that is due to excessive change in land use, shift in agriculture practices and gap in health services. Therefore, in Ghumarwin tehsil the planner needs to attend to these two critical factors on priority.



While analyzing the pressure variables vulnerability on sector basis it is observed that the agriculture, which also includes horticulture and livestock, does not indicate any noticeable vulnerability score. However it is the demography which is the critical factor with roads network. There is a need to plan growth in urban and rural population and ensuring the connectivity to basic amenities. A programme level intervention is required in the tehsil to sensitize the people about the growth in planned manner. It is also felt necessary through the analysis that there is gap in tourism services and needs some intervention.

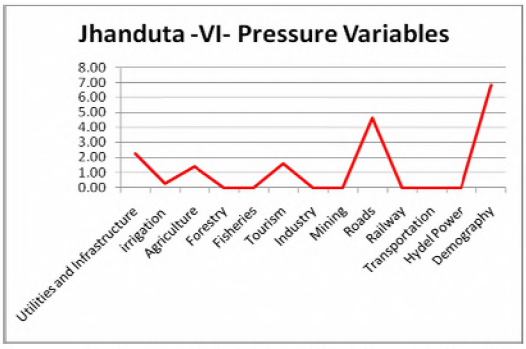
Jhanduta: Overall Vulnerability Index -1.91

Matter of concern is primarily the Quality of Life in view of educational services besides health services and needs programme kind intervention in the tehsil. Programs related



to improve the access to Quality of Life (Health) and the access to Quality of Life (Education) are recommended so the vulnerability is reduced.

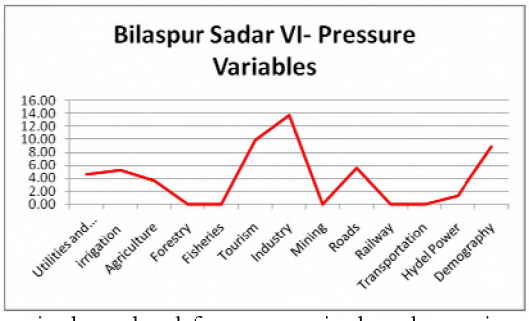
While analyzing the pressure variables vulnerability on sector basis in Jhanduta tehsil it is observed that the demography is the critical factor along with roads network. There is a need to plan growth in urban and rural population and ensuring the connectivity to basic amenities. A



programme level intervention is required in the tehsil to sensitize the people about the growth in planned manner. It is also felt necessary through the analysis that there is gap in tourism services and needs some intervention.

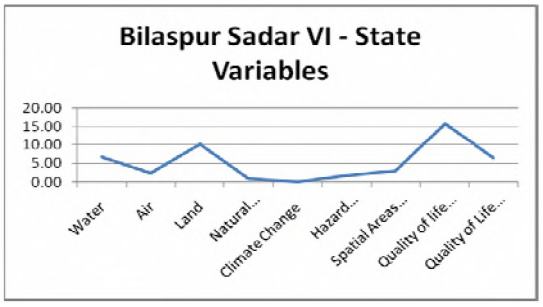
Bilaspur Sadar: Overall Vulnerability Index -4.92

It is observed from this analysis that, primarily the land use change under State Variable is the critical factor besides the quality of life in terms of health services. Probably that is due to excessive change in land use, shift in agriculture practices, use of



agriculture land for non agricultural practices and huge gap in health services. Therefore, in Bilaspur Sadar tehsil the planner needs to attend to these two critical factors on priority giving to priority to improve the health services in this area.

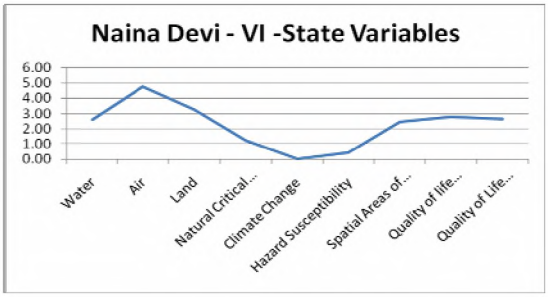
Diversion of agricultural land to non agricultural use needs to be strongly discouraged through programme level intervention besides intervention for improving the access to Quality of Life (Health) as to reduce the vulnerability rise in future.



While analyzing the pressure variables vulnerability on sector basis in Bilaspur Sadar tehsil it is observed that the Industry development is the critical factor along with demography and roads network. There is a need to plan growth in Industrial sector in future besides planning urban and rural population and ensuring the connectivity to basic amenities. It is also observed necessary through the analysis that there is gap in tourism services and needs intervention through programme, plan level.

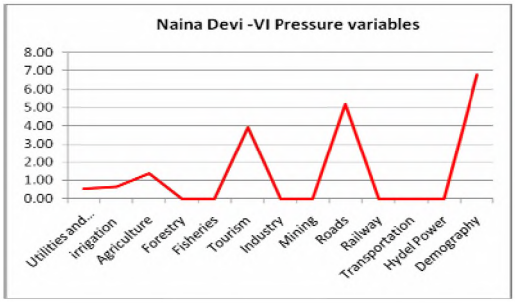
Any future/ proposed Industrial corridor could have an adverse impact and thus should be implemented by adopting appropriate arrangements in the tehsil.

Naina Devi: Overall Vulnerability Index - 2.08



The variables under component Air are matter of concern in the tehsil primarily due to excessive transportation emissions. The

probable reason for the higher vulnerability in the Air sector has been noted in view of the physiographical valley formed on the north eastern slopes of the tehsil along with the south western slopes of Jhanduta, which also displays some concern over Air sector.



This valley, housing the Govind Sagar Lake entraps the air dispersal from Bilaspur Sadar, which is in its east side. In view of this fact it is observed that the proposed development of industrial corridor in the tehsil requires attention from the fact that the air pollution intensive industry in the area should be discouraged or allowed with appropriate technology for control of air pollution.

While analyzing the pressure variables vulnerability on sector basis in Jhanduta tehsil it is observed that the demography is the critical factor along with roads network. There is a need to plan growth in urban and rural population and ensuring the connectivity to basic amenities. A programme level intervention is required in the tehsil to sensitize the people about the growth in planned manner. It is also felt necessary through the analysis that there is gap in tourism services and needs some intervention.

Vulnerability Levels in Regional Context:

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives an understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

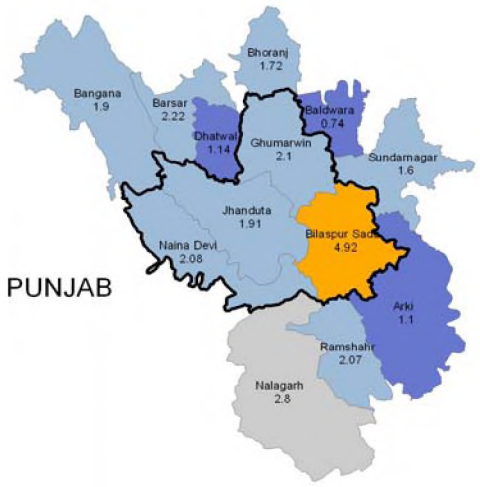
Bilaspur

S. No.	Tehsil	VI	Adjoining Tehsil in Bilaspur District	VI	Adjoining Tehsil in Other District	District	VI
1	Ghumarwin	2.10	Jhanduta	1.91	Sundernagar	Mandi	1.60
			Bilaspur Sadar	4.92	Baldwara	Mandi	0.74
					Barsar	Hamirpur	2.22
					Bhoranj	Hamirpur	1.72
					Dhatwal	Hamirpur	1.14
2	Jhanduta	1.91	Ghumarwin	2.10	Dhatwal	Hamirpur	1.14
			Bilaspur Sadar	4.92	Barsar	Hamirpur	2.22
			Naina Devi	2.08	Bangana	Una	1.90
3	Bilaspur Sadar	4.92	Ghumarwin	2.10	Sundernagar	Mandi	1.60
			Naina Devi	2.08	Arki	Solan	1.10
			Jhanduta	1.91	Ramshahr	Solan	2.07
4	Naina Devi	2.08	Bilaspur Sadar	4.92	Bangana	Una	1.90
			Jhanduta	1.91	Nalagarh	Solan	2.08

Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Bilaspur is surrounded by various Tehsils of District Mandi, Hamirpur, Una and Solan, the vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils of District Bilaspur, as Bilaspur Sadar is significantly higher than Ghumarwin and Naina Devi in the district and others also. The transitional impact of vulnerability possibly will give rise to vulnerability levels in Ghumarwin and so in Naina Devi when analysed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameter

(i) As is observed from the analysis, the quality of life in terms of health and education required to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometers and a Hospital within a distance of 10 Kilometers. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)-. Bilaspur Sadar, Ghumarwain, Jhanduta and Naina Devi

Though the scenario as far as quality of life (education) is fairly better yet the gaps which exist, are required to be addressed, according to the norms stating accessibility to a

Primary School within a distance of 2 kilometers, a Secondary School within a distance of 6 kilometers, a College within a distance of 10 kilometers, and a Vocational Institution within a distance of 25 kilometers. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Jhanduta, Bilaspur Sadar, Ghumarwain and Naina Devi

The benchmarking of the norms has been done with a view of the profile, terrain of the State.

A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(ii) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken.

Detailed conservation and management plans for the water resources in the entire district are required at the moment as a preventive exercise. This type of intervention will help in sustainable management of water resources so that in case later any major water demanding Industrial corridor is established there would not be any detrimental impact on the water resources and the resource conserved sustainably.

Priority Tehsils- Bilaspur Sadar, Jhanduta and Naina Devi.

(iii) It has been observed that there is a gap between the forest area and the forest cover and hence a specific programme for attending this gap is required to enrich this resource wealth of the district.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(iv) There is a need felt to recharge the ground water by developing the small check dams on the non perennial *khuds* and tributaries to improvise the irrigation scenario in the district.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed District Level Plans for Tourism is required to be prepared.

(iii) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable.

Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(iv) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization plan is required to be prepared through scientific studies.

(v) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

S. No	Variable	Policy	Plan	Program	Project	Remarks
State						
1	Water		*	*		Water Resource Conservation Plans, Ground Water recharge program
2	Natural Critical Habitat			*	*	Program and Projects to cover the gap Program for maintenance of moisture content and ground water recharging
3	Quality of life (Health)			*		Program to improve access
4	Quality of life (Education)			*		Program to improve access
Pressure						
1	Roads	*				Policy Guidelines for environmental concerns
2	Tourism		*			Tourism Plan at State, District, and Destination Level
3	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
4	Hydel Power	*	*			Policy regarding Catchment Area Treatment, Ecological Flow etc Water Utilization Plan
5	Proposed Industrial Corridor		*	*		

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Ghumarwin	Jhanduta	Bilaspur Sadar	Naina Devi
VI	5149.37	4689.27	12070.36	5097.67
denominator = 57x43			2451	
Normalized VI	2.10	1.91	4.92	2.08

Population Projections

	2001	2011	2021	2031	2041
Ghumarwain	143645	163431	186039	211878	241403
Jhanduta	64,347	74527	86774	100891	116676
Bilaspur Sadar	2,07,992	2,37,958	2,72,813	3,12,769	3,58,079
Naina Devi	59,179	69298	81253	94881	110015

Calculation of per capita share of VI

	2001	VI 2001	Per Capita Share
Ghumarwain	120442	2.1	1.74
Jhanduta	81,499	1.91	2.34
Bilaspur Sadar	97,622	4.92	5.04
Naina Devi	41,322	2.08	5.03

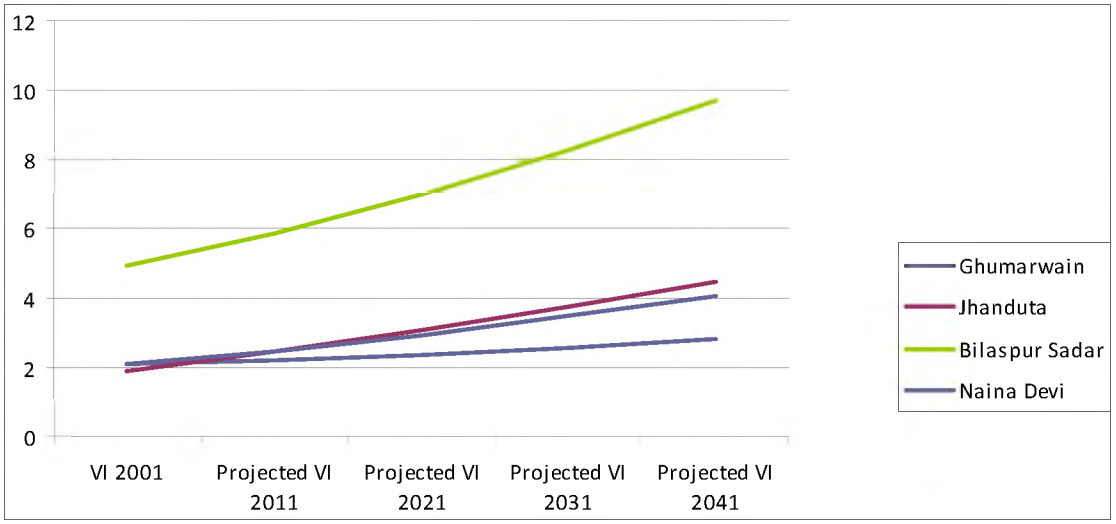
Calculation of Projected VI

	2001	VI 2001	per capita share	2011	VI 2011	2021	VI 2021	2031	VI 2031	2041	VI 2041
Ghumarwain	120442	2.1	1.74E-05	125650	2.19	134310	2.34	146055	2.55	160459	2.80
Jhanduta	81,499	1.91	2.34E-05	105271	2.47	131519	3.08	160083	3.75	190808	4.47
Bilaspur Sadar	97,622	4.92	5.04E-05	1,16,401	5.87	1,38,641	6.99	1,64,132	8.27	1,92,676	9.71
Naina Devi	41,322	2.08	5.03E-05	49170	2.48	58462	2.94	69062	3.48	80840	4.07

Projected Vulnerability Index

	2001	2011	2021	2031	2041
Ghumarwain	2.1	2.19	2.34	2.55	2.80
Jhanduta	1.91	2.47	3.08	3.75	4.47
Bilaspur Sadar	4.92	5.87	6.99	8.27	9.71
Naina Devi	2.08	2.48	2.94	3.48	4.07

Vulnerability Index Scenarios – District Bilaspur at Tehsil Level



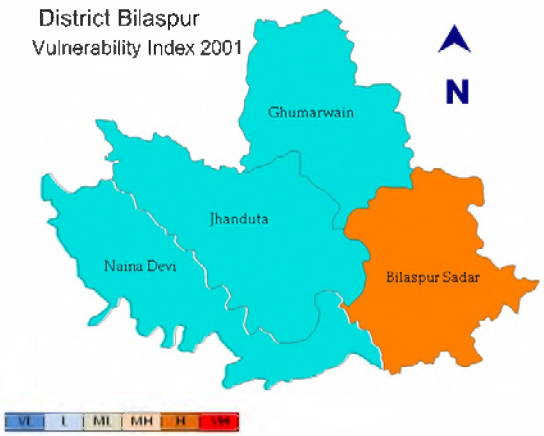
Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

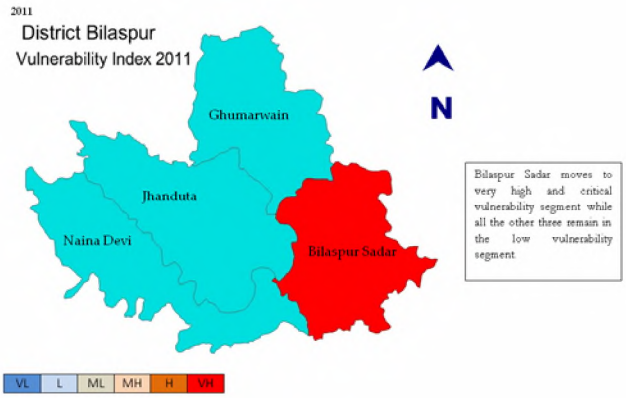
It is observed that the Ghumarwain in projected scenarios have low vulnerability and so does Naina Devi in moderately low vulnerability segment. However, the Jhanduta moves to the higher segment of moderately high vulnerability from moderately low while Bilaspur Sadar remains overall highly critical and therefore indicates for intervention prioritization accordingly.

The vulnerability has also been presented through special plots by using autocad software.

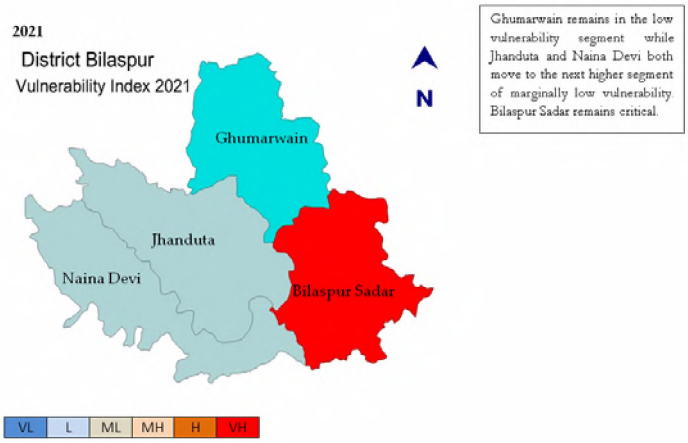
2001



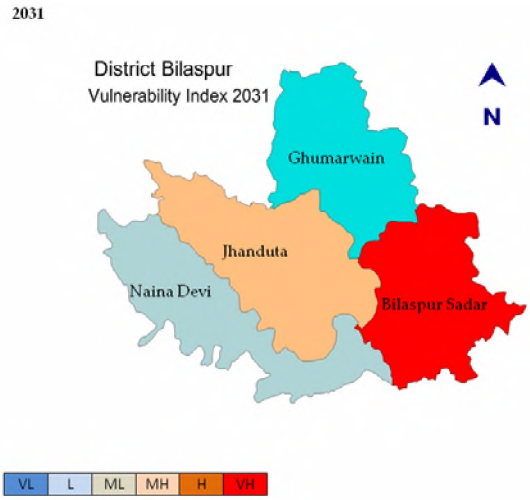
2011



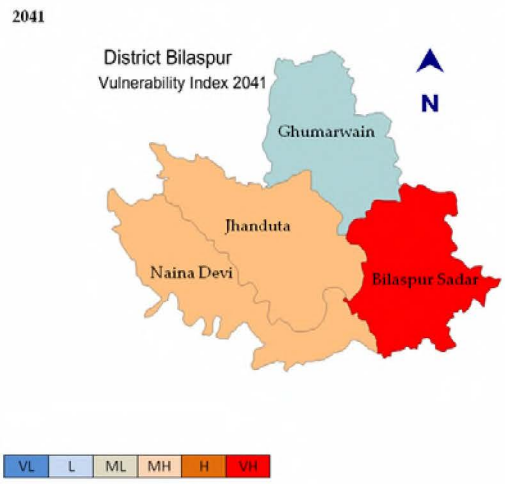
2021



2031



2041



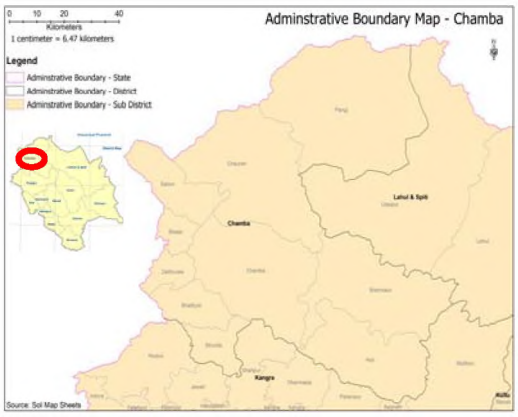
Ghumarwain shifts to moderately low vulnerability. Jhanduta remains moderately high vulnerability and is joined by Naina Devi in this segment. Bilaspur Sadar retains the critical segment.

CHAMBA

General Background

Chamba district is a part of the Northern Himachal Pradesh. The district is bounded in the north and west by Jammu & Kashmir state, in the south-west by Punjab state, in the south and south-east by Kangra district whereas Lahaul & Spiti district encloses it from east.

It lies between 32°10' and 33°13' north latitudes and 75°48' and 76°53' east longitudes and covers an area of 6,528 sq. kms. and ranks 2nd in terms of area occupying 11.72 percent area of the State.



The entire district is mountainous with an altitude ranging from 559 metres to 6,162 metres above the mean sea level. The habitation is found only up-to a height of 3,000 meters. The District is divided in to 10 administrative units in terms of Tehsils or sub-tehsils as under (in descending order of area covered in square kilometres).

Sr. No.	Tehsil	Area in sq.kms
1	Pangi	1600.5
2	Chamba	1271.9
3	Chauraha	1069.3
4	Holi	1062.8
5	Bharmaur	755.6
6	Saluni	372.7
7	Bhattiyat	249.6
8	Sihunta	246.9
9	Dalhousie	164.1
10	Bhalai	131.3

The top four units occupy almost three fourths of the area of the entire district, while the balance one fourth is being covered by rest eight units.

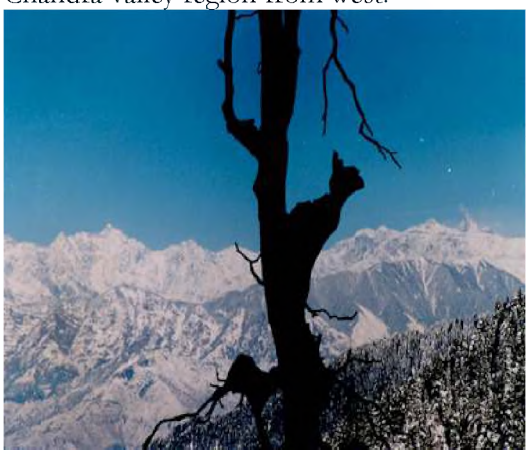
Physiography

The entire Chamba district is mountainous with an altitude ranging from 559 metres to 6,162 metres above the mean sea level. *Ravi* and *Chandra Bhaga* or *Chenab* is the main rivers which form their own valleys in the district.

The valleys on the south-west of the district are more fertile and the distribution of population is mainly confined to these valleys. The climate is found varying from semi-tropical to semi-arctic. In lower areas, climatic conditions are similar to those of Kangra district and Siwalik areas while in higher altitude the climate is of temperate type. The district has five sub-micro regions, the details of which are given below:

Greater Himalaya

This region spreads over the extreme north-eastern part of the district and occupies eastern half of Pangi tehsil. It is surrounded by Jammu & Kashmir from north, by Lahaul & Spiti district from east and south, by Chandra valley region from west.



The region is very rugged and mountainous and its major parts remain under snow cover for about 5 to 6 months in the year. The

Zanskar range separates the region from Jammu & Kashmir. The region has an altitude varying between 3,844 metres and 6,162 metres above the mean sea level. *Ram Dhari, Jariun and Kali Barf* (*Rebarf*) are the prominent glaciers in the region. Summer is cool and winter is severe. Several tributaries like *Saichu, Lugal, Mahal* and *Garotu Nala* of *Chandra Bhaga* or *Chenab* river originate from this region. A few patches of mixed forests like pine/blue pine are found along the Saichu Nala. The geological structure of the region is mostly formed by Granites (unclassified) and Jutogh group/Vaikrita group/Central gneiss types.

Chandra Valley

The region covers the valley area of Pangi tehsil lying on both sides of *Chandra Bhaga* or *Chenab* river. It lies between the Greater Himalaya and the *Pir Panjal.* Jammu and Kashmir encloses it from north-east and Lahul & Spiti district from south direction. It is a close valley formed by *Chandra Bhaga* or *Chenab* river which enters the region from south near Dhar Lunei village and flows towards north. *Saichu Nala, Lugal Nala, Mahal Nala* and *Garotu* and *Dheda Nala* are the tributaries of the *Chandra Bhaga* river.



The region has an altitude varying between 3,568 metres and 4,209 metres above the mean sea level and rises steeply from the river banks towards Greater Himalaya and *Pir Panjal* range. *Chandra Bhaga* is the main river of the region, where summers are cool and winters severe. The valley remains cut off from the outer world due to snowfall from October to March, and people of this region are mainly confined to their houses during this period. Chandra valley has a thick cover of Pine/Blue Pine and Deodar forests. Geological structure of the region is formed of Jutogh group/Vaikrita group/Central gneiss.

Pir Panjal

This region extends longitudinally from north-west to south-east direction covering major parts of Chauraha and Bharmaur tehsils and also small areas of Pangi, Chamba tehsils and Holi sub-tehsil. It is bound by Jammu & Kashmir in the north and north-west, the Ravi Basin in the south, Kangra district in the south-east and the Chandra valley and Lahul & Spiti district in the north-east.

The region has many hill ranges/Dhars and prominent among them are *Pangi Dhar, Drabla Dhar, Deorah Dhar, Dodana Dhar, Sanini Dhar, Manimahesh Dhar* etc. The region has an altitude varying between 2,698 metres and 5,857 metres above the mean sea level. The maximum height of 5,857 metres is at *Bar Kanda* in the northern Bharmaur tehsil. Sutch pass (4,313 metres high), which is the only way to Pangi tehsil from west, is also located in this region. The higher areas of the region remain covered with snow during most part of the year are barren. *Nikora* and *Tal* glaciers are located in the south-western part of the region. Some tributaries of *Ravi* river, namely, *Tunah Nala* and *Budhil Nala* also originate from this region. The Himalayan Sub-Alpine type of forests mainly of Fir and Birch grow in the region. However, the higher slopes are covered with grass meadows. The region has the geological structure of Jutogh group/ Vaikrita group/Central gneiss and Granites (unclassified).

***Ravi* Basin**

The *Ravi* Basin is the biggest sub-micro region in the district. It lies between *Pir*

Panjal range in the north and the *Dhaula Dhar* range in the south thereby covering the whole of Saluni and Bhalai tehsil/sub-tehsils, major parts of Chamba and Bharmaur tehsils and Holi sub-tehsil, western part of Chauraha and north-western part of Bhattiyat tehsil. It is surrounded by Jammu & Kashmir from west, by Punjab from south-west and Kangra district it from the east.



This basin is formed by *Ravi* river. It rises in Bara Banghal area of Kangra district and flows through Holi, Bharmaur, Chamba and goes up to Ulhansa. Along with the other tributaries, namely *Tundah*, *Siul*, *Saho* and *Budhil*, it drains the entire water between the *Pir Panjal* and the *Dhaula Dhar* ranges. The valley is most fertile and the *Ravi* river is a lifeline of the region. The region has an altitude varying between 559 metres and 5,556 metres above the mean sea level and the slope rises towards *Pir Panjal* and *Dhaula Dhar*. Vegetation, Semi-tropical to Himalayan temperate and Sub-Alpine types in nature forms a thick cover of reserved forests. The important species found in this region are *Pinus longifolia*, Oak, Chestnut, Deodar, Kail, Juniper and Birch.

Geologically, major portion of the basin is composed of Jutogh group / Vaikrita group / Central gneiss formations while Blaini/ Infra-Krol formations are found in the bed of *Ravi* river. In the area adjoining Punjab border, the geological structure is also composed of Siwalik, Murree Series, Shimla group and Panjal Traps.

Dhaula Dhar

This region is situated in the southern part of district covering whole of Sihunta sub-tehsil, major portion of Bhattiyat tehsil (except north-west portion), southern part of Chamba tehsil and Holi sub-tehsil and south-western tip of Bharmaur tehsil. It is bounded by the *Ravi* Basin in the north-west, north and north-east, and Punjab and Kangra district from south-west, south and south-east, respectively.



The region revels in the fact that the *Dhaula Dhar* in Chamba district forms a mountain barrier with high peaks. *Hathi Dhar* is another important lower hill range which runs parallel to *Dhaula Dhar*, in its south. A narrow tract between *Dhaula Dhar* range and *Hathi Dhar* is plain and fertile. *Talang* glacier is also located in south-western part of the region. The region has an altitude varying between 1,188 metres and 4,692 metres above the mean sea level. *Bhed Khad*, *Barahl Khad*, *Dramman Khad* and *Khauli Khad* are minor khuds of this region whereas *Chakki Khad* in an important Khad which rises in the western part of this region and flows towards west. In the lower part of the region, the climatic conditions are similar to Kangra district and Siwalik areas while in the higher portion, it is temperate. During winter, snowfall on the *Dhaula Dhar* range is very heavy. This range also receives very high rainfall during monsoon.

The region has formation of Granites (unclassified), Jutogh group/Vaikrita group/ Central gneiss, Siwalik, Murree Series, Panjal Traps and Shimla group of geological structure.

Culture and Social Brief

Fairs & Festivals

Chamba district is full of fairs and festivals, some of these are: Minjar Fair, Sui Fair of Chamba, Mani Mahesh Fair, Nag Fair, Khajiar Jatar, Saluni Jatar, Phool Jatar, Bhanjraru Chhinj, Baar, Sheel, Chamba Dussehra, Summer Festival Dalhousie and Swami Hari Giri Fair.

Places of Historical, Archaeological, Religious Importance and Tourist Interest

Chamba town is the headquarters of the district and was also the capital of the erstwhile State. The town is situated at an altitude of 996 metres above the mean sea level on the bank of river *Ravi*. Founded in 920 AD by Raja Sahil Varman, the town still has a medieval feel about it. Isolated by the high mountains in its beautiful valley, Chamba has developed over the centuries its rich style of Pahari art and architecture. Much of this heritage has been preserved and Chamba is known today for the splendour of its temple. The famous temples of Chamba town are as under:

i. *Rani Suhi Temple*
ii. *Lakshmi Narayan Temple*
iii. *Hari Rai Temple*
iv. *Chamunda Temple*

Other evidence of Chamba's rich past are to be found in the *Bhuri Singh* museum, with its collection of exquisite miniatures from the Kangra, Basholi and Chamba schools of paintings as well as murals and artifacts from the Rang Mahal Palace.

Chaugan, a grassy meadow forms the heart of the town – the centre of its cultural activities. Each year in July/ August the *Minjar* fair is held here when gods and goddesses are brought from their mountain homes with the sound of drums and music, to pay homage to lord Raghuvira. During the week-long harvest fair, the Chaugan comes alive as villagers dressed in colourful costumes celebrate with song music and sport. Besides the above mentioned temples, there are also some other temples and places of interest for the tourists around Chamba town some of these are:

Katasan Devi Temple: A popular place of pilgrimage, the temple has a beautiful view of Chamba valley. It is located at a distance of 30 kms. from Chamba town.

Jhamwa: Located at a distance of 10 kms. from Chamba town, Jhamwa is known for its beautiful apple orchards, surrounded by dense forests.

Sarol: Sarol is an interesting place for picnics at a distance of 11 kms. from Chamba town. Besides its lovely landscaped gardens it has an apiary and a sheep breeding centre.

Saho: Situated on a high plateau, Saho is famous for the temple of Lord Chandrashekhar- Lord Shiva with his moon crow. The temple is located on the bank of river Sal at a distance of 20 kms. from Chamba town.

Saluni: Located at a distance of 56 Kms. from Chamba town, Saluni presents breathtaking views of the snow-capped mountain ranges.

Bhandal Valley: Beautiful Bhandal Valley is known for its rich wildlife. It is located at a distance of 22 Kms. from Saluni.

Bharmaur: It is the headquarters of Bharmaur tehsil which is 65 kms. from Chamba alongwith an attractive hill road that follows the river *Ravi* for much of its route. Bharmaur is the base for the famous Manimahesh Yatra and for various marvelous treks in the region. Life in

Bharmaur centres around the temple square, the Chaurasia, which owes its name to the 84 shrines built within its periphery. The beautiful shikara of Manimahesh temple dominates the square. A life size image of Nandi in polished brass stands before it. Places of tourist's interest around Bharmaur are:

Manimahesh: It is an important place of pilgrimage located at a distance of 35 kms. from Bharmaur. The towering, solitary peak of Manimahesh Kailash (5,656 metres) mirrored in the still waters of a little lake in its foot steps, presents an awe inspiring stark grandeur. People from Himachal Pradesh and adjoining states visit Manimahesh in the month of August/September for the main pilgrimage yatra.

Chhatrari: Located at a distance of 40 Kms. from Bharmaur, at Chhatrari there is a temple of Shakti Devi. It is considered of great archaeological importance.

Kugti: The last inhabited village of Bharmaur, Kugti has a little forest house, overlooking splendid forests of conifer and the famous temple of Keylong Wazir is located at a distance of 2 Kms. from Kugti.

Dalhousie: Dalhousie established in 1858 by the British Governor General Lord Dalhousie, is today a small hill station that still retains much of its charm. It is situated at a distance of 56 kms. from Chamba town at an altitude of 2,039 metres from mean sea level. Its marvelous forests of deodar and oak overlook vistas of wooded hills, water falls, springs and rivulets. There are also magnificent views of Chamba valley and the mighty Dhauladhar range with its awe-inspiring snow covered peaks filling an entire horizon. Dalhousie still has a touch of the 'Raj' about it and its colonial style buildings and houses bring back the flavour of earlier era. A veneer of Tibetan culture has added a touch of the exotic to this serene resort and along road-sides are huge rock carved in low relief and painted in Tibetan style. Around Dalhousie, there are a number of places of tourist's interest:-

Kalatope: At a distance of 8.5 kms. from Dalhousie, Kalatope is known for its little wildlife sanctuary and scenic splendour.

Khajjiar: A picturesque spot with an emerald saucer shaped meadow set amidst a dense deodar forest, it has a lake at its centre with a floating island, a forest rest house, a little temple with a golden spire and a golf course. Khajjiar is located at a distance of 22 kms. from Dalhousie.

Bara Pathar: Set at amidst thick forests is the small temple of Bhulwani Mata, in the village of Ahla on the way to Kalatope. A fair is celebrated in July to venerate the goddess. Bara Pathar is located at a distance of 4 kms. from Dalhousie.

Pangi Valley: Located at a distance of 137 kms. north-east of Chamba is the wild and beautiful Pangi Valley. The valley is noted for its beautiful people and their colourful folk dances. Extremely remote Kilar is the sub-divisional headquarters of Pangi sub-division. From Kilar, located in the deep gorge of the Chenab, there are exciting treks to Keylong, Mandi and to Kishtwar in Kashmir.

Tisa: It is the headquarters of Chaurah tehsil and is about 69 kms. from Chamba. There is a temple of Chamunda Devi in the village.

Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the

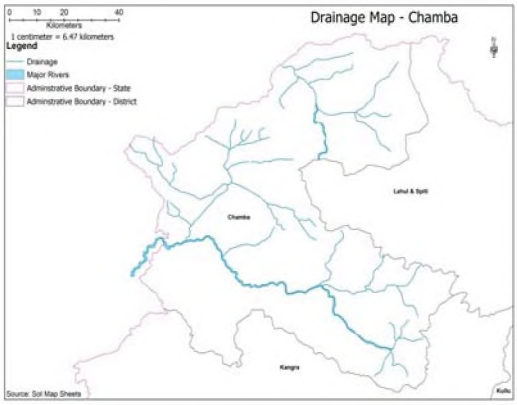
natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Chamba district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

There are two main rivers i.e. the *Ravi* and the *Chenab* or *Chandra-Bhaga* in the district. The *Ravi* is the main river of the district and drains the whole of Chamba valley between *Dhaula Dhar* and *Holi* ranges.



In its upper reaches, the river is called *Rauti* or *Irauti*. It rises in the mid-Himalaya and Bara Banghal ranges. This range separates it from the Beas in the upper Kullu. It flows through Bara Bansu, Tretha and Chanota to Ulansa. *Budhil* and *Tundahen* are the two main tributaries. After passing Piur, Rakh and Mehla, the river courses to the north-west and approaches Chamba town where the Saho or Sal from the Saho ranges merges with the river. The other largest tributary of the river is *Siul* and it flows westward and touches Jammu territory at the point where the Seawa, a stream forming the boundary falls into it from north. It then bends to the south-west and skirting the terminal spurs of the *Dhaula Dhar* separates Chamba from Jammu and finally leaves the district at Kheri to the plains at Shahpur. During winter the *Ravi* is generally very low and the water is quite clear. During the summer, the volume of flow increases with the melting of snow in upper reaches. The maximum flow is reached during rainy season. Some fishing activity is also carried out in the river downwards Chamba town.

The *Chenab* or *Chandra-Bhaga* as it is called in this part of the country rises near the top of *Bara Larcha* Pass in Lahul, by two heads, the Chandra and Bhaga. These two unite at Tandi and form the *Chenab* river and flows immediately to the north-west at mid-Himalaya. At Shaor it enters Chamba and forms the boundary between Chamba and Lahul and follows a westerly course to Tindi after which it turns to the north. At Shaor and Purthi and Kilar, villages are located on the right bank. The valley again becomes narrow as far as Mindhal and Sutch. From this point, it is more open. The river flows on a north-westerly direction through picturesque scenery, past Kilar and Dharwas to *Ganaur* or *Sansari Nala* where, it leaves the territory. Then, it continues its course through Padar, Kishtwar and outer hills in Jammu territory to the plains. Gold in small quantity is found in *Chandra-Bhaga* and gold washing was carried out at some places on a small scale. The main tributaries of the river are *Miyar Nala*, meeting the *Chandra-Bhaga* at Udaipur and *Saichu Nala* joining the river at Sach. On the left bank, the river receives small ice-streams from snowy passes in the Pangi range. These are the *Chobia* and *Kalicho* streams at *Triloknath*, *Harser*, *Drati* and *Martu* streams near Tindi and *Cheni* and *Sach* streams near Mindhal.

There are two better known lakes in the district at Manimahesh in Bharmaur tehsil and at Khajiar in Chamba tehsil.

Manimahesh is considered sacred and a fair is held there on the occasion of Radha-Asthmi in the month of September and the pilgrims from far and near gather there to have a dip in the icy-cold water of the lake. It is situated at an altitude of 4,170 metres.

Khajiar Lake is located in one of the most picturesque saucer shaped plateau about 1.5 Kms. long and one km. broad surrounded by dense pine forest at gigantic undisturbed and unspoiled deodars. This place has soothing and refreshing quietness in its atmosphere. It has a small lake in the middle with small floating island.

Climate

As the district is wholly mountainous, with altitudes ranging from 1,834' to 20,218' above mean sea level, a variety of climate is found from the semi-tropical to the semi-arctic. In the lower part of Bhattiyat tehsil and Sihunta sub-tehsil, the climatic conditions are similar to those of Kangra and the Siwalik area. The temperature begins to increase rapidly after the middle of April and this rise continues till the break of rains in July.

In the *Ravi* valley the climatic conditions vary with altitude. In the lower portion of the valley from the capital downwards they are semi-tropical. The summer and the rainy season are well marked, while winter is mild and the snowfall light.

In the *Chandrabhaga* valley the climate is temperate in summer and semi-arctic in winter. Summer is exceedingly mild and pleasant. Owing to the scanty rainfall the degree of humidity is always low. The winter is very severe and snowfall starts in October and continues till March and April.

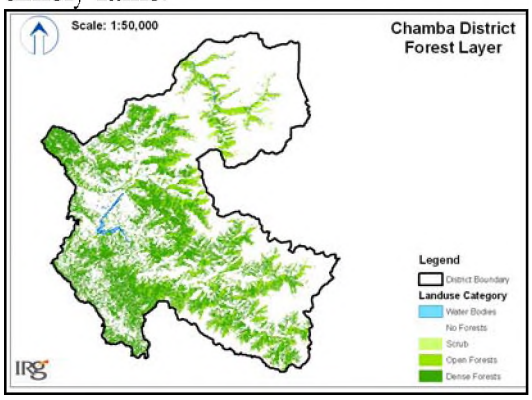
Precipitation/ Rainfall

The rainy season is heavy and prolonged. The district is having rainy season from the middle of June to the middle of September and has bulk of the rainfall during this season. Though July and August months are wettest months yet rainfall in the months of January and February is also significantly high in the district. South and western Chamba district receives more rainfall than north and eastern Chamba. Average annual rainfall in Chamba district is 1,741 millimetres. Snow may fall as early as the beginning of October. The snowfall on the *Dhaula Dhar* and *Pangi* ranges and *Zanskar* range is heavy and in severe winter it lasts from the early November to late March.

Particulars	Maximum	Minimum
Rainfall	212.65 mm	7.94 mm
Temperature	34.70° C	2.29° C

Forests

The forests play a vital role in shaping the climatic conditions of an area. Besides, these also influence the economic and social life of the people considerably. The forests provide valuable timber, medicinal herbs, and raw materials for industries and also provide employment and play a vital role in conserving the soil and ensure timely rains.



These forests lie in the Siwalik and Himalayas at the height between 1,066 to 3,657 metres above mean sea level. The composition and condition of the forest considerably varies with the altitude. The forests of the district can broadly be classified into the following categories:

Himalayas Sub-Tropical Blue Pine Forests: These are found at an elevation of 1,066 to 1,524 metres. Chil is largely sprung up on grassy slopes. Among other trees Kainth, Kakeran, *Albizia*, Siris, Kao, Ban, Dhamman and Toon are worth mentioning.

Ban Oak Forests: These serve as chief source of winter fodder and excellent fuel and remarkable wood for agricultural implements. Ban oak forest occupies an important position in the agricultural economy of the district. These forests are found at an elevation of 1,524 to 2,438 metres above mean sea level. The main species is Ban Oak. These forests represent the remains of climax vegetation that has been replaced through the ages, largely as a result of falling, with coniferous forest mainly of Deodar and Kail.

Deodar Forests: This type occurs at the same altitude as ban, oak. The main species found in these are the Oak, Chirindi, Khark, Dauri, Chaloon, Charkri, Maral, Haleau etc.

Western Mixed Coniferous Forests: These forests are found at an elevation of 2,438 to 3,048 metres above mean sea level. The spruce and silver fir attain large dimensions and the growing stock per hectare is considerable high. Deodar generally seen scattered, singly or in groups along the crests of spurs and ridges associated with the firs and frequently forming considerable bits of deciduous forests in depressions and nallas are the Goon, Kear, Mandar, Kharak, Jammu, Maral, Tunnu and Karun.

Kharsu Oak Forests: These are mixed coniferous forests of spruce and silver fir and are bits of Kharsu oak with their characteristic brown tinged foliage festooned with mosses.

Lower Blue Pine Forests: These forests are represented by the blue pine forests of the dry eastern zone. Here Kail grows in remarkable pure even aged formations. On eastern and north eastern slopes the Kail extends right up to 3,657 metres elevation, although above 3,048 metres it is generally stunted and deformed.

Moist Alpine Scrub or Grass Lands: Extensive tracts of alpine pastures are stretched above forest limits to the line of perpetual snow. Great variety of medicinal herbs and flowers are found in them. Dhub, Mohri, Patis, Kaur and Kuth are some of well known valuable plants. Bana fasha (*Viola odorata*), Ban kakaru (*Podophyllum emodi*), Mushkbala (*Valeriana wallichi*) and Thuth (*Salvia moorcroftiana*) are also found in abundance in the deodar and fir zone.

More than seventy percent of the total area of the district has been classified as forest area. But actual forest cover in the district is spread over 2,301 sq. kms. in the district constituting 35.25 percent of the total geographical area of the district. Of this, 1,585 sq. kms. is under dense forests while 716 sq. kms. is open forests. This shows a gap between the forests area and forest cover in the district. The district has much scope for bringing more area under the forest cover due to the availability of forest land.

A distinct gap between the Forest Area and the Forest cover is observed which should be reduced to increase the area under Forest cover.

The district has five Wildlife Sanctuaries covering a total area of 724 sq. kms. The Wildlife Sanctuaries with their areas are- Sach–Tuan Nala (103 sq.kms.), Gamgul-Siyabehi (109 sq.kms.), Tundah (64 sq.kms.), Kugti (379 sq.kms.) and Kalatop - Khajiar (69 sq.kms.)

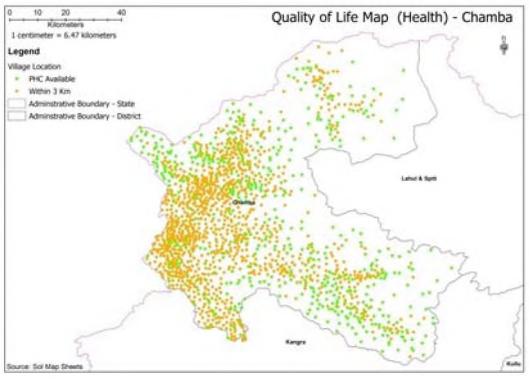
The following statement shows broadly the area under different types of forest covers.

Type of Forests	Area in Hectares
Reserve forests	32,798

Type of Forests	Area in Hectares
Protected forests	326,948
Unclassified forests	99,256
Other	1,253
Total	**460,255**

Quality of Life (Health)

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector.



There are 1,115 villages in the district which have been devoid of Hospital facility and 1,091 villages which are deprived of PHC facilities. Of these 65 villages have the facility of Hospital available within 5 kms., while in respect of 77 villages the inhabitants have to cover a distance of 5-10 kms. in order to avail this facility.

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population.

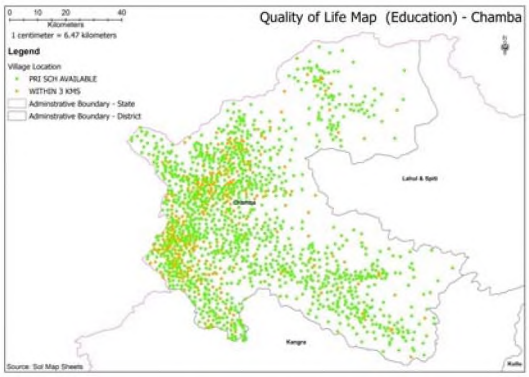
Similarly overwhelming number i.e. 973 villages have this facility at a distance of 10+ kms. As regard PHC, 313 avail this facility at a distance of less than 5 kms., 287 at a distance of 5-10 kms. and the remaining 491 have to travel a distance of more than 10 kms. to avail this facility. In fact, to summarize, according to 2001 census, on an average 80% of villages in the district do not have access to a Primary Health Centre within a distance of 3 kms, 73 % of the villages do not have access to Community Health Centre within a distance of 6 kms, and, 85% of the villages do not have access to a Hospital within a distance of 10 kms.

As can be seen from the map, fewer villages in the west and south west of the district have a PHC. A lot of them have a PHC within a distance of 3 kms. The distance of even 3 km in the terrain is still some distance for a patient to be carried over, but without all weather road connectivity even 3 kms. could become treacherous and fatal.

Quality of Life (Education)

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. A number of villages do not have educational facilities within the village at district level. They have to go out of their village to avail these facilities. 266 villages do not have primary school in their villages and out of these villages; children of 263 villages have to travel less than 5 kms. for schooling Out of 1,118 inhabited villages as many as 828 are deprived of middle school and 1,116 of degree college. Of these 579 avail the facility of middle school at a distance of less than 5 kms. 201 at a distance 5-10 kms. and the remaining 48 at a distance of 10+ kms. In respect of Degree College 29 avail this facility at a distance of less than 5 kms., 52 between 5 to 10 kms. and rest 1,035 villages at a distance of 10+ kms.

The District Primary Education Program had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.



To summarize, according to Census of India 2001, on an average across the district, 22% villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 47% of the villages do not have access to a Secondary School within a distance of 6 kms., 42% of the villages do not have access to a College within a distance of 15 kms. and a staggering 88% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Chamba such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Chamba district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Chamba district is 460,887 comprising of 235,218 males and 225,669 females (the Census of India, 2011 gives a provisional population figure of 518844 with a density of 80 per sq. km. Data at tehsil level is not available). This population of the district forms 7.58 percent of the state population and ranks at 5th place among the districts. Out of the total population of the district 92.5 percent lives in rural areas while 7.5 percent lives in urban areas. Rural population of the district is distributed among 10 tehsils, sub-tehsils and urban population is spread over 5 towns. The total urban population in the district is 34,542 persons comprising 18,514 males and 16,028 females. The total rural population in this district is 426,345 persons and is composed of 216,704 males and 209,641 females as per 2001 Census. This rural population is distributed in 1,118 villages. Out of the total 1,591 villages in the district 1,118 are inhabited villages while 473 villages are uninhabited. The concentration of villages are mainly along the valleys of rivers and streams as well as on undulating slopes while higher altitude areas are mostly devoid of any habitation.

Population Growth

The 1991 Census stated the total population of the district to be 393,286. There has been net addition of 67,601 persons during 1991-2001. The decadal growth rate of district comes 17.19 percent. The growth rates for the rural and urban areas of the district are 17.32 and 15.57 percent respectively. The growth rate of urban population is very slow in the district due to interior location of the district and lack of industrial development. Moreover, there is decline in the urban population of cantonment Board area of Bakloh by 9.0 percent during the decade resulting low growth in urban population. The highest growth of urban population has taken place in Chauri Khas (N.P.) where population shows increase of 43.1 percent during the decade.

DECADAL CHANGE IN POPULATION OF TEHSILS BY RESIDENCE, 1991-2001

Sr.	Tehsil	Population	Percentage decadal	% urban

No.		1991			2001			variation 1991-2001			population	
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Pangi	14,960	14,960	0	17,598	17,598	0	+17.6	+17.6	0	0	0
2	Chauraha	55,751	55,751	0	66,315	66,315	0	+18.9	+18.9	0	0	0
3	Saluni	35,266	35,266	0	41,730	41,730	0	+18.3	+18.3	0	0	0
4	Bhalai	20,181	20,181	0	22,257	22,257	0	+10.3	+10.3	0	0	0
5	Dalhousie	38,353	29,754	8,599	42,065	32,676	9,389	+9.7	+9.8	+9.2	22.4	22.3
6	Bhattiyat	33,463	29,366	4,097	38,576	33,750	4,826	+15.3	+14.9	+17.8	12.2	12.5
7	Sihunta	31,051	31,051	0	35,701	35,701	0	+15.0	+15.0	0	0	0
8	Chamba	130,352	113,158	17,194	159,399	139,072	20,327	+22.3	+22.9	+18.2	13.2	12.8
9	Holi	13,966	13,966	0	14,514	14,514	0	+3..9	+3.9	0	0	0
10	Bharmaur	19,943	19.943	0	22,732	22,732	0	+14.0	+14.0	0	0	0
	District Total:	393,286	363,396	29,890	460,,887	426,345	34,542	+17.2	+17.3	+15.6	7.6	7. 5

Density

The density of population in Chamba district is 71 persons per sq. km. against the state average of 109 persons. At tehsil/sub-tehsil level, the density of population varies between 256 persons in Dalhousie tehsil and 11 persons in Pangi tehsil. In rural areas, the density of population works out 66 persons per km^2 while in urban areas it comes to 1,669 persons.

Sex Ratio

There are 959 females for every thousand males in Chamba district. The sex-ratio figures for rural and urban areas of the district are 967 and 866 respectively. It is also observed that, the proportion of females in rural areas is higher than that of urban areas. Among the tehsils/sub-tehsils, the highest sex ratio of 1,037 females has been recorded in Sihunta sub-tehsil and the lowest is recorded in Pangi tehsil (901). The urban areas of Dalhousie have lowest sex ratio of 779 females. Sex-ratio in age-group 0-6 comes 959 females per 1,000 males in the district, as a whole. In rural areas, this proportion is 966 females while in urban areas the sex-ratio of child population works out 853 females per 1,000 males.

Work participation rate

The work participation rate is defined as percentage of total workers to total population. In the same way it is defined for main workers and marginal workers. According to 2001 Census, the total workers including main and marginal workers constitute 50.0 percent of the total population of the district. Of the total workers the share of the main workers is 27.9 percent and the marginal workers is 22.1 percent. The remaining half of population belongs to the category of non-workers. As per 2001 Census among the main workers male participation rate in the district is 40.3 percent and corresponding proportion of females is 14.9 percent. Male and female marginal workers account for 13.6 and 31.0 percent respectively. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or more economic activities in addition to their house duties to improve the family income.

It is observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than that of the female main workers.

Literacy

A person who can read and write in any language with understanding is taken as literate in census. All children of age below 7 years are treated as illiterates. As per 2001 census Chamba district reported 246,169 persons as literates constituting 62.9 percent of the total population. The proportion of male and female literates in the district is 76.4 and 48.8 percent respectively.

The total literacy rates of rural and urban areas are 60.6 and 89.5 percent respectively. The proportion of male and female literates in rural areas is 74.9 and 45.9 percent respectively. In urban areas this proportion is 93.6 and 84.8 percent respectively. The difference between male and female literacy rates in urban areas is about 8.8 points as against 29.0 points in rural areas. It is thus clear that females are better educated in urban areas than their counterparts in rural areas.

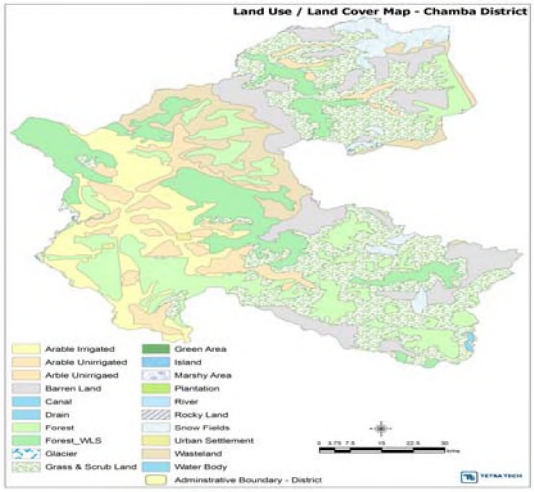
Urban Population

There are five urban centres in the district. The names and the 2001 census population are:-

Bakloh (Cantonment Board)	1,810
Chamba (Municipal Council)	20,327
Chauri Khas (Nagar Panchayat)	3,016
Dalhousie (Municipal Council)	7,425
Dalhousie (Cantonment Board)	1,964

It is interesting to observe that all these five urban centres are predominantly in the south west areas of the district. Apart from Chamba Town, which is the district headquarters and an old town, having been the capital city in historical times, all the four urban centres are in proximity to the plains and adjoining major city of Pathankot. Pathankot is not only a major transportation hub, but also has a large defense establishment since British times. This led to the development of the Cantonment Towns of Dalhousie and Bakloh. Of the five urban centres, three, i.e. Bakloh, Chauri Khas and Dalhousie Cantonment would not have qualified as urban centres on the basis of Population content, if the population would not have been non agrarian in occupation. Even the Dalhousie Town area developed as a town due to it being an established tourist destination.

Landuse



Land use Classification of Area	Land utilization in hectares
Total Geographical Area	692,409
Forest	271,611
Barren and unculturable land	17,127
Land put to non-agricultural uses	359,055
Cultural waste	2,477
Total cropped area	66,330

Agriculture

Agriculture is the mainstay of the majority of the population in the district. The 70 percent main workers fall in the category of cultivators/agricultural labourers. Though agricultural holdings do not provide whole time work to agriculturists, but, in majority of cases the production is not even sufficient to provide reasonable standard of living to the agricultural families, even then it has became a way of life. Agriculturists continue to engage themselves on the land which has been inherited by them from their forefathers. Farming in hilly areas is not productive as compared to plain areas. Generally, two crops are taken from the land. Main crops grown are as under:

Kharif Season: Paddy, Maize, Rajmah, Mash, Moong, Ragi, Sorghum, Soya bean
Rabi Season: Wheat, Gram, Lentil, Barley, Oats
*Commercial Crops:*Potato, Vegetables Crops, Ginger etc.

Cash Crops: Vegetables are mainly grown as Cash Crops in Chamba district. In low hills Brinjal, Khira, Bhindi etc. are grown as Cash Crops. The Cash Crops of mid hills are tomato, French bean, Capricorn, potatoes and ginger etc. The Cash Crops of high hill are Peas, French bean, Cauliflower, Cabbage, Radish, Carrot, Potatoes and Sugar-beat, whereas the Cash Crops of dry temperate zone are peas, potato, onion and cole crops.

Irrigation

The hilly terrain of the district present difficulties in providing adequate irrigation facilities. The only source of irrigation available in the district is the Kuhls. Out of total cropped area (66,330 hectares)of the district, only 6,580 hectares (slightly more than 10%)were having the irrigation facilities of one type or the other, which shows that large part of cultivated land depends upon the vagaries of weather. The proportion of irrigated area is only 9.92 percent out of total net cultivated area in the district.

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

Livestock

Livestock is the main wealth next to agriculture of a large chunk of rural population in the district. Every house invariably keeps a few cows or buffalos, sheep, goats, pigs and ponies. Animals are kept for milk as well as for other purposes and sheep and goats are reared for meat and wool in addition to providing manure for the fields. A large proportion of nomadic population of the district depends mainly on livestock rearing for their livelihood. According to the livestock census 1992, total livestock in the district was 723,024 out of which total cattle were 243,673; buffalos were 35,765, sheep 261,523 goats, 176,867 and other 5,196.

Horticulture

The variations in the climatic and soil conditions in the district present immense possibilities for the development of horticulture. Thus horticulture plays an important role in the socio-economic upliftment and prosperity of the inhabitants of the district. The district has suitable pockets for the production of Hazelnut, Chilgoza, apricot, walnut, peach, apple, pear, plum, quince and mango. The district has made considerable progress in the field of horticultural activities. The apple orchards are located predominantly in Chauraha, Bharmaur, Chamba and Pangi tehsils and Saluni sub-tehsil, where delicious varieties of red, royal and golden etc are mostly found. Plum is grown in Chamba and Bharmaur tehsil and Holi sub-tehsil and besides the local varieties Sentoroza and Maricoza have also been found in the district. Walnuts are grown all over the district. Chilgoza is mostly found in Pangi and certain pockets of Bharmaur tehsil and Holi sub-tehsil. Mango is generally found in the lower portion of Bhattiyat tehsil and Sihunta sub-tehsil. The lower areas of development block of Chamba, Tissa and Saluni are most suitable for propagating the plantation of olive.

Fisheries

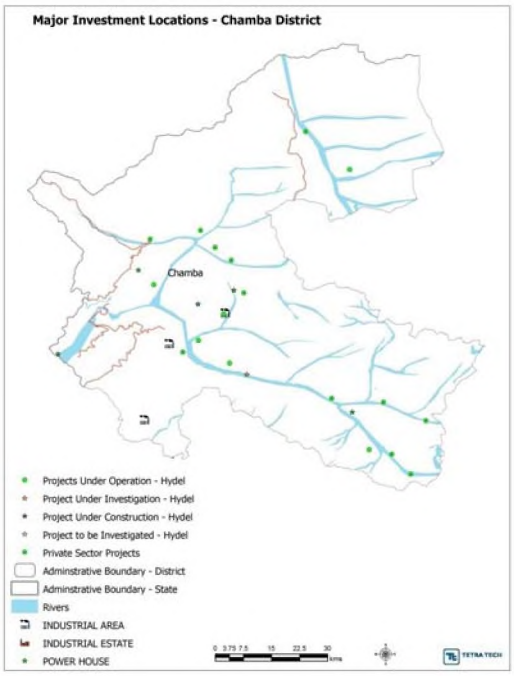
A small quantity of fish is caught in the Ravi near about Chamba by the occupational fishermen, after obtaining a license from the District Fishery Officer, Chamba district. The khuds and nallahs of Bhattiyat tehsil yield some fish catch. At Sarol Tank fish is kept for breeding purposes and for distribution. The species of fish found in the district are *Tor putitora* (Mahseer), *Labeo dero*

(Gid), *Labeo dyocheilus* (Kunil), *Barilius bendelisis* (Patha), *Garra lamta* (Kurta) and *Oreinus sinuatus* (Himalayan Barbel).
With the construction of Chamera Dam on the river *Ravi*, the area under fisheries has increased many folds. In addition, small area of about 67 hectares is in the forms of village ponds, has been identified for development of fishery.

Industries

Industrially, the district is most backward as no large or medium scale industry exists in the district. Chamba produces shawls and other woollen goods and cotton fabrics. Chamba 'chappals' are famous and are in much demand. Government runs a leather training centre which trains local artisans in leather work.

The important village industries are weaving, carpentry and blacksmithy which are practiced since the old times to cater to the local needs only. The rich traditional skills of its inhabitants and opportunities for local resources based industries, offer a vast potential for growth of small scale and cottage based industries in the district. The cottage industries like weaving, basketry, rope making, mat making, earthen ware, blacksmithy, carpentry, rice mills, leather works, gold and silver smithy are essential for the self sufficiency of rural areas which are scattered all over the district. There is one training institute relating to technical education at Chamba. The industrial sector consists of the units mostly under tiny and cottage industries and is artisans based. Among the other industries, Handloom is the most common. For the development of handicrafts industries in the district the Handloom and Handicrafts Corporation runs textile production centres at Chamba and Tisa, footwear factory and Chamba 'Rumal' production centre at Chamba.



The District Industries Centre has developed 12 industrial plots and constructed 15 sheds at Sultanpur and all the sheds are occupied by the entrepreneurs there. Another industrial area is at Parel. The District Industries Centre has constructed 9 sheds there and developed 10 plots. At Hatli, 5 sheds are ready and 22 plots have been developed. At Holi 10 sheds are under construction. A few more industrial areas are being developed at Garnota, Judera and Bhanota

Minerals and Mining

Chamba district is fairly rich in mineral wealth. Mica deposits are found in Pangi valley, lime stone in Chamba tehsil and Magnesium Carbonate in Bharmaur tehsil. These minerals are yet to be exploited. Excellent Slate is found around Chamba and is used for roofing. A small portion of these slates is suitable for making school slates. Besides slates, building stones, bajri and sand are also extracted in the district.

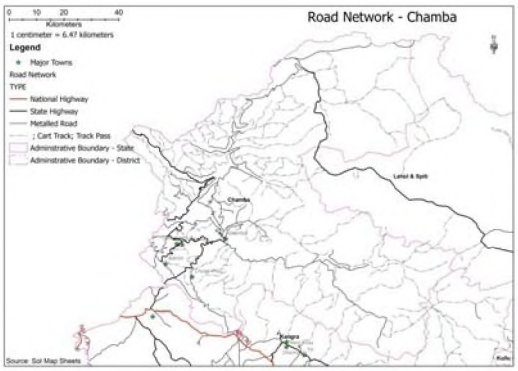
Roads & Transport

In the absence of railways and navigable rivers, the district is entirely dependent upon the road transport system. The total road length in the district was 1,255 kms. including state highways during 1998. Of this length of roads, 83 kms. is double lane and length of 1,172 kms. is single lane. The length of jeepable roads is 410 kms. while less than jeepable roads in the district is 1,008 kms. Where other means of transport are not possible, the sheep, goats, mules and ponies are used to carry essential commodities.

Roads including National Highways (in kms.)

Type of Roads	1990	1991	1992	1993	1994	1995	1996	1997	1998
1	2	3	4	5	6	7	8	9	10
1 Motorable Double lane	71	71	71	73	76	76	79	N.A.	83
2 Motorable Single lane	889	912	946	953	982	1039	1077	N.A.	1,172
3 Jeepable	325	330	390	402	414	370	380	N.A.	410
4 Less than Jeepable	917	936	920	939	939	955	975	N.A.	1,008
Total	**2,202**	**2,249**	**2,227**	**2,367**	**2,411**	**2,440**	**2,511**	**N.A.**	**2,673**

Above statement shows that there is gradual increase in the length of single and double lane motorable roads in the district.



Electricity and Power

The development of agriculture and industries can hardly be accelerated without the availability of power. In addition to it the electricity for domestic use has become indispensable in modern times. The rural electrification plays a significant role in bringing the socio-economic gap between rural and urban areas and raising the quality of life even in the remote corner of the district. All inhabited villages in the district have electricity facility. It thereby, presents an encouraging scenario. The State has made remarkable achievements in the field of rural electrification despite the fact that it was a difficult task due to mountainous terrain.

The district has a great potential for the Hydel power projects. The following projects are in operation in the district.

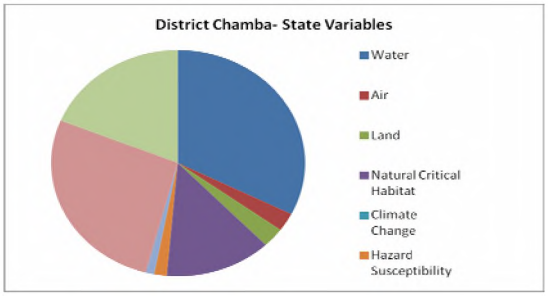
1 Baira Siul Hydel project
2 Bhuri Singh Hydel project
3 Bharmaur Hydel project
4 Garola Hydel project
5 Chamera stage-I Hydel project Khairi
6 Chamera stage-II Hydel project Kariyan
7 Hibra power project Holi (Chamera-III)
8 Padma Shri Kailash Chand Mahajan power project Sal-II

Summary of State Variables at District Level

Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Chamba. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as

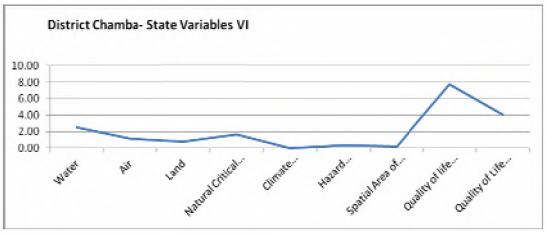
grids on x-axis, which actually represent the value of vulnerability ($V_{State\ Sector}$) as a total for that particular system.

Chamba	
Variable Sector	Vulnerability of State Sector $V_{State\ Sector}$
Water	15870.93
Air	1278.99
Land	1375.87
Natural Critical Habitat	6618.84
Climate Change	0.00
Hazard Susceptibility	775.72
Spatial Area of Conflict	532.92
Quality of life (health)	13268.95
Quality of Life (education)	9202.27



The analysis of data indicates that water resources show a remarkable presence. There are gaps in education and health infrastructure and services. Natural Critical habitat also displays a strong presence.

Analysis of data further indicates that the health sector has crossed criticality while education is in high vulnerability segment.



State Variables at Tehsil Level

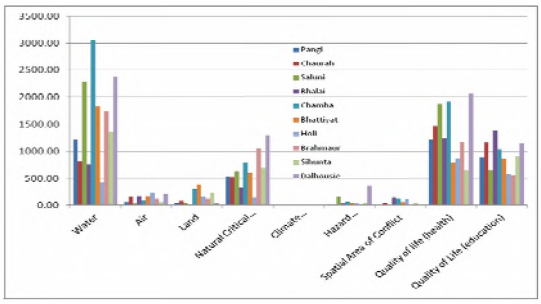
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

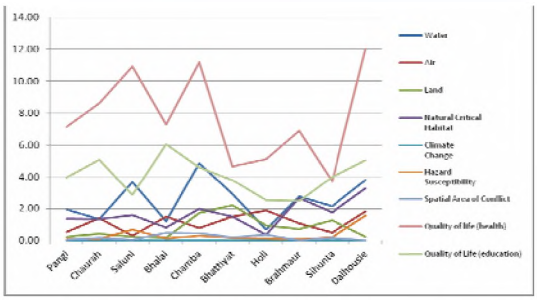
Analysis of data indicates that water resources show a remarkable presence in all Tehsils with the exception of Chaurah, Bhalai and Holi. All the Tehsils display a higher degree of gaps in education and health infrastructure and services, especially health.

District Chamba- State Variables Tehsilwise

State Variables	Pangi	Chaurah	Saluni	Bhalai	Chamba	Bhattiyat	Holi	Bharmaur	Sihunta	Dalhousie	Vulnerability of State Sector $V_{State\ Sector}$
Water	1222.64	823.78	2290.45	759.82	3057.27	1830.16	423.19	1730.06	1349.34	2384.23	15870.94
Air	60.00	157.40	31.76	170.10	90.31	170.36	214.35	122.21	56.64	205.86	1278.99
Land	36.06	73.73	36.06	25.27	291.09	376.35	161.59	123.88	215.80	36.06	1375.89
Natural Critical Habitat	544.19	528.00	636.49	317.04	793.28	600.37	144.38	1055.54	696.08	1303.46	6618.83
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	13.83	25.49	156.53	28.02	63.05	40.52	28.54	18.08	46.56	355.10	0
Spatial Area of Conflict	5.00	43.50	8.00	138.42	127.56	59.28	104.75	0.00	46.41	0.00	775.72
Quality of life (health)	1220.07	1474.25	1867.22	1249.30	1913.64	796.10	873.26	1181.13	640.02	2053.96	0
Quality of Life (education)	899.28	1160.52	652.17	1381.10	1046.21	864.56	579.99	558.16	905.99	1154.27	532.92



State Variables vulnerability at Tehsil level in District Chamba



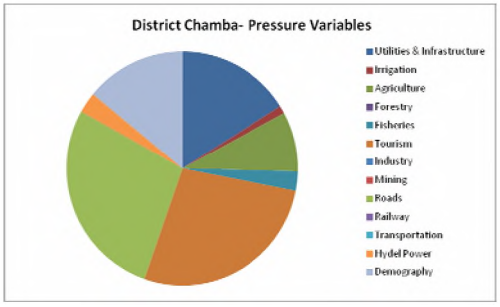
Analysis of data indicates that there are gaps in health and education infrastructure and services and are in high vulnerability segments. Infact, gaps in health infrastructure and services have crossed the critical stage in all the Tehsils with the exception of Bhattiyat, Holi and Sinhuta where it is in high vulnerability segments. Similarly, education infrastructure is critical at Bhalai and is in the high segment in Dalhousie and Chaurah. Water resources are in the high vulnerability segment in Chamba, while in Dalhousie and Saluni it is in the moderately high segment. Other variables are in controllable stages.

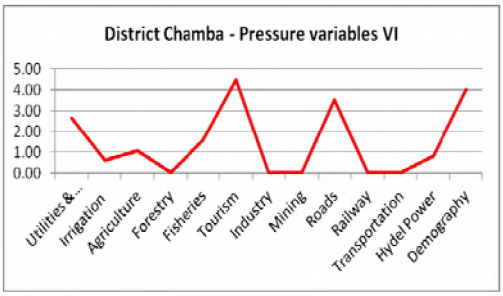
Summary of Pressure Variables at District Level

Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Chamba. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Variable Sector	Chamba Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities & Infrastructure	7931.76
Irrigation	523.09
Agriculture	4071.51
Forestry	0.00
Fisheries	1329.00
Tourism	13446.35
Industry	0.00
Mining	0.00
Roads	13689.00
Railway	0.00
Transportation	0.00
Hydel Power	1412.43
Demography	6923.17

Analysis of data indicates that lot of work has already been done in the road sector. The Tourism plays a major role in the District and is highly vulnerable. Being a border District, demographic pressure is significant though there are only few urban centres in the District. As a result, Utilities & Infrastructure variables indicate pressure. The higher levels of vulnerability are observed from VI graph from tourism, roads and demography sectors are.



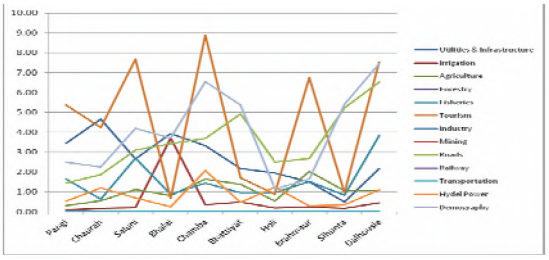


Pressure Variables at Tehsil Level

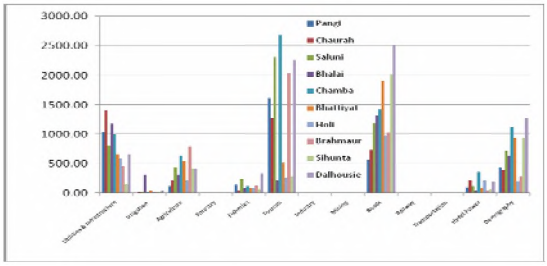
Similarly, the pressure variables computed at tehsil level for comparison is given below.

Comparison of pressure variables at Tehsil level:

Pressure Variables	Pangi	Chaurah	Saluni	Bhalai	Chamba	Bhattiyat	Holi	Bharmaur	Sihunta	Dalhousie	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities & Infrastructure	1039.66	1405.33	801.65	1181.55	999.83	656.83	585.26	454.83	151.60	655.21	7931.75
Irrigation	7.10	14.82	18.42	318.80	29.64	42.33	15.71	22.00	14.38	39.89	523.09
Agriculture	119.96	214.99	431.99	317.53	639.03	533.48	207.23	782.84	412.95	411.51	4071.51
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fisheries	141.00	55.00	233.00	76.00	125.00	83.00	82.00	132.00	72.00	330.00	1329
Tourism	1615.26	1274.97	2307.55	206.65	2678.17	511.99	261.90	2032.45	290.35	2267.07	13446.36
Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roads	556.62	727.01	1199.06	1323.39	1429.39	1904.17	967.68	1034.96	2023.19	2523.53	13689
Railway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydel Power	93.36	205.32	118.66	42.00	357.20	81.44	213.82	49.62	60.00	191.01	1412.43
Demography	430.13	389.23	721.17	639.07	1124.15	924.45	196.45	284.35	932.37	1281.81	6923.18



Pressure Variables vulnerability at Tehsil level in District Chamba



Analysis of data indicates that road infrastructure has been adequately developed and district is tourist destination. As a result, tourism related activities create the highest pressure in the District. The Demography, Utilities & Infrastructure and Agriculture variables also creates pressure. The Demographic variables have pressure in Dalhousie and Chamba, the District Headquarter in particular.

The Tourism activities and demand gaps have crossed the criticality mark in Chamba, Dalhousie, Saluni and Bharmaur Tehsils. All these are popular tourist destination of the district and pilgrimage centers. The Tourism is in the high vulnerability segment in Pangi as well. The Utilities and Infrastructure is in the high vulnerability segment in Chaurah and it is in the moderately high vulnerability segment in the Bhalai. The Demography has crossed the critical vulnerability mark in Chamba, Sinhuta and Dalhousie, while it

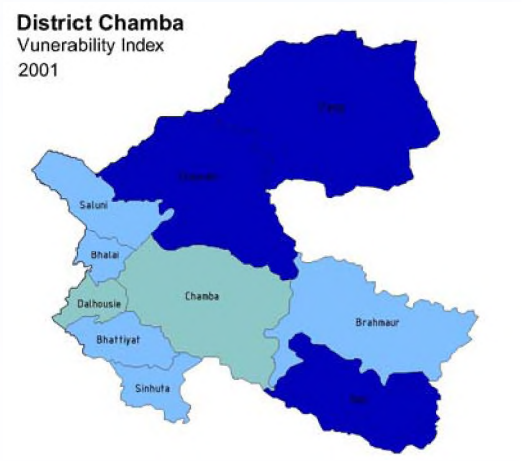
shows high vulnerability in Bhattiyat and moderately high vulnerability in Saluni. It is interesting to note that Tehsils bordering with Punjab and Kangra, except Holi are demonstrating high demographic pressures thus vulnerability on higher side. Though, the Roads create pressure but since the work has been done, tourism and demography are other sectors which create pressure.

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Chamba. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

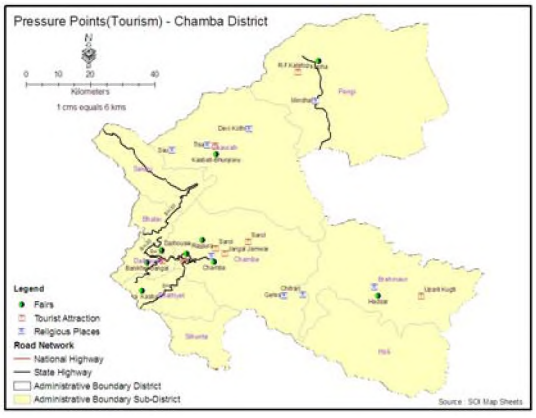
$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

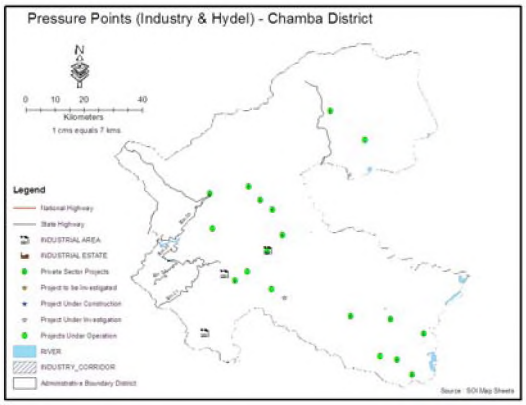
Vulnerability Index

	Pangi	Chaurah	Saluni	Bhalai	Chamba	Bhattiyat	Holi	Brahmaur	Sihunta	Dalhousie
VI	3584.10	4286.67	5831.51	4104.99	7382.41	4737.7	2530.05	4793.06	3956.83	7700.02
denominator = 57x43	**2451**									
Normalized VI	**1.46**	**1.75**	**2.38**	**1.67**	**3.01**	**1.93**	**1.03**	**1.96**	**1.61**	**3.14**



From the analysis of the data and observations from the Vulnerability Index map above, it is inferred that the Tehsils bordering the neighboring States shows higher VI, which is explicable. Saluni, Bhalai and Dalhousie borders Punjab and Bhattiyat and Sinhuta borders the border district of Kangra. Chamba and Dalhousie, both being Tourist destination Tehsils have comparatively higher Vulnerability. In general, Chamba, as a whole is in various levels of low vulnerability segments ranging from very low vulnerability in Pangi, Chaurah and Holi, low vulnerability in Saluni, Bhalai, Bhattiyat, Sinhuta and Bharmaur and moderately low vulnerability in Chamba and Dalhousie.

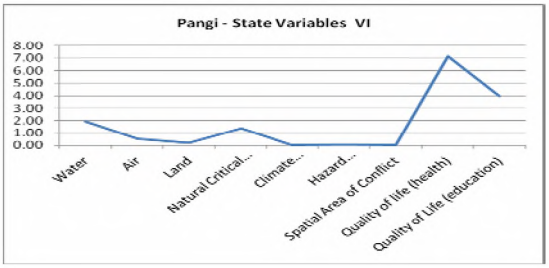




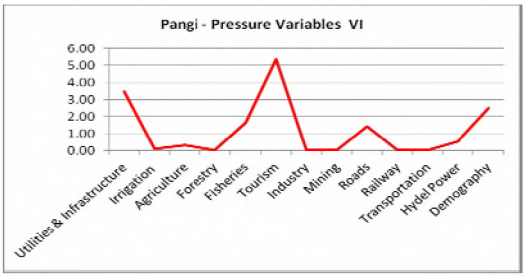
Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables, have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Tehsil Pangi - Overall Vulnerability Index = 1.46

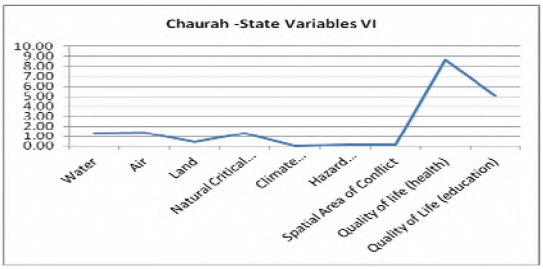


The analysis of the data indicates the gaps in infrastructure and services in Health and Education sectors making it the most vulnerable in the Tehsil. Health infrastructure and services has crossed the critical segment while education infrastructure is in the moderately high segment. The gaps Health and Education need to be bridged on priority. Rest of the State variables are in the low vulnerability segment and are not cause of immediate concern yet.

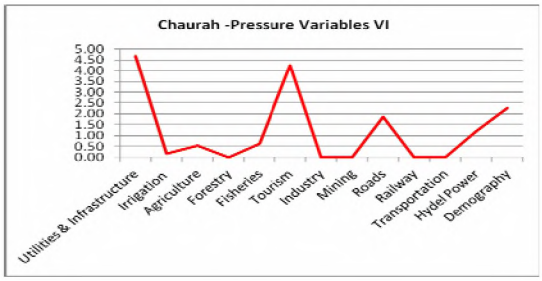


Tourism has crossed the critical vulnerability stage in the Tehsil, while Utilities and Infrastructure are in the moderately high vulnerability segment. All others are in controllable range.

Tehsil Chaurah -Overall Vulnerability Index = 1.75

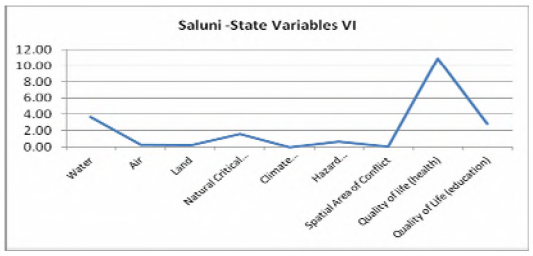


The analysis of the data indicates that gaps in Health infrastructure and services are critical. Further analysis shows gaps in Education infrastructure which is in high vulnerability segment. These can be addressed on priority. Rest of the variables is within controllable range.

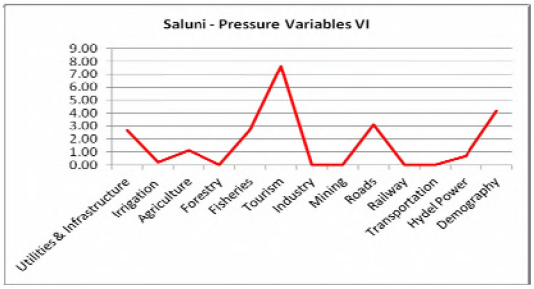


The analysis of the data indicates that gaps in Utilities and Infrastructure have reached a high vulnerability level. Tourism is in the moderately high segment.

Tehsil Saluni- Overall Vulnerability Index = 2.38

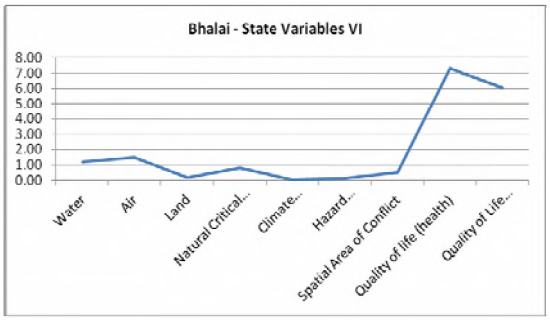


The analysis of the data indicates that gaps in Health infrastructure and services have crossed the critical stage by a long way. All other variables are in the low or very low vulnerability segments. The gaps in health infrastructure and services can be bridged by improving health infrastructure and services through a programme which will also reduce VI.

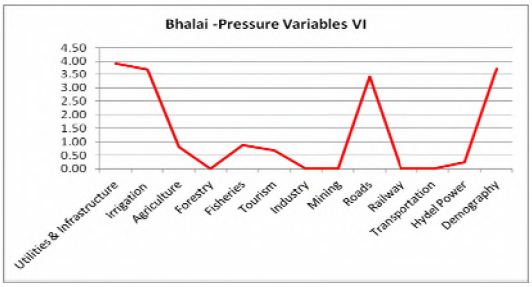


The analysis of the data indicates that Tourism has crossed the critical vulnerability mark and the Demography is also touching the high vulnerability segment. It is recommended that a Sub Regional Plan (including a Tourism Plan) for the Tehsils bordering Punjab can be made.

Tehsil Bhalai – Overall Vulnerability Index 1.67

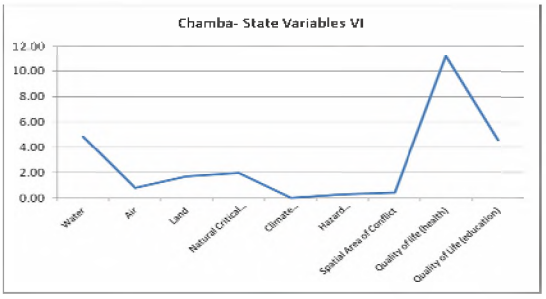


The analysis of the data indicates gaps in Health and Education infrastructure and services making them critically vulnerable. Rest of the variables are controllable. A programme for reducing the gaps in Health and Education infrastructure and services can be taken up.

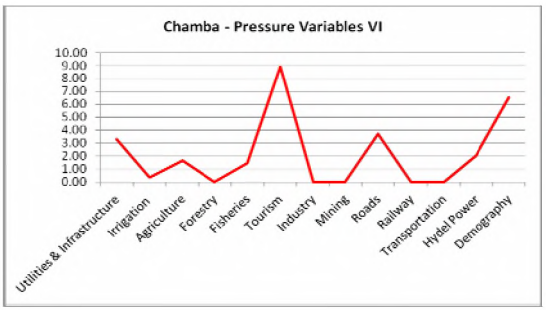


The analysis of the data indicates gaps in Utilities and Infrastructure and Irrigation. Further, Demography creates pressure making it the most vulnerable in this border Tehsil, though in the moderately high segment. Some work has been done in the Road sector. Projects to bridge the gaps in the Utilities and Infrastructure sector can be undertaken.

Tehsil Chamba – Overall Vulnerability Index = 3.01

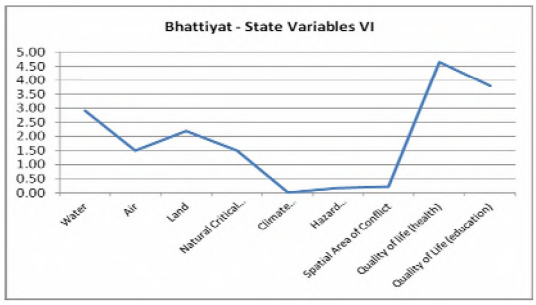


The analysis of the data indicates that gaps in Health infrastructure and services have crossed the critical stage by a long way in a Tehsil which also houses the District Headquarters. Further, Health infrastructure is also in the high vulnerability stage. Water resources are in a high vulnerability stage. An improvement in Health and Education infrastructure and services shall help in reducing the vulnerability of the Tehsil.

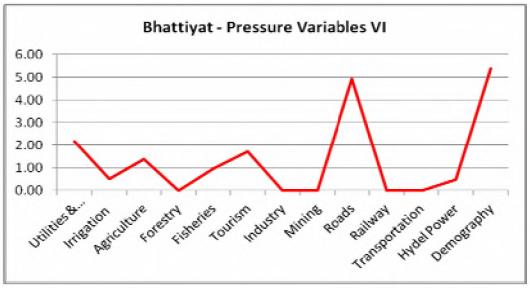


The analysis of the data indicates that Tourism and demographic pressures have crossed the critical vulnerability stage. Almost all the other variables are under control.

Tehsil Bhattiyat – Overall Vulnerability Index- 1.93

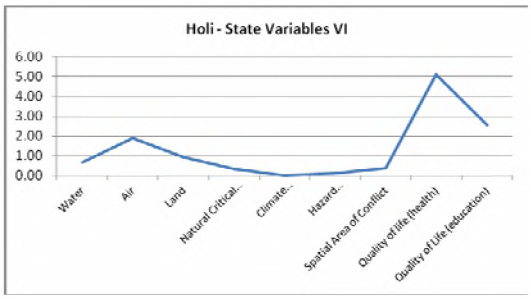


The analysis of the data indicates gaps in health infrastructure and services thereby making Bhattiyat highly vulnerable in health sector. Further, gaps in education infrastructure is also in moderately high vulnerability segment. A programme can be developed to improve health and education infrastructure and services to address the gaps, which would also reduce the VI of the Tehsil.

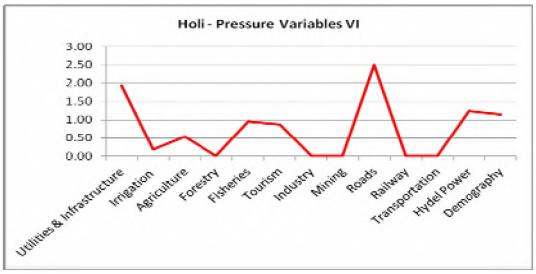


The analysis of the data indicates that Demography has created pressure thereby making it a High vulnerability segment. It appears that a lot of people are settling here from the neighboring Kangra District. A lot of work in the road sector has been done.

Tehsil Holi – Overall Vulnerability Index- 1.03



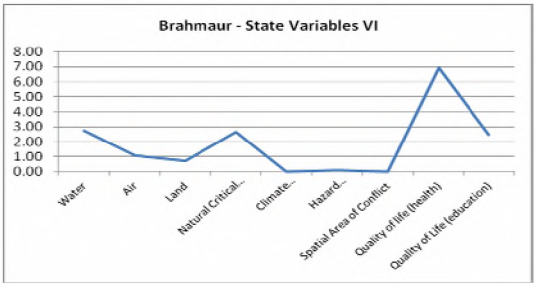
The analysis of the data indicates gaps in health infrastructure and services. All the other variables are in controllable situation. A programme for improving health infrastructure and services can help in reducing the vulnerability of the Tehsil.



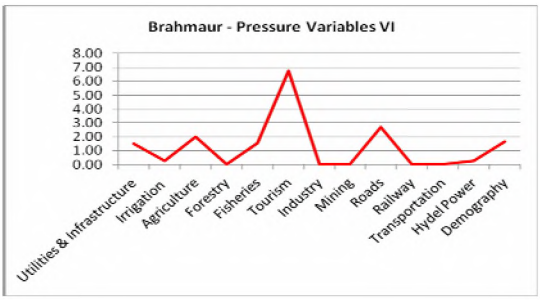
The analysis of the data indicates that all the variables are in low or very low vulnerability segment.

A programme for improving health infrastructure and services can be developed.

Tehsil Bharmaur – Overall Vulnerability Index- 1.96

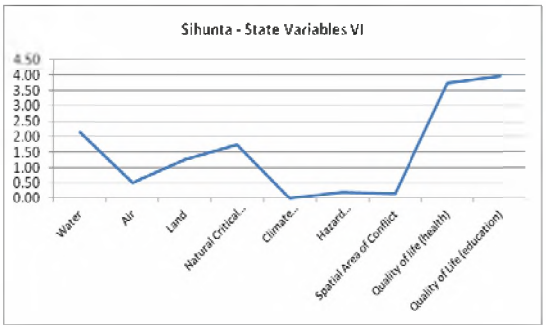


The analysis of the data indicates gaps in health infrastructure and services making it a critically high vulnerable sector. A programme for improving health infrastructure and services can help in reducing the vulnerability of the Tehsil. All other variables are in controllable ranges.

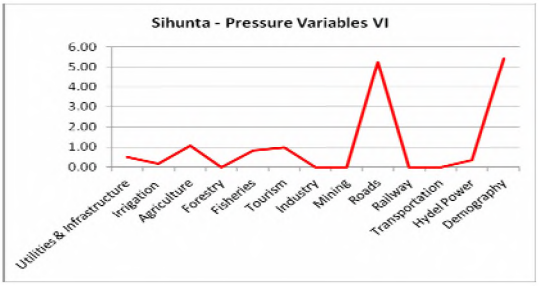


The analysis of the data indicates that Tourism pressure has created vulnerability beyond the critical stage. A Tourism Plan can be made. All other variables are in controllable limits.

Tehsil Sinhuta- Overall Vulnerability- 1.61

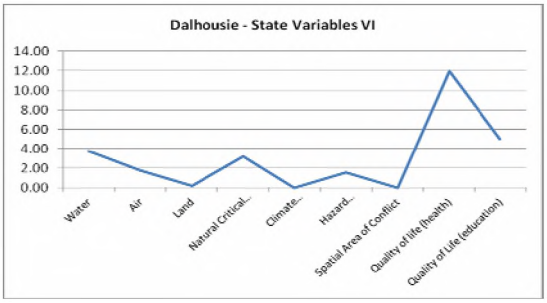


The analysis of the data indicates that health and education sectors are in the moderately high vulnerability segment. A programme for improving health infrastructure and services can help in reducing the vulnerability of the Tehsil. All other variables are in controllable ranges.

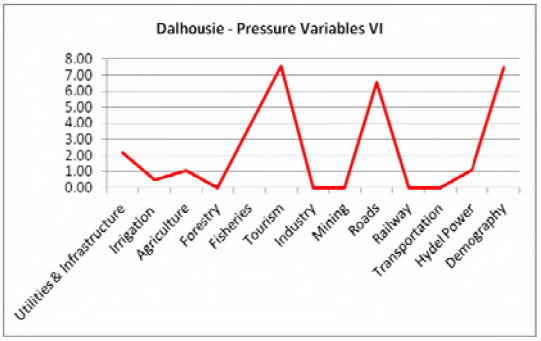


The analysis of the data indicates that the Demography is putting pressure thereby making Tehsil critically vulnerable. It can be inferred that a lot of migratory population from the neighboring District have settled here. A substantial amount of work has been done in the Road sector which may have possibly opened up new areas for in-migration.

Tehsil Dalhousie – Overall Vulnerability Index – 3.14



The analysis of the data indicates gaps in Health infrastructure and services making it critically vulnerable. Further, gaps in Education sector are high and reaching criticality. A programme for improving health and education infrastructure and services can help in reducing the vulnerability of the Tehsil. Rest of the variables is under controllable range.



The analysis of the data indicates pressure from Tourism, Roads and Demography which displays critical vulnerability. A Tourism Plan can be recommended.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in considerate of the intervention prioritization.

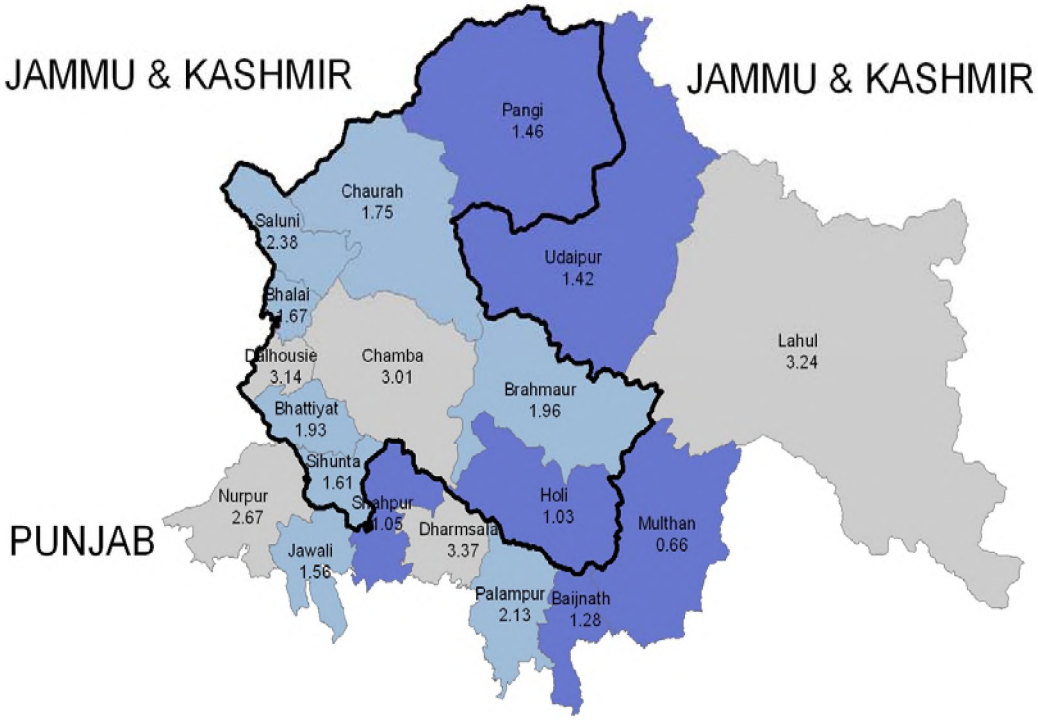
Sr. No	Tehsil	VI	Adjoining Tehsil in Chamba District	VI	Adjoining Tehsil in other District	District	VI
1	Pangi	1.46	Chaurah	1.75	Udaipur	L&S	1.42
2	Chaurah	1.75	Saluni	2.38	Udaipur	L&S	1.42
			Chamba	3.01			
			Pangi	1.46			
			Bharmaur	1.96			
3	Bharmaur	1.96	Chaurah	1.75	Udaipur	L&S	1.42
			Chamba	3.01	Lahaul	L&S	3.24
			Holi	1.03	Multhan	Kangra	0.66
4	Holi	1.03	Bharmaur	1.96	Multhan	Kangra	0.66
			Chamba	3.01	Baijnath	Kangra	1.28
					Palampur	Kangra	2.13
					Dharamshala	Kangra	3.37
5	Chamba	3.01	Chaurah	1.75	Harchakian	Kangra	1.06
			Bharmaur	1.96			
			Holi	1.03			
			Sinhuta	1.61			
			Bhattiyat	1.93			
			Dalhausie	3.14			
			Bhalai	1.67			
			Saluni	2.38			
6	Saluni	2.38	Chaurah	1.75			
			Chamba	3.01			
			Bhalai	1.67			
7	Bhalai	1.67	Saluni	2.38			
			Dalhausie	3.14			
			Chamba	1.75			
8	Dalhausie	3.14	Bhalai	1.67			
			Chamba	3.01			
			Bhattiyat	1.93			
9	Bhattiyat	1.93	Dalhausie	3.14	Nurpur	Kangra	2.67
			Chamba	3.01			
			Sinhuta	1.61			
10	Sinhuta	1.61	Bhattiyat	1.93	Harchakian	Kangra	1.06
			Chamba	3.01	Jawali	Kangra	1.56
					Nurpur	Kangra	2.67

Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Chamba is surrounded by various Tehsils of District Lahaul and Spiti and Kangra. The vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils of District Chamba except for Nurpur tehsil in Kangra district. The transitional impact of vulnerability possibly will give rise to

vulnerability levels, when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameters

(i) As is observed from the analysis of the data available, the gaps in quality of life in terms of health and education need to be addressed on a priority. To reiterate our basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils(in descending order)-. Dalhausie, Chamba, Saluni, Chaurah, and Bharmaur

Similarly, the quality of life parameters for education include accessibility to a Primary School within a distance of 2 kilometres, a Secondary School within a distance of 6

kilometres, a College within a distance of 10 kilometres, and a Vocational Institution within a distance of 25 kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Dalhausie, Sinhuta, Bhattiyat, and Bhalai

The benchmarking of the norms has been done with a view of the terrain in the State.
A programme in collaboration with the Health and Education Departments of the State Government would reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability

Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken.
The district has two important lakes, Manimahesh in Bharmaur and Khajjiar in Dalhousie Tehsils. While Mani-mahesh is a pilgrimage centre, Khajjiar is a tourist destination for recreation. Detailed Conservation and Management Plans for both these lakes are very important so that sustainability is achieved and the resource conserved.

Priority Tehsils- Dalhausie, Bharmaur,

(ii) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats i.e. Reserve forests, Wild life sanctuaries etc can be done through a series of plans culminating into projects.

It has been observed that there is a gap between the forest area and the forest cover and hence a specific programme for attending this gap is required to enrich this resource wealth of the district.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(iii) Though the Hazard Susceptibility values for the district are is low, an incidence a village, sinking has been reported. Reportedly, haphazard construction in the waterway, at Village Sutch, in Tehsil Pangi lead to this sinking as there was excess flow of water in the Sutchu Khad A detailed study of such susceptible areas can be conducted and a detailed action plan prepared and implemented through projects.

(iv) The ground water may be recharged through the creation of small check dams on the non perennial khuds, which could also improve the irrigation scenario.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed State Level and District Level Plans for Tourism is required to be prepared.

(iii) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact

that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(iv) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization plan is required to be prepared through scientific studies.

(v) It was observed that data at the Tehsil level is not available for many parameters. A system has to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations annually to assess the variation in VI at annual level. This would make the Environmental Master Plan more relevant and updated.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Program	Project	Remarks
State						
1	Water		*	*		Lake Conservation Plans, Ground Water recharge program
2	Natural Critical Habitat		*	*	*	Plans for Buffer zones Program and Projects to cover the gap Program for maintenance of moisture content and ground water recharging
3	Hazard Susceptibility		*			Study and Plan
4	Quality of life (Health)			*		Programme to improve access
5	Quality of life (Education)			*		Programme to improve access
Pressure						
1	Roads	*				Policy Guidelines for environmental concerns
2	Tourism		*			Tourism Plan at State, District, and Destination Level
3	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
4	Hydel Power	*	*			Policy regarding Catchment Area Treatment, Ecological Flow etc Water Utilization Plan

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Pangi	Chaurah	Saluni	Bhalai	Chamba	Bhattiyat	Holi	Bharmaur	Sihunta	Dalhousie
VI	3584.10	4286.67	5831.51	4104.99	7382.41	4737.7	2530.05	4793.06	3956.83	7700.02
denominator = 57x43	**2451**									
Normalized VI	**1.46**	**1.75**	**2.38**	**1.67**	**3.01**	**1.93**	**1.03**	**1.96**	**1.61**	**3.14**

Population Projections

Tehsil	Population 2001	Proj. Pop 2011	Proj.Pop 2021	Proj.Pop 2031	Proj Pop. 2041
Pangi	17598	20929	24881	29395	34412
Chauraha	68326	82191	98621	117317	138017
Saluni	41730	50424	60640	72235	85068
Bhalai	22257	26428	31098	36239	41816
Chamba	159399	193546	234226	280729	332400
Bhattiyat	38576	45746	54075	63462	73810
Holi	14514	15529	16678	17957	19359
Brahmour	22732	26203	30337	35075	40357
Sinhuta	35701	47964	61340	75675	91175
Dalhousie	42065	50657	60224	70401	82018

Calculation of per capita share of VI

Tehsil	Population 2001	VI 2001	VI share
Pangi	17598	1.14	6.48
Chauraha	68326	1.42	2.08
Saluni	41730	2.38	5.7
Bhalai	22257	1.67	7.5
Chamba	159399	3.01	1.89
Bhattiyat	38576	1.93	5
Holi	14514	1.03	7.1
Brahmour	22732	1.96	8.62
Sinhuta	35701	1.61	4.51
Dalhousie	42065	3.14	7.46

Calculation of Projected VI

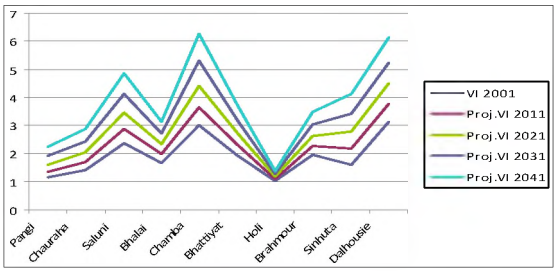
Tehsil	Pop. 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj. Pop 2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Pangi	17598	1.14	6.48	20929	1.36	24881	1.61	29395	1.90	34412	2.23
Chauraha	68326	1.42	2.08	82191	1.71	98621	2.05	117317	2.44	138017	2.87
Saluni	41730	2.38	5.7	50424	2.88	60640	3.46	72235	4.12	85068	4.85
Bhalai	22257	1.67	7.5	26428	1.98	31098	2.33	36239	2.72	41816	3.14
Chamba	159399	3.01	1.89	193546	3.65	234226	4.42	280729	5.30	332400	6.28
Bhattiyat	38576	1.93	5	45746	2.29	54075	2.71	63462	3.18	73810	3.69
Holi	14514	1.03	7.1	15529	1.10	16678	1.18	17957	1.27	19359	1.37
Brahmour	22732	1.96	8.62	26203	2.26	30337	2.62	35075	3.02	40357	3.48

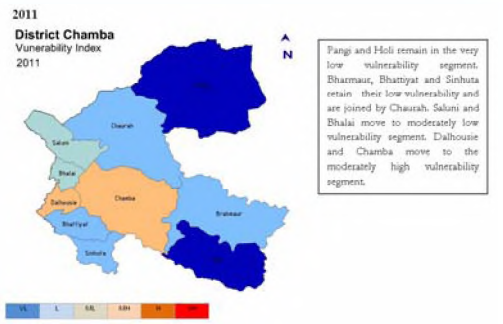
Tehsil	Pop. 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj. Pop 2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Sinhuta	35701	1.61	4.51	47964	2.16	61340	2.77	75675	3.41	91175	4.11
Dalhousie	42065	3.14	7.46	50657	3.78	60224	4.50	70401	5.26	82018	6.12

Projected Vulnerability Index

Tehsil	VI 2001	Proj.VI 2011	Proj.VI 2021	Proj.VI 2031	Proj.VI 2041
Pangi	1.14	1.36	1.61	1.90	2.23
Chauraha	1.42	1.71	2.05	2.44	2.87
Saluni	2.38	2.88	3.46	4.12	4.85
Bhalai	1.67	1.98	2.33	2.72	3.14
Chamba	3.01	3.65	4.42	5.30	6.28
Bhattiyat	1.93	2.29	2.71	3.18	3.69
Holi	1.03	1.10	1.18	1.27	1.37
Brahmour	1.96	2.26	2.62	3.02	3.48
Sinhuta	1.61	2.16	2.77	3.41	4.11
Dalhousie	3.14	3.78	4.50	5.26	6.12

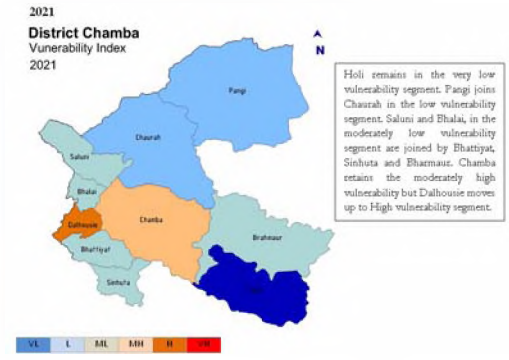
Vulnerability Index Scenarios – District Chamba at Tehsil Level

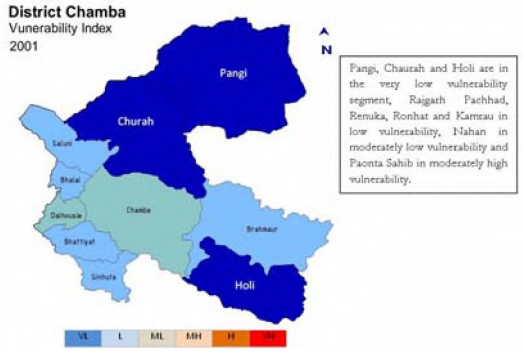


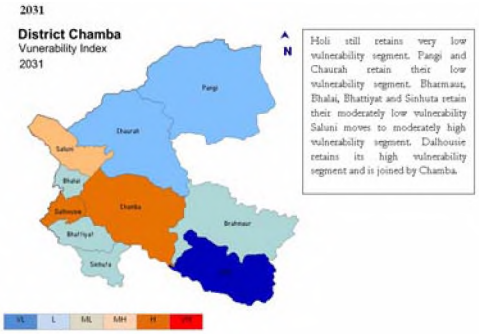


Range

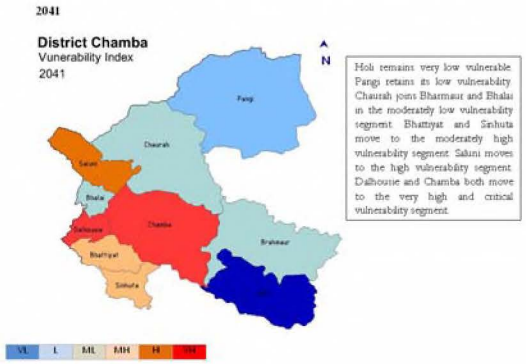
Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	







2041

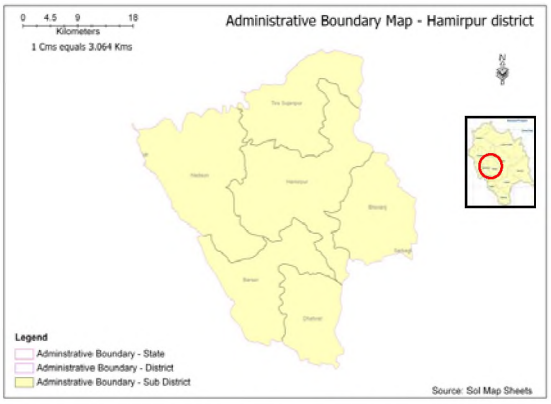


Holi remains very low vulnerable. Pangi retains its low vulnerability. Chaurah joins Bharmaur and Bhalai in the moderately low vulnerability segment. Bhattiyat and Sinhuta move to the moderately high vulnerability segment. Salooni moves to the high vulnerability segment. Dalhousie and Chamba both move to the very high and critical vulnerability segment.

HAMIRPUR

General Background

Hamirpur district is situated between 76°17'50"east to 76°43'42" east longitude and between 31°24'48" north to 31°53'35" north latitudes. It is located in the south western part of Himachal Pradesh. It is covered by lower Himalayas; the elevation varies from the 400 metres to 1,100 metres. Hamirpur district is bounded in the north by river Beas which separates it from Kangra district in Jaisinghpur, Khundian and Dera Baba Gopipur Tehsils of the Kangra district. In the east Bakar and Seer Khads in Lad bharol and Sandhol Tehsils of Mandi district create the boundary with Hamirpur. In the south, it is bounded by Ghumarwain and Jhanduta Tehsils of Bilaspur district and in the west by Bangana Tehsil of Una district.



This district has been divided into six administrative units as Tehsil/ Sub-Tehsil (area in descending order as follows):

Sr. No.	Tehsil/Sub-Tehsil	Area (sq. km.)
1	Nadaun	247.40
2	Hamirpur	247.40
3	Tira Sujanpur	180.40
4	Barsar	153.30
5	Bhoranj	150.90
6	Dhatwal	121.30

Physiography

The main hill ranges of the district are known as Jakh Dhar & Sola Singhi Dhar. The Jakh dhar runs in continuation of Kali Dhar range in the Kangra district. It enters in Hamirpur district near Nadaun and transverses it into southeastern direction.



The town of Hamirpur lies to the east of this range where the country is undulating but in the north and north east bare and rugged hills, deep ravines with precipitous sides transform the landscape into what has been described as an agitated sea suddenly arrested and fixed stones. The Chabutra hills have the same dip and strike as in the Jakh Dhar and are continued beyond the Beas to what is known as the Changar, a mass of rugged and broken hills. The Sola Singhi Dhar is the longest range of the tract and is known under various names such as Chintpurni and Jaswan Dhar in Una and by Sola Singhi in Hamirpur. This Dhar enters Hamirpur to the east of Tappa Daruhi and traverses it in a south-easterly direction more or less parallel to the Jakh Dhar and terminated on the Sutlej.

Culture and Social Brief

Fairs & Festivals

In district Hamirpur various fairs & festivals are celebrated round the year, these fairs and festivals have religious sanctity such as *Holi Fair, Gasota Mahadev Fair, Baba Deotsidh Fair, Gashian Fair, Chaniari Devi Fai* and, *Awah Devi Fair.*

Places of religious, historical, archaeological importance and Tourist interest:

Hamirpur district does not represent any specific places of historical & archeological importance except Old fort at Sujanpur but there are some places of the tourism significance:

Hamirpur: Hamirpur town is situated on Dharamsala-Bilaspur road. Its main attraction is Chil forest and its undulating surroundings.

Tira Sujanpur: It was founded by Raja Abhay Chand, the king of ruling Katoch dynasty of Kangra in 1748 A.D. There is a tomb of Nawab Gulam Mohammed of Rampur. There are five old temples at Tira and Sujanpur. The temple dedicated to Gauri Shankar was built during the time of Raja Sansar Chand in 1793 A.D. in the sacred memory of his mother. The temple of Murli Manohar and Narbadeshwar (built by Pransani Devi, The Suketi Rani of Raja Sansar Chand) were also built in this time in 1970 and 1823 A.D. respectively. Other temples of repute are the Mahadev temple, Devi and Vyasheshwar (dedicated to Rishi Vyas) temple. Obreen's horses grave (he was Raja Sansar Chand's commander) is also located in Sujanpur. This place is suitable for adventure sports like Paragliding, Angling, Rafting and trekking in and around this area.

Nadaun: In princely days, it used to be the headquarters of the Nadaun Jagir, Maharaja Sansar Chand of Kangra used to hold his court during summer for a number of years during his reign. Nadaun is also known for Blikleshwar Mahadev temple which is said to be have been founded by the Pandavs. Nadaun is famous for its beautiful people and a Gurudwara founded in A.D. 1929. There was a saying in Kangra hill that w*ho that comes to Nadaun will not go away*. This is explained by the fact that there were two hundred singing and dancing girls at Nadaun and whoever came under the spell of these enchantresses never thought of leaving. The palace building at Amtar still houses some of the paintings of that time. Jwalajee temple is also not very far and can be visited from here. This place provides excellent facilities for Mahseer fishing in the Beas River flowing close by. Another attraction is the river rafting from this place to Dehra and further. There are beautiful camping sites for anglers.

Deotsidh Temple: It is situated on the border of Bilaspur (70 kms.), Hamirpur (30 kms.) and is well connected by roads from all sides. During Navratras, there is a continuous stream of visitors to receive blessings of the Babaji. Government makes arrangements for stay in tented colonies and provides water, toilets and other essential services. Additional accommodation and installation of rope way to Shah - Talai is expected to attract more tourists. This temple is one of the biggest revenue earning institutions of the Himachal state and is visited by nearly 45 lakhs of devotees across the country every year. 'Mela's are organized during Holi festival. Sunday is considered auspicious day of Babaji (Baba Balak Nath) and consequently attracts huge devotees on this day.

Markanda: It is located in district Hamirpur, 6 kms. away from Dera parol on the bank of Kunah Khad, is the place of Markandya Rishi. According to Puranas, it is there that the idol of Rishi Markandya was installed. A Natural water spring is also located there. The fair of Markanda is also famous.

Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State'* variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability

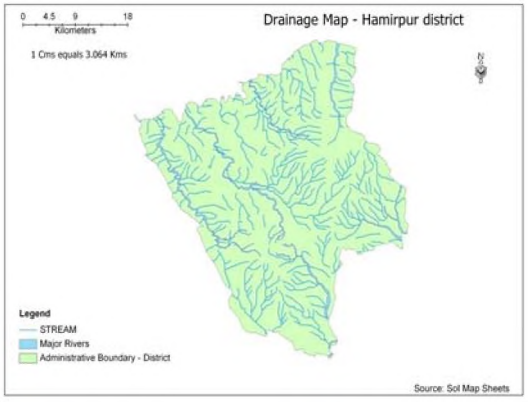
of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Hamirpur district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

The drainage system of District contains a number of perennial streams which are tributaries of either river Beas or river Sutlej. *Bakar Khad, Kunha Khad* and *Man Khad* drain into river Beas, while *Sukar Khad* and *Mundkhar Khad* drain into Seer Khad which ultimately joins the river Sutlej. As can be clearly seen from the map above, the drainage flows primarily either in the north- west or the south east direction. It clearly implies the existence of a watershed ridge running in the north east- south west direction forming a clear basin demarcation.



Climate

Hamirpur district falls under humid *sub-tropical zone* where annual temperature ranges from 20°C to 40°C. The climatic conditions of district are almost similar to Kangra and Shiwalik area. In generally the climate of district remains warm and varies with altitudes.

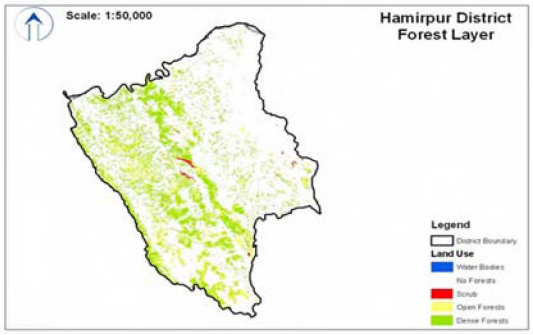
Precipitation/ Rainfall

Rainfall in district varies from 1180 mm to 1900 mm. Rainy season is well marked and extends from July to September.

Particulars	Maximum	Minimum
Rainfall	1900 mm	1180 mm
Temperature	40° C	20° C

Forest

The territorial jurisdiction of forest division of district is co-terminus with district boundaries. The forests in the district have been classified as demarcated protected forest and un-demarcated forest. The district doesn't have any reserve forest. The district has a forest area of 186.76 sq. kms., which is approximately 17% of the total geographical area of the district. Majority of forest in district consist of chil forest. The area under different types of forest is 95.58 sq. kms. as protected forest, 60.84 as unprotected forest & 35.01 Sq. km. are other types of forest. These figures total to 191.43 sq. kms. which is 4.67 sq. kms. more than the area designated under forest in the land use analysis. This means that some area, which is classified under non forest area is also under forest cover.

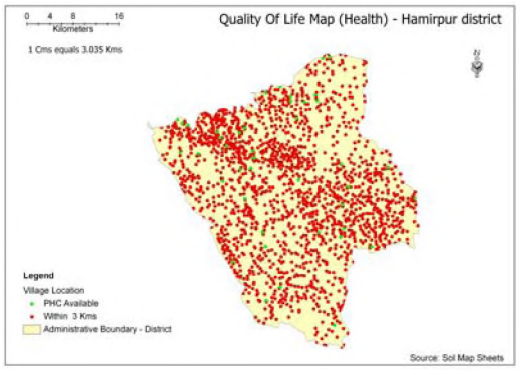


The north eastern segment of the district are almost devoid of the forest cover. The central North Western- South Eastern ridge houses the maximum dense forest cover while the lower ridge pre-dominantly comprises open forest which is in synergy with the *Solah Singhi Dhar* as is evident in the Bangana Tehsil in Una also.

Quality of Life (Health)

Out of 1635 inhabited villages, 1619 villages are deprived of primary health centre while 1634 villages are deprived of hospitals. With regard to primary health centre it is available to 653

villages at distance of less than 5 kms., for 522 villages at 5-10 kms. while rest 444 villages have this at more than 10 kms. With regard to hospital 157 have it at less than 5 kms., 242 have it between 5-10 kms. while inhabitants of 1235 villages have to travel more than 10 kms. In fact, to summarize, according to 2001 Census, on an average 59.31% of villages in the district do not have access to a Primary Health Centre within a distance of 3 kms, 43.34 % of the villages do not have access to Community Health Centre within a distance of 6 kms. and, 63.87% of the villages do not have access to a Hospital within a distance of 10 kms. This clearly means that the district has a better network of Community Health Centers as compared to other districts, but is at par with other districts as far as Primary Health Centers and accessibility to Hospital within a reasonable distance is concerned.



As the map above clearly displays, the settlements are densely clustered and thus the lack of facilities like PHC shows up distinctly.

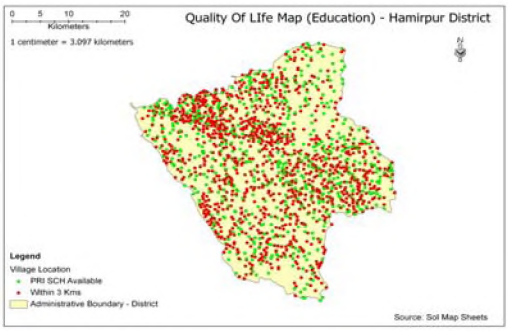
Quality of Life (Education)

Out of 1635 inhabited villages, 1080 villages are deprived of primary schools, 1411 of secondary schools while 1632 villages doesn't have degree colleges. For all 1080 villages, it is available at distance less than 5 kms. With regards to middle school 1378 villages have it at less than 5 kms, 32 villages have it at 5-10 kms while inhabitants of 1 village have to travel distance of more than 10 kms. Considering degree college inhabitants of 127 villages have to travel distance of less than 5 kms those of 279 villages have to travel between 5-10 kms while those of rest 1226 villages have to travel more than 10 kms.

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

To summarize, according to 2001 census, on an average 33.47% of villages in the district do not have access to a Primary School within a distance of 2 kms, 39 % of the villages do not have access to a Secondary School within a distance of 6 kms, 43.34% of the villages do not have access to a College within a distance of 10 kms, and 57.89% of the villages do not have access to a Vocational Institute within a distance of 25 kms.

It is observed that District Hamirpur is comparatively good conditions in terms of quality of life- education than other districts. A National Institute of Technology has also been established in the District besides other major institutions.



The map above amply demonstrates the higher accessibility to Primary Schools in the district.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Hamirpur such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Hamirpur district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to 2001 Census, the total population of Hamirpur district is 412,700 comprising 196,593 males and 216,107 females (***the Census of India, 2011 gives a provisional population figure of 454293 with a density of 406 per sq.km. Data at tehsil level is not available***). This population of the district forms 6.79 % of the state population and ranks at 8th place among the districts. Out of total population of the district, 92.68 % is distributed in rural areas while 7.32 % lives in urban areas. The rural population of the district is distributed among 6 Tehsil and urban population is spread over in 4 towns. The total urban population in the district is 30,206 persons constituting 16,227 males and 13,979 females. The total population of rural areas in the district is 382,494 persons with 180,366 males and 202,128 females. This rural population is spread over in 1635 villages. Out of total 1672 villages in the district, 1635 are inhabited villages while 37 are uninhabited villages.

Population Growth

According to the 1991 Census the total population of the district was 369,128 persons which rose to 412,700 persons in 2001 Census showing net addition of 43,572 persons during 1991-2001. The decadal growth rate of the district comes to 11.8% during this decade. The growth rate in the rural population is 10.4 % while the urban population has grown by 33.1% during 1991-2001.

Decadal Change in Population of Tehsils by Residence, 1991-2001

Sr. No.	Tehsil/ Sub-Tehsil	Population						Percentage decadal variation 1991-2001			Percentage urban population	
		1991			2001							
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Tira Sujanpur	38,688	33,211	5,477	43,189	36,112	7,077	(+)11.6	(+)8.7	(+)29.2	14.2	16.4
2	Nadaun	80,659	77,280	3,379	91,410	87,005	4,405	(+)13.3	(+)12.6	(+)30.4	4.2	4.8
3	Hamirpur	96,772	84,228	12,544	111,210	93,958	17,252	(+)14.9	(+)11.6	(+)37.5	13.0	15.5
4	Barsar	45,594	44,308	1,286	50,090	48,618	1,472	(+)9.9	(+)9.7	(+)14.5	2.8	2.9
5	Dhatwal	32,108	32,108	-	34,816	34,816	-	(+)8.4	(+)8.4	0.0	0.0	0.0
6	Bhoranj	75,307	75,307	-	81,985	81,985	-	(+)8.9	(+)8.9	0.0	0.0	0.0
District Total		**369,128**	**346,442**	**22,686**	**412,700**	**382,494**	**30,206**	**(+)11.8**	**(+)10.4**	**(+)33.1**	**6.1**	**7.3**

The rate of growth of the rural population is in synergy with the rest of the state, although a bit lower, yet, the growth of urban population in Hamirpur rings a bell.

Density

The density of population in Hamirpur district is 369 persons per sq. km. against the state average of 109 persons. At Tehsil/ sub-Tehsil level, the density of population varies between 543 persons in Bhoranj Tehsil and 239 persons in Tira Sujanpur Tehsil. In rural areas, the density of population is about 346 persons per sq. km. while the density of 2,604 persons per sq. km. has been observed in urban areas. The comparatively high densities in the district indicate pressures on the resources.

Sex Ratio

There are 1099 females per 1,000 males in Hamirpur district. The sex-ratio figures for rural and urban areas of the district are 1120 and 861 females per 1,000 males respectively. It is also seen that the proportion of females in rural areas is higher than that of urban areas. Sex-ratio in age-group 0-6 comes to 850 females per 1,000 males in the district, as a whole. In rural areas this proportion is 851 females while in urban areas the sex-ratio of child population comes to 842 females per 1,000 males. The high sex ratio in rural areas denote out migration from rural areas while the low sex ratio in urban areas indicate in migration.

Work Participation Rate

According to 2001 Census the total workers including main & marginal workers comes to 49.77 % of the total population of the district. Of the total workers 58.35 and 41.64 % is shared by the main and marginal workers respectively. 50.23 % of total population is occupied by the category of non-workers. As per 2001 Census the main workers participation among male is 33.83 and for females is 24.52 %. Males and females have 14.88 and 26.76 percentages in the category of marginal workers. The proportion of female marginal workers is subsequently higher than that of males as the females are attending to one or more economic chores in addition to their household duties to increase the family income. It is observed that the proportion of male main workers is higher than that of female workers in the district.

Urban Population

Urban population in the district is spread over 4 towns. Its distribution is as follows:

Sr. No.	Name of UA/Town	Urban status	Population		
			Persons	Males	Females
1	Tira Sujanpur	NP	7,077	3,879	3,198
2	Nadaun	NP	4,405	2,249	2,156
3	Hamirpur	Mpl. Council	17,252	9,327	7,925
4	Bhota	NP	1,472	772	700
	District (Urban)		**30,206**	**16,227**	**13,979**

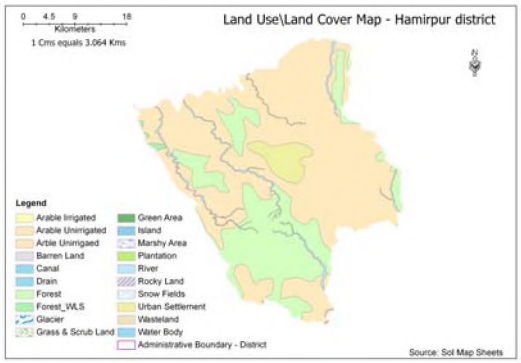
As can be seen from the table, Hamirpur, the district headquarters, is the urban core of the district. The town of Bhota, which is very much like a suburb of Hamirpur has its urban content due to the proximity to the District Headquarters.

Literacy

As per 2001 Census Hamirpur district reported 298,498 persons as literates constituting 72.33% of the total population. The proportion of male and female literates in the district is 36.96 and 35.36 % respectively. The literacy rate of males is higher than females in the district. The total literacy rates of rural and urban areas are 71.73 and 79.77%. The proportion of male & female literates in rural areas is 77.12 and 66.88% respectively. The proportion of male & female in urban areas is 82.20 and 76.98 %. Females are better educated in urban areas than that of rural areas.

Land Use

Land use Classification of Area	Land utilization (sq. km)
Total Geographical Area	1101.62
Forest	186.76
Land Not Available for cultivation	309.27
Fallow Land	77.05
Net Cropped Area	359.65
Area sown more than once	329.73
Total Cropped Area	700.62



Agriculture

Agriculture is the mainstay of the people and 72% of the total population depends on it. The soil is young, shallow and sandy loam in texture which is mixed with boulders in eastern & north eastern part of district. Wheat & Maize are the main crops of district. These are followed by gram, paddy & other pulses. Besides Barley, Ragi, mustard sesame and sugarcane are also grown. Out of total 1101.62 sq. km geographical area net cropped area is 348.28 sq. km , 343.27 sq. km. is area sown more than once i.e. total cropped area is 691.95 sq. km. The farmers grow more than two crops in a year to get maximum production from land. The crop rotation followed in district is (1) Maize-Toria-Wheat; (2) Maize-Potato-Potato; (3) Maize-Toria-Wheat-

Baisakhi Moong. In addition to these rotation farmers also follow Paddy-Wheat, Maize-Wheat rotation. Improved high yielding varieties of seeds of maize, paddy, wheat, mash & moong have been introduced in district and fertilizers are made available to cultivators.



Tehsil-Wise Area under Principal Crops

Name of Tehsil	Area under Principal Crops (ha)
Hamirpur	9546
Bhoranj	8000
Barsar	4271
Nadaun	7306
Tira Sujanpur	3721
Dhatwal	3274

Irrigation

To increase the crop production, the importance of irrigation is well established, adequate and timely supply of irrigation water to crops is essential in the agriculture production, particularly in areas where the rainfall is scanty and irregular. The growth in production is possible through multiple cropping, which in turn depends upon irrigation. About 95% of total cultivated area in district is rain-fed. Hence production of different crops depends entirely on rains. More than 70% rainfall is received in monsoon. However, most of the water is drained away & lost. Some efforts have been made for water harvesting by constructing water storage structures like small irrigation tanks, ponds, check dams etc. Of the total cultivated area net irrigated area is 18.03 sq. km. This accounts for just about 2.5% of the sown area, which is dismal. The main sources of irrigation in the district are lift canals, tube wells & well etc.

Tehsil-Wise Position of Irrigated Area (Sq.Km)

Name of Tehsil/Sub-Tehsil	Kuhls/ Canals	Well/Tube well	Other sources	Total
Hamirpur	18.57	13.5	211	243.07
Bhoranj	65	0	301	366
Barsar	0	10.8	207	217.8
Nadaun	0	0	372	372
Tira Sujanpur	0	0	298	298
Dhatwal	0	0	86	86
Total	**83.57**	**24.3**	**1475**	**1582.87**

Livestock

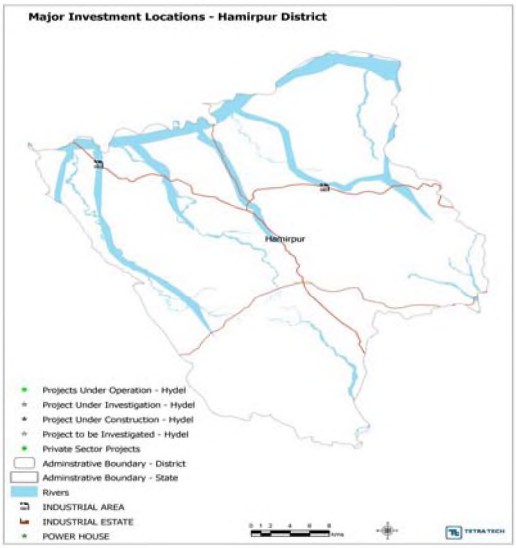
Livestock is the main wealth next to agriculture of rural population. Almost every household in rural areas invariably keeps a few cows, buffaloes, sheep and goats. Besides some rear pigs and keep poultry birds. Animals are kept for milk, meat and providing manure for the fields. The district has a large number of livestock. As per 1992 livestock census there are 60810 cows, 94352 buffaloes, 50027 sheep, 30794 goat, 1854 other animals & 29814 poultry birds. There are 113 veterinary institutions in the district, which include 16 veterinary hospitals, 89 veterinary dispensaries, one mobile veterinary dispensary, I.C.V.D and 6 other institutions. These institutions are providing veterinary aid for common ailment and also helping in prevention and control of contagious diseases.

Horticulture

Hamirpur falls in subtropical zone of State. Apple the main fruit of Himachal is not grown in district. Various other fruits like lime, mango, peach, plum, guava, orange, papaya are grown in district. In recent years, mango has emerged as the important fruit crop. Litchi is also gaining importance in certain regions of the district. There is no established market of fruit in district so fruit growers send their fruits to neighboring state of Punjab. Since there is no processing plant in district, fruit growers are unable to utilize their unmarketable/surplus fruits.

Industries

There has been no large & medium scale industrial unit in the district due to lack of infrastructural facilities, resources and demand. An industrial estate has been set up at the distance of 2 kms from Hamirpur. Some of the established industrial units are M/s Verma Steel Fabricators, M/s Dev Raj Sewing Machine Assembling, M/s Jagdamba Association has set up resin and turpentine factory at Kahdru assisted by Village and Khadi Board and P.V.C. shoes at Hamirpur. As per 2001 Census 940 small scale & cottage industries have been reported. There are 40 handloom units & 150 Khadi & Village industries.

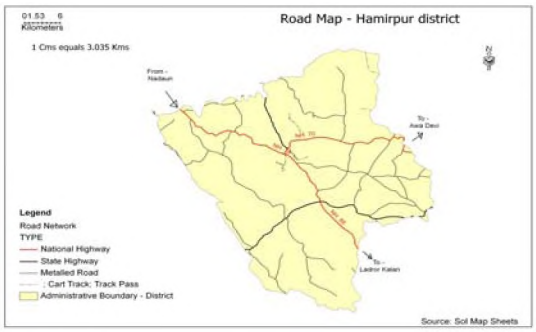


Fisheries

Hamirpur district has limited inland sources of water in the shape of river, rivulets, ponds and tanks. Main river of the district is Beas, which runs along the boundary line with district Kangra and covers about 45 kms of length of running water in the district from Sachuhi to Chamukhas. Two rivulets namely Kunah Khad (37 kms.) and Man Khad (40 kms.) are the main tributaries of the Beas. The fisheries of district Hamirpur comprises of natural fish fauna, inhabiting in the river and its two main tributaries and other streams, which are *Tor putitora* (Mahseer), Gulguli, Gid, Kalbans, Bam, Sal, Malhi, Singhara, Singhi, Kunhi and Mori. There are 275 registered fishermen and total production of fish is about 314 MT.

Roads & Transport

In view of topographical constraints, roads are the only means of transportation in district. Therefore, emphasis has been laid on construction of roads. About 755 kms. of *pucca* road & 586 kms. of *kutcha* road have been constructed constructed in the district so far. The state highways Nos. 32 & 39 and national highway nos. 70 & 88 passes through the district. Road transportation is mainly carried by buses of Himachal Pradesh Road Transport Corporation.



Length of Roads in Kms. Including National Highways

Type of Road	Length as on 3/ 1999	Length as on 3/ 2009
Un-metalled	583	362
Metalled	567	1352
Total	1150	1714
Density of Roads per 100 Sq. km.	-	153.31

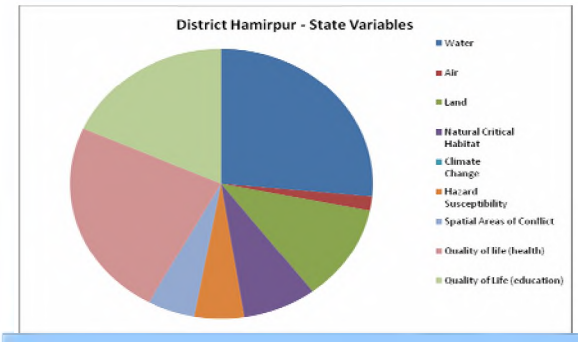
Electricity & Power

For the distribution of electricity for industrial and domestic consumption, the district has 132 KV line, 33 KV line and 11 KV line in the district. There are also six grids in the district viz. Hamirpur, Tira Sujanpur, Nadaun, Ladraur, Bijhri, Kotla and Barsar having the capacity of 33 KV each.

Summary of State Variables at District Level

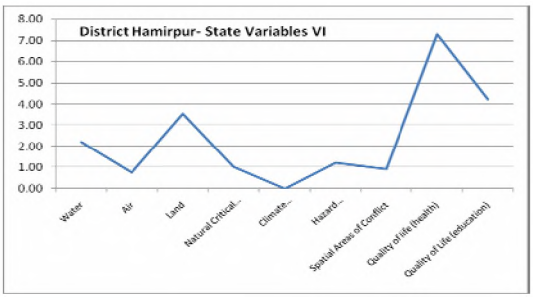
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Hamirpur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V_{State\ Sector}}$) as a total for that particular system.

Hamirpur Variable Sector	Vulnerability of State Sector $V_{State\ Sector}$
Water	8342.12
Air	525.72
Land	3625.01
Natural Critical Habitat	2475.80
Climate Change	0.00
Hazard Susceptibility	1663.31
Spatial Areas of Conflict	1601.90
Quality of life (health)	7473.46
Quality of Life (education)	5769.58



It has been observed that the table as well as the chart, the District has abundant water resources. A substantial portion of the District is also prone to Hazards. The high scores of Quality of Life indicators in terms of non accessibility to Health and education facilities points out the deficiencies in these sectors. The vulnerability in health and education sector is clearly observed with the health variables crossing the critical stage of vulnerability while the education variables are on a high vulnerability stage. Therefore the quality of life needs to be improved in view of demographic pressures in the district both in terms of educational and health services. Land as resource is also under pressure in the district probably due to demographic pressures again and requires planned growth.

Rest of the variables of State theme represents lower vulnerability.



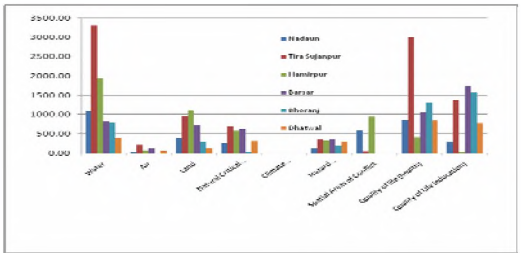
State Variables at Tehsil Level

Similarly the state variables quantified at Tehsil level are given below:

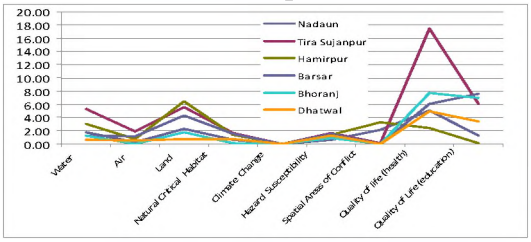
Comparison of State variables at Tehsil level:

State Variables	Nadaun	Tira Sujanpur	Hamirpur	Barsar	Bhoranj	Dhatwal	Vulnerability of State Sector $V_{State\ Sector}$
Water	1093.30	3301.18	1942.62	819.10	792.58	393.34	8342.12
Air	35.32	219.30	80.87	135.00	0.00	55.23	525.72
Land	397.58	958.20	1103.24	733.41	305.59	126.99	3625.01
Natural Critical Habitat	256.60	680.00	573.60	620.00	30.00	315.60	2475.8
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	135.96	362.23	318.01	356.07	190.63	300.41	1663.31

State Variables	Nadaun	Tira Sujanpur	Hamirpur	Barsar	Bhoranj	Dhatwal	Vulnerability of State Sector $V_{State\ Sector}$
Spatial Areas of Conflict	597.60	50.00	943.30	10.00	1.00	0.00	1601.9
Quality of life (health)	856.52	2990.55	413.39	1048.14	1320.67	844.19	7473.46
Quality of Life (education)	284.05	1382.90	26.86	1727.41	1579.88	768.48	5769.58



State Variables vulnerability at Tehsil level in District Hamirpur



It has been observed from the analysis that Tira Sujanpur has adequate water resource base to meet the requirements. The gaps in health services indicates inadequate health infrastructure tehsils Tira, Bhoranj and Barsar indicate higher vulnerability in the Health sector. Tira Sujanpur, Hamirpur and Barsar demonstrate vulnerability over Land as a resource because of demographic pressure and high population density. Education sector also has deficiencies due to inadequate Education infrastructure, though to a lesser extent.

Summary of Pressure Variables at District Level

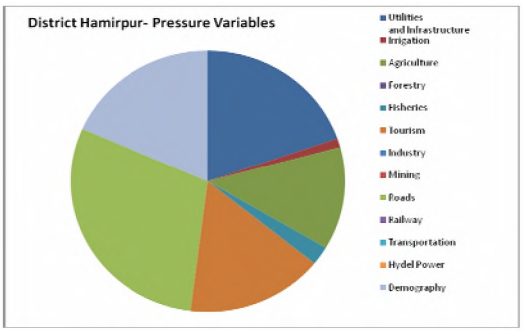
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Hamirpur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($V_{pressure\ Sector}$) as a total for that particular system.

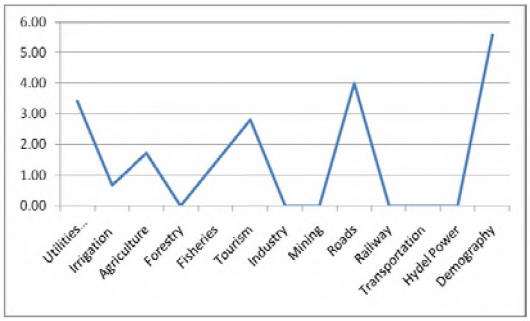
Hamirpur	
Variable Sector	Vulnerability of Pressure Sector $V_{Pressure\ Sector}$
Utilities and Infrastructure	6182.68
Irrigation	346.86
Agriculture	4002.70
Forestry	0.00
Fisheries	724.70
Tourism	5081.56
Industry	0.00
Mining	0.00
Roads	9304.76
Railway	0.00
Transportation	0.00
Hydel Power	0.00
Demography	5779.49

It has been observed from the table as well as the chart for the Pressure variables for the District as a whole, the maximum score is in the Roads sector followed by Utilities and Infrastructure, Demography, Tourism and Agriculture. Rest of the sectors indicates marginal vulnerability.

As per analysis it has been observed that the Demography, has already reached the critical stage of vulnerability. This may be a virtual scenario as the base population content is extremely small and any increase emerges as an exponential figure, thus indicating a higher vulnerability. The road network

existing in the district requires optimum and planned utilization.





District Hamirpur- Pressure Variables VI

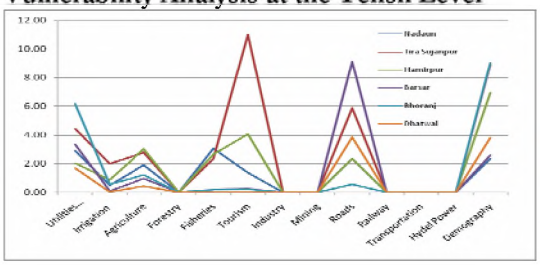
Pressure Variables at Tehsil Level

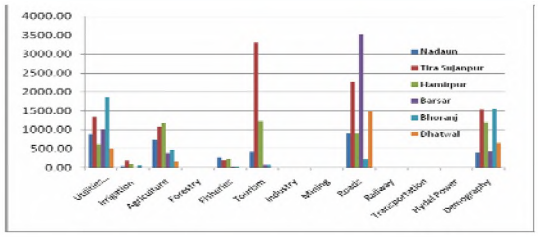
Similarly, the pressure variables computed at Tehsil level for comparison is given below.

Comparison of Pressure variables at Tehsil level:

Pressure Variables	Nadaun	Tira Sujanpur	Hamirpur	Barsar	Bhoranj	Dhatwal	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	880.32	1332.05	609.80	1004.41	1852.54	503.56	6182.68
Irrigation	42.95	171.20	73.88	8.00	47.89	2.94	346.86
Agriculture	745.96	1075.12	1175.37	374.29	464.90	167.06	4349.56
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	4002.7
Fisheries	264.50	200.00	227.29	16.46	16.45	0.00	724.7
Tourism	411.40	3311.00	1221.89	71.54	65.73	0.00	5806.26
Industry	0.00	0.00	0.00	0.00	0.00	0.00	5081.56
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0
Roads	905.21	2270.46	903.93	3526.96	217.88	1480.32	9304.76
Railway	0.00	0.00	0.00	0.00	0.00	0.00	9304.76
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0
Hydel Power	0.00	0.00	0.00	0.00	0.00	0.00	0
Demography	406.49	1530.52	1189.71	447.48	1554.95	650.34	5779.49

Hamirpur District- Pressure Variables – Vulnerability Analysis at the Tehsil Level





It is interesting to observe from the table as well as the graph, that though Bhoranj has not been so urbanised, yet, it indicates higher gaps in availability of utilities and infrastructure. A lot of work in the road sector has been done in Barsar and Tira Sujanpur and interestingly , that had helped to increase/ opened up the tourism activities in Tira Sujanpur. Though tourism

displays some presence in Hamirpur too, implying that a good network already existed in the Tehsil. Tira Sujanpur and Bhoranj, both tehsils bordering other districts indicates a higher demographic vulnerability/ pressures.

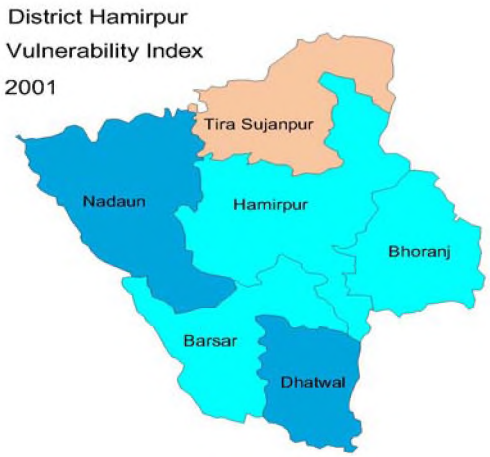
Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Hamirpur. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

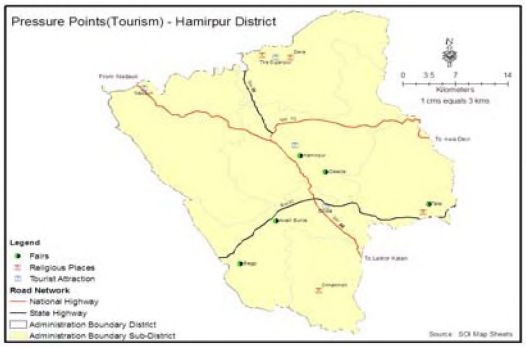
Vulnerability Index

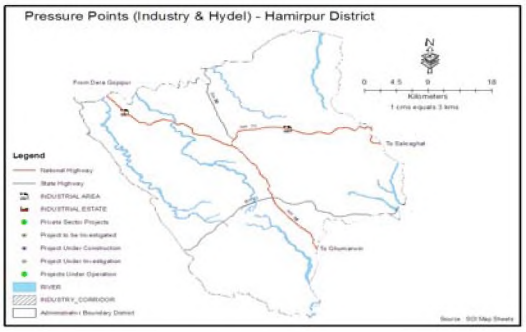
	Nadaun	Tira Sujanpur	Hamirpur	Barsar	Bhoranj	Dhatwal
VI	3656.93	9890.36	5401.88	5449.13	4220.35	2804.23
Denominator = 57x43			**2451**			
Normalized VI	**1.49**	**4.04**	**2.20**	**2.22**	**1.72**	**1.14**

District Hamirpur presents a very interesting scenario. Almost all the Tehsils are in the very low or low vulnerability segment except for Tira Sujanpura which interestingly borders with the higher reach areas in Kangra and Mandi Tehsils. Tehsils which border industrialized Tehsils such as Una and Hamirpur, that is Nadaun, Barsar, Dhatwal, Hamirpur and Bhoranj have a low or very low vulnerability index. This very fact also indicates that that the district has not been affected by the impact of industrialization from the south or the west.



A detailed analysis of the scenario follows. The detailed analysis commences with viewing the entire District as a whole for its State and Pressure variables on a cumulative basis and evolving the vulnerability for each of the variables.

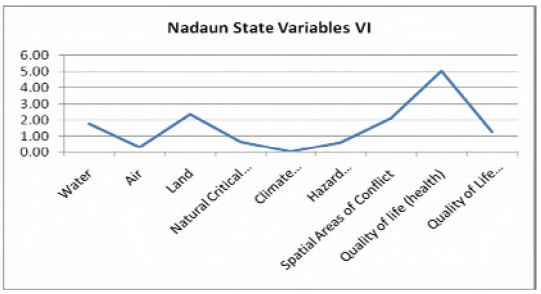




Description of Sectoral Vulnerability at Tehsil Level

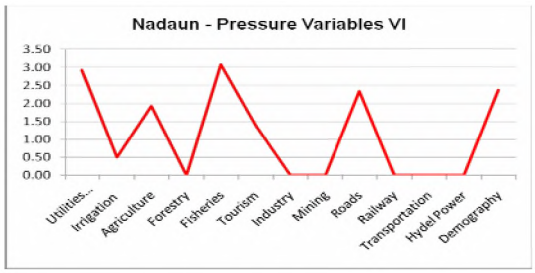
State & Pressure variables, have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Nadaun - Overall Vulnerability Index = 1.49



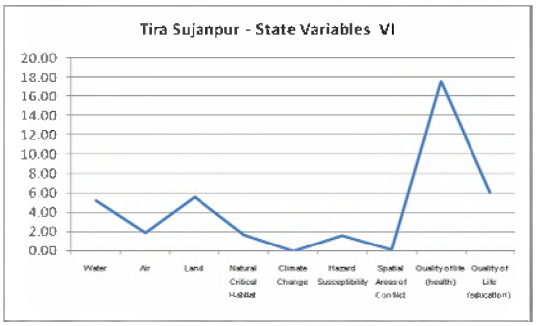
The Quality of life in terms of Health services is in the high vulnerability segment, and thus an improvement in attending the gaps in Health services shall help in reducing the vulnerability of the Tehsil. Rest of the variables are either in the low vulnerability or very low vulnerability segments.

The accessibility to Health facilities at three levels such as Primary, Community, referral/ district Health Centre required to be improved in view of demographic pressure i.e. as demand is more. A programme for the improvement in the Quality of Life in terms of Health services and improvement in health infrastructure is recommended.



No variable in the Pressure theme shows any major concern, as the variables indicates the moderate low or lower vulnerability.

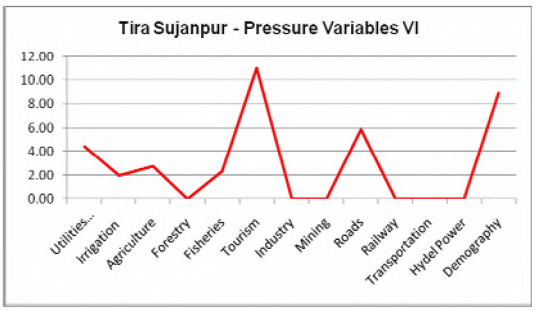
Tira Sujanpur - Overall Vulnerability Index = 4.04



The Quality of life in terms of Health services and infrastructure indicates the critical vulnerability stage, and thus an improvement of Health services and infrastructure may help in reducing the vulnerability of the Tehsil. It has also been observed that the abundance of water resources is indicating higher vulnerability in the Tehsil. Due to increasing tourism and demographic pressures the Land is also critically vulnerable and triggers change in land use. Inadequate educational facilities/ services indicates higher vulnerability thus needs improvement. Rest all variables are either in the low vulnerability or very low vulnerability segments.

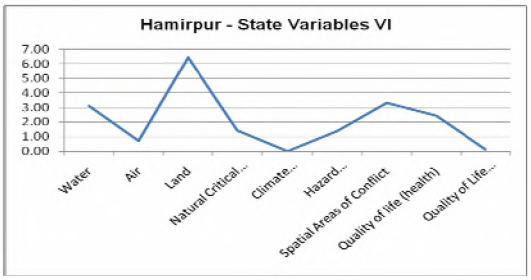
Tira Sujanpur crossed into the Moderately High Vulnerability segment and needs an effort in the Quality of Life and Critical Natural Habitat to help in bringing it down or at least in withholding at the same level.

The accessibility to Health facilities at all the three levels of need to be improved. Similarly, an effort in the variables for Quality of Life (Education) would also help in reducing the vulnerability. A programme for the improvement in the Quality of Life (Health) & (Education) is recommended. Tehsil level local Tourism Plan need to be prepared on priority with focus on Land requirement and its availability taking into account vulnerability of Land which has reached critical levels.

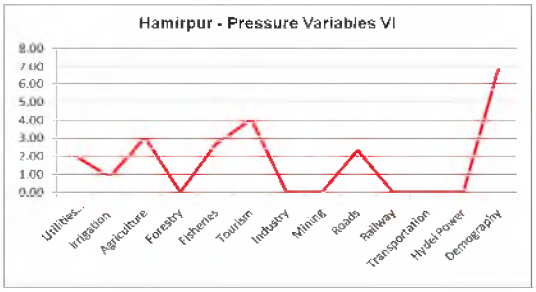


Tourism and Demography have crossed the critical vulnerability stage and thus plans have to be prepared for the sectors. The vulnerability due to the road network has emerged as an issue and a plan need to be developed to utilize the roads network optimum level that have been constructed already for providing additional/ improved health and education facilities to improve quality of life variables (Health and Education).

Hamirpur- Overall Vulnerability Index = 2.20

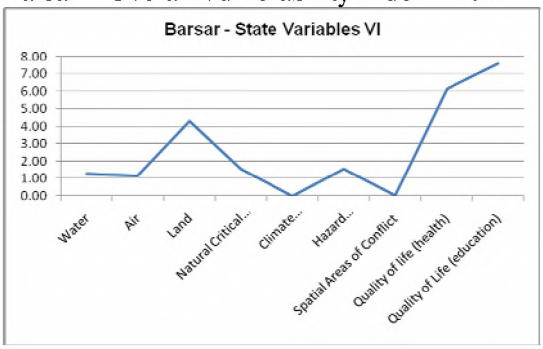


District headquarters have also been located in Hamirpur Tehsil and thus the land is under pressure due to land use change and excessive urbanization besides other sectors of development such as institutional expansion etc. Land diversion should be in conformity with development plans and future development needs. The Development Plans for Hamirpur Town need to be re-visited and plans for the entire Tehsil should be made taking into account the vulnerability of the Land. Rest all variables are either in the low vulnerability or very low vulnerability segments.



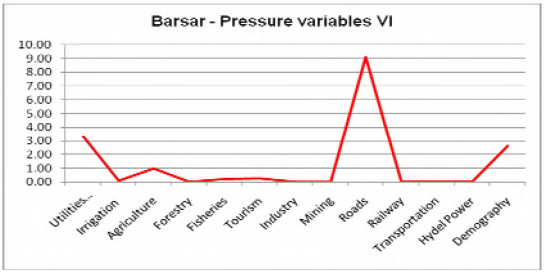
Demography sector has crossed the critical vulnerability stage and thus as recommended earlier action plans should be re-visited and reformulated. The Tourism sector shows moderate to high vulnerability, this is due to the District headquarter being situated in the Tehsil besides other institutional pressures.

Barsar - Overall Vulnerability Index = 2.22



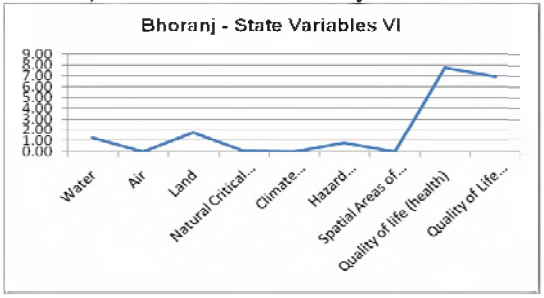
The most Vulnerable sate variables, that is Quality of life (Education) and (Health) have already crossed the critical vulnerability stage, thus, an improvement in attending to the deficient gaps in Quality of Life of (Education) and (Health) variable shall help in reducing the vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.

The accessibility to Education and Health facilities at all the levels needs to be improved. An effort in the variables for Quality of Life (Education) and (Health) would help in reducing the vulnerability. A programme for the improvement in the Quality of Life (Health) & (Education) is recommended.

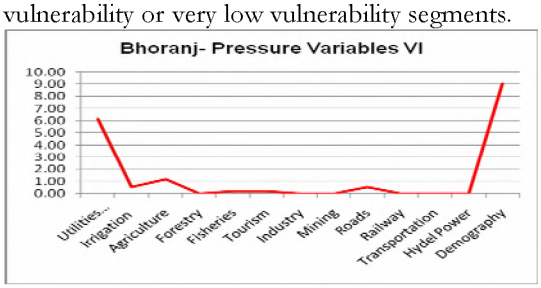


Of all the sectors, roads, which have already been executed, display a highly critical stage of vulnerability. A plan needs to be prepared to address the vulnerability of areas on account of road development and maintenance (both new and expansion of existing roads) in accordance with sectoral guidelines of Road and Transport.

Bhoranj - Overall Vulnerability Index = 1.72



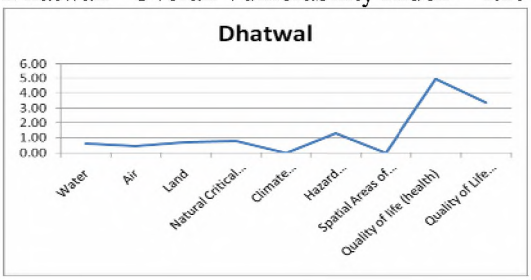
State variables, Quality of life (Education) and (Health) have already crossed the critical vulnerability stage, thus, an improvement in attending to the deficient gaps for improving the in Quality of Life of (Education) and (Health) shall help in reducing the vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.



The accessibility to Education and Health facilities at all the levels needs to be improved. An effort in the improving Quality of Life (Education) and (Health) would help in reducing the vulnerability. A programme for the improvement in the Quality of Life (Health) & (Education) is recommended.

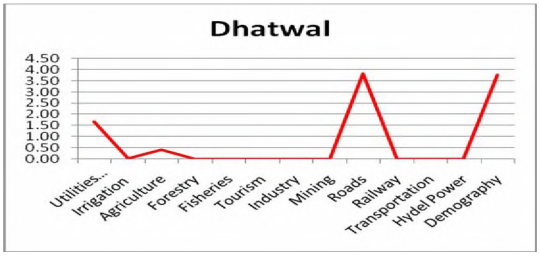
The Demography and Gaps in Utilities & Infrastructure have crossed the critical vulnerability stage. Projects in clustered approach for improving the gaps in utilities & infrastructure shall help reduce the vulnerability. All the other Variables of the Pressure theme have very low vulnerability and therefore may not require priority action. The high vulnerability of demography, predominantly in the rural segment is alarming.

Dhatwali - Overall Vulnerability Index = 1.14



The state variable, Quality of life (Health) is in the very high vulnerability segment, and thus an improvement in health services and infrastructure shall help in reducing the vulnerability of the Tehsil. Similarly, the Quality of Life (Education) variables are in the moderately high segment. Rest all variables are either in the low vulnerability or very low vulnerability segments.

The accessibility to health facilities at all the three levels need to be improved. Similarly, an effort in the variables for Quality of Life (Education) would also help in reducing the vulnerability. A programme for the improvement in the Quality of Life (Health) & (Education) is recommended.



Roads network, which have been provided, show a moderately high vulnerability. A plan needs to be prepared to address the vulnerability of areas on account of road development and maintenance (both new and expansion of existing roads) in accordance with sectoral guidelines of Road and Transport. Demography displays a high vulnerability trend in the Tehsil.

The high vulnerability of Demography, in the rural segment is alarming.

Vulnerability Levels in Regional Context:

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

Hamirpur

Sr. No.	Tehsil	VI	Adjoining Tehsil in Hamirpur District	VI	Adjoining Tehsil in Other District	District	VI
1	Nadaun	1.49	Tira Sujanpur	4.04	Rakkar	Kangra	0.89
			Hamirpur	2.20	Deragopipur	Kangra	2.01
			Barsar	2.22	Khundian	Kangra	0.89
					Bangana	Una	1.90
2	Tira Sujanpur	4.04	Hamirpur	2.20	Sandhol	Mandi	1.09
			Nadaun	1.49	Jaisinghpur	Kangra	0.82
					Khundian	Kangra	0.89
3	Hamirpur	2.20	Barsar	2.22	Sarkaghat	Mandi	1.05
			Bhoranj	1.72			
			Nadaun	1.49			
			Tira Sujanpur	4.04			
4	Barsar	2.22	Nadaun	1.49	Bangana	Una	1.90
			Hamirpur	2.20	Jhanduta	Bilaspur	1.91
			Dhatwal	1.14			
5	Bhoranj	1.72	Hamirpur	2.20	Sarkaghat	Mandi	1.05
					Baldwara	Mandi	0.74
					Ghumarwin	Bilaspur	2.10
6	Dhatwal	1.14	Barsar	2.22	Ghumarwin	Bilaspur	2.10
			Hamirpur	2.20	Jhanduta	Bilaspur	1.91

Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Hamirpur is surrounded by various Tehsils of District Mandi, Bilaspur, Una and Kangra, the vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils of District Hamirpur, except for Dhatwal Tehsil, as Tira Sujanpur is significantly higher than Hamirpur and Nadaun in the district and others also. The transitional impact of vulnerability possibly will give rise to higher vulnerability levels in Hamirpur and also in Nadaun when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.

Analysis & Recommendations

The preceding study and observations reveals that though the district comparatively is not high in the Vulnerability Index, yet there are indicators that the scenario may change negatively in times to come in case current growth patterns prevails. The pristine environment that exists today needs

to be preserved for tomorrow and ever-after. A series of observations and issues emerging there from, needs to be addressed as responses in terms of Policy, Plans, Programs and Projects. The temporal scale for each of these would be the Policy and the Plan as a long term response, the programme as the medium term response and the Projects as a short term response.

State Parameters

(i) As is observed from the analysis of the data available, the quality of life parameters in terms of health and educational services need to be addressed on priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters turn out to be parameters of prime significance.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometers, Community Health centre within a distance of 6 Kilometers and a Hospital within a distance of 10 Kilometers. Areas which do not have such facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Tira Sujanpur, Bhoranj , Barsar, Nadaun, Dhatwal and Hamirpur.

Though the scenario as far as quality of life (education) is somewhat better yet the gaps which exist, need to be addressed according to the norms stating accessibility to a Primary School within a distance of 2 kilometers, a Secondary School within a distance of 6 kilometers, a College within a distance of 10 kilometers, and a Vocational Institution within a distance of 25 kilometers. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Barsar, Bhoranj, Tira Sujanpur, Dhatwal, Nadaun and Hamirpur

The benchmarking of the norms has been done with a view of the terrain in the State.

(ii) A programme in collaboration among the stakeholder Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department may also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(iii) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken.

Detailed conservation and management plans for the water resources in the entire district are required at the moment as a preventive exercise. This type of intervention will help in sustainable management of water resources so that in case later any major water demanding Industrial corridor is established there would not be any detrimental impact on the water resources and the resource conserved sustainably.

Priority Tehsils- Tira Sujanpur, Hamirpur, Nadaun, Barsar, Bhoranj and Dhatwal.

It has been observed that there is a gap between the forest area and the forest cover and hence a specific programme for attending this gap is required to enrich this resource wealth of the district.

It is also inferred that in view of water scarcity and forest fires incidents in the districts, in entire district water ponds on the ridges in forest areas be created to hold and

store the surface run off from rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater and safety from forest fires.

Priority Tehsils (in descending order)- Hamirpur, Tira Sujanpur, Barsar, Nadaun, Bhoranj and Dhatwal

(iv) There is a need felt to recharge the ground water by developing the small check dams on the non perennial *khuds* and tributaries to improvise the irrigation scenario in the district.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from availability of infrastructural & utilities point of view, and has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. on other hand. It is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed State Level and District Level Plans for Tourism is required to be prepared.

(iii) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-designed/ re-fixed in the local context. Since the settlement patterns are very distinct, it is also felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. should be adopted.

(iv) The proposal to expand existing industrial area may be considered after proper environmental impact assessment and cost benefit analysis. The proposal to establish and expand industrial corridor should be carefully analyzed to prevent any adverse environmental impact and an environmental impact assessment study can be made mandatory in the regional context.

(v) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Natural Habitat	Critical		*		Programme and Projects to cover the gap Programme for maintenance

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
						of moisture content and ground water recharging
2	Quality of life (Health)			*		Programme to improve access
3	Quality of life (Education)			*		Programme to improve access
4	Spatial Areas of Conflict		*			Plan preparation to mitigate possible conflict
Pressure						
1	Roads		*			Policy Guidelines for environmental concerns
2	Tourism			*		Tourism Plan at State, District, and Destination Level
3	Utilities & Infrastructure			*	*	Tehsil level plan Cluster level projects

VI- 2001

	Nadaun	Tira Sujanpur	Hamirpur	Barsar	Bhoranj	Dhatwal
VI	3656.93	9890.36	5401.88	5449.13	4220.35	2804.23
denominator = 57x43			**2451**			
Normalized VI	**1.49**	**4.04**	**2.20**	**2.22**	**1.72**	**1.14**

Population Projections

	2001	2011	2021	2031	2041
Nadaun	91,410	104540	120237	138306	158547
Tira Sujanpur	43,189	49094	56152	64340	73643
Hamirpur	1,11,210	135544	163814	196056	232364
Barsar	50,090	55885	62705	70488	79152
Bhoranj	81,985	86820	93262	101184	110430
Dhatwal	34,816	26538	30419	35664	41629

Calculation of per capita share of VI

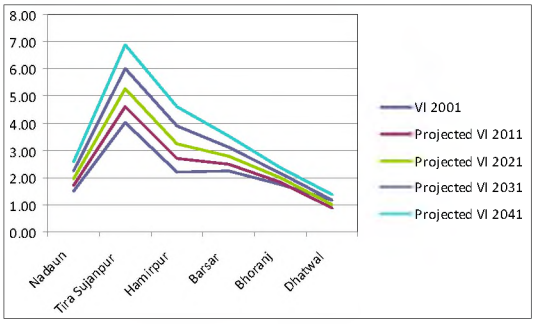
	Population 2001	VI 2001	Per Capita Share
Nadaun	91,410	1.49	1.63
Tira Sujanpur	43,189	4.04	9.35
Hamirpur	1,11,210	2.2	1.98
Barsar	50,090	2.22	4.43
Bhoranj	81,985	1.74	2.12
Dhatwal	34,816	1.14	3.27

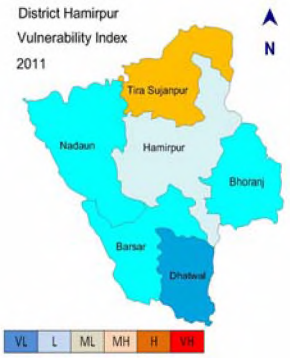
Calculation of Projected VI

	Pop 2001	VI 2001	per capita share	Proj Pop 2011	Proj. VI 2011	Proj Pop 2021	Proj VI 2021	Proj Pop 2031	Proj VI 2031	Proj Pop 2041	Proj VI 2041
Nadaun	91,410	1.49	1.63	104540	1.70	120237	1.96	138306	2.25	158547	2.58
Tira Sujanpur	43,189	4.04	9.354	49094	4.59	56152	5.25	64340	6.02	73643	6.89
Hamirpur	1,11,210	2.2	1.978	135544	2.68	163814	3.24	196056	3.88	232364	4.60
Barsar	50,090	2.22	4.432	55885	2.48	62705	2.78	70488	3.12	79152	3.51
Bhoranj	81,985	1.74	2.122	86820	1.84	93262	1.98	101184	2.15	110430	2.34
Dhatwal	34,816	1.14	3.274	26538	0.87	30419	1.00	35664	1.17	41629	1.36

Projected Vulnerability Index

	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Nadaun	1.49	1.70	1.96	2.25	2.58
Tira Sujanpur	4.04	4.59	5.25	6.02	6.89
Hamirpur	2.20	2.68	3.24	3.88	4.60
Barsar	2.22	2.48	2.78	3.12	3.51
Bhoranj	1.74	1.84	1.98	2.15	2.34
Dhatwal	1.14	0.87	1.00	1.17	1.36

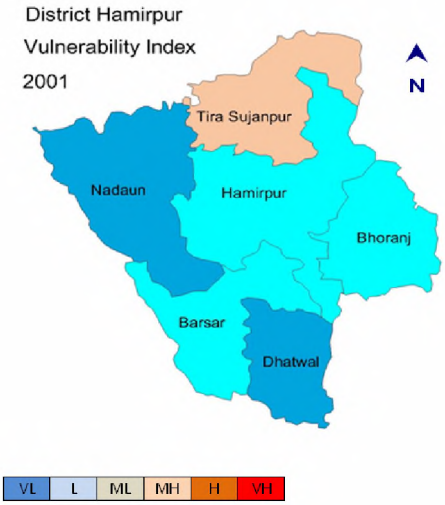


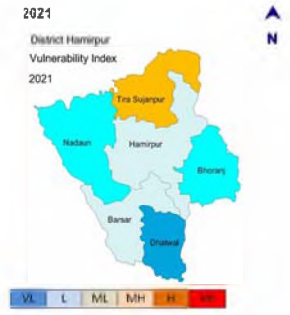


Tira Sujanpur moves to high vulnerability sector while Hamirpur moves up to moderately low vulnerability segment Rest of the Tehsils retain their low or very low vulnerability segments.

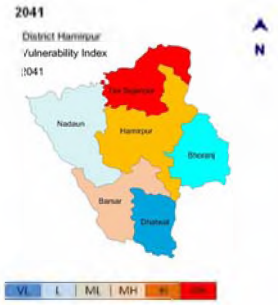
Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

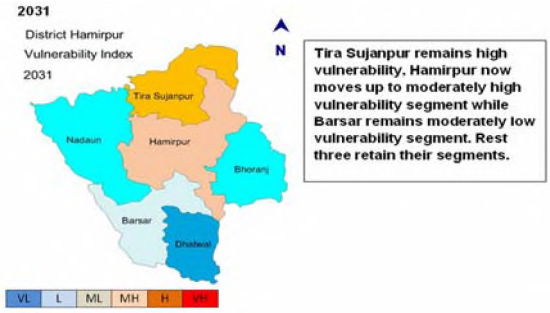




Tira Sujanpur and Hamirpur retain their high and moderately low vulnerability segment. Barsar now joins in the moderately low vulnerability segment from the low vulnerability segment. The other three remain in their segments



Tira Sujanpur goes critical ally vulnerable, Hamirpur becomes Highly vulnerable. Barsar moves up to moderately high vulnerability segment while Nadaun moves up to moderately low vulnerability segment from low vulnerability segment. Bhoranj remains low vulnerable and Dhatwal retains its very low vulnerability segment

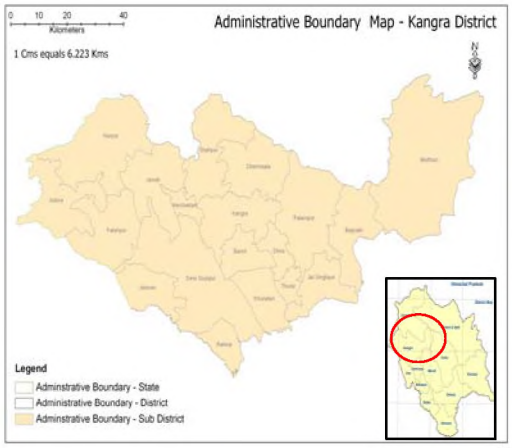


KANGRA

General Background

Kangra district forms a north-western part of the Himachal Pradesh. Kangra district is bounded in the north by Chamba district, on the north-east it touches Lahaul & Spiti district, on the east it is bounded by Kullu district, on the South by Mandi, Hamirpur and Una district and on the west by Punjab state. The district lies between 31^0 41´ 0´´and 32^0 28´ 05´´ in North latitudes and 75^0 35´ 34´´ and 77^0 04´ 46´´ in east longitudes. The district has a total area of 5739 sq.km. and constitutes 10.31% area of State. The district ranks first in population while fourth among area in all districts of state.

The district lies in the Shivalik lesser Himalayan zone and its topography is well defined by a series of almost parallel hill ranges which rise in height towards north–east. The altitudes generally vary from 400 metres to over 6,000 metres. The district is divided into 19 administrative units in terms of Tehsil/Sub Tehsil as follows (in descending order of area covered in sq.km.).



Tehsil/Sub Tehsil	Area (sq.km.)
Multhan	1014.8
Deragopipur	723.4
Nurpur	538.4
Palampur	433.3
Dharamsala	350.9
Jawali	303.8
Indora	301.6
Baijnath	288.1
Fatehpur	285.6
Kangra	275.0
Shahpur	249
Jaisinghpur	190.9
Khundian	190.1
Jaswan	172.1
Baroh	133.5
Rakkar	114
Dhira	82.4
Harchakain	72.5
Thural	58.2

Physiography

The district consists of series of parallel mountain ranges divided by longitudinal valleys, the general direction of which, from north-west to south-east, has determined the shape of the district. These ridges and

valleys increase gradually in elevation as they recede from plains and approach the snowy barrier which forms the northern boundary of district. *Dhauladhar* is the most important mountain range of the district which stretched out beautifully facing the fertile valleys of Palampur and Kangra. *Dhauladhar* range starts from the right bank of the river *Beas* and forms boundary of the district with Kullu district.



Thereafter the range passes through Banghal area above Kangra and Palampur valley covering *Bara Banghal* ridge, which is about 6,000 metres high from the mean sea level and thereafter runs parallel to another mountain range known as *Hathi Dhar* which forms boundary between Chamba and Kangra districts of the state. The *Paprola* range shuts out *Bir Banghal* from Kangra valley and this range after crossing Binoa at Paprola runs on to Mandi where it acquires the name of *Sikandar Dhar* and attains considerable elevation. Kangra valley and some areas of Dera Gopipur Tehsil fall in the *Beas* valley and the valley stretching from Shahpur on the banks of the river *Ravi* to Dhatwal on the border of Bilaspur falls in this zone. The basis of physiography, climate, natural vegetation, soil and geology, this district is divided into 5 sub-micro regions as follows:

Pir Panjal

This region is situated in extreme north–eastern part of the district spreading over Multhan sub-Tehsil consisting of Bara Banghal area. It is surrounded by Lahaul & Spiti district from north, by Kullu district from east, by Dhauladhar from south and by Chamba district from west. This region covers most rugged part of the district, with glaciers like *Shah, Sililaluni, Tabni Lahuni, Jeshari, Kudi, Biaru, Phulan, Bhadol, Karu, Tantgariomd Raighar* being the main physical feature in this region.



The elevation of this region varies between 2,429 metres and 6,023 metres above the mean sea level. *Ravi* river originates in this region and flows from east to west direction in the centre of the region. *Laluni Nala* and *Tantgari Nala* drain the waters of this region and join *Ravi* river on its right bank and left bank, respectively. This region has severe climatic conditions. In the western part of this region green patches of forests with mainly Pine trees are observed.

Dhauladhar

This region forms a horizontal tract running from north–west to south–east direction and includes North–Western corner of the Kangra Tehsil, north–eastern part of Dharamsala Tehsil, northern part of Palampur Tehsil and north–western, central and south–eastern parts of Baijnath Tehsil. The region is bounded by Chamba district from north–west, by Pir Panjal from north–east, by Kullu district from east, by Mandi district from south–east, while Kangra valley encloses it from south and south–west direction.



The elevation of this region varies between 1,819 metres and 5,194 metres above the mean sea level. Pine forests are observed in Bangahal areas while in the remaining areas species like Oak and Deodar are found. Several rivers and streams viz. *Brahi*, *Khauli*, *Bhated*, *Baner*, *Neogol*, *Awa*, *Luni* and *Uhl* which play major part in the drainage pattern of the district, originate in this region. Most part of this region remains under snow cover.

Kangra Valley

This region covers relatively plain areas of Kangra, Dharamsala, Palampur Baijnath tehsils and Dhira and Thural sub-tehsils stretching in north–west to south east direction. It is enclosed by Dhauladhar from north and north–east, by Mandi district from south–east, by *Beas* Basin from south, by Kangra Siwalik from south–west while Chamba district touches it from west.

The region is relatively plain and fertile, but in the north–western part adjoining Dhauladhar region, it is rugged and mountainous. The elevation of this region ranges between 626 metres and 2,184 metres above the mean sea level. Maximum tracts of this region fall between 600 to 900 metres of elevation. Important rivers/streams of this region are *Gaj*, *Baner*, *Neogal* and *Binno*. They originate from Dhauladhar and flow towards south direction and ultimately join the *Beas* River.

Kangra Shiwalik

This region extends over north-western and central parts of the district. It covers whole of Nurpur Tehsil, Baroh Tehsil and Harchakain sub-Tehsil, north–eastern Jawali Tehsil, south and south–western Kangra Tehsil, western Dhira sub-Tehsil, northern and eastern extremes of Dera Gopipur Tehsil, Western margin of Khundian Tehsil and very small tract of Palampur Tehsil. It makes its boundaries with Chamba district in the north, with Kangra valley in the north–east, with Beas Basin in the south–east and south and with Punjab state in the west.

This region is characterized by the hills of small heights and thus Hathi Dhar and Kali Dhar range are the two main physical features of this region. These ranges have highest altitude of 1,599 metres and 1,097 metres respectively. *Chakki Khad* in north–west direction forms the boundary of this region and separates it from Punjab state. Other rivers/streams which play an important part are *Jabbar*, *Bhul*, *Chhaunchh*, *Dehar*, *Gaj* and *Baner* and these are all the tributaries of *Beas* River. These are the source of irrigation facilities in this region.

Beas Basin

This region is formed of the western and southern parts of the district-covering whole of Indora, Jaswan, Jaisinghpur Fatehpur and Rakkar, south- western part of Jawali Tehsil, Dera Gopipur Tehsil except its north–eastern extreme, southern extremes of Dhira sub-Tehsil and Palampur, Baijnath tehsils and about 95 % are of Khundian Tehsil and Thural sub-Tehsil. It is bounded by Kangra Shivalik and Kangra valley in the north, Mandi district in the east, Hamirpur and Una district in the south and state of Punjab in the west. This region is relatively plain and has hills of lower elevation. Elevation in this region varies between 261 metres and 1,248 metres above the mean sea level. Solasinghi Dhar is the main physical feature of this region. *Beas* river is the lifeline of this region. The main tributaries of *Beas* river which join it on its right Bank are *Binno*, *Mandh*, *Neogal*, *Tall*, *Nakehr*, *Baner*, *Gaj*,

Dehar, Bhul, Chhaunch khads while *Sohan* river, *Ghamir, Gurhala, Daya, Chanaur, Ther, Nalsona and Sohari Khads* meet on its left bank in this region. The soil of this region is fertile and due to the availability of irrigation facilities, under intensive farming, crops are grown twice in a year. Maize and Potato are the main crops of this region.



The geological structure of this district pertains to Alluvium, Shiwalik, Murree Series, Jutogh groups, Granites (unclassified) and Panjal Traps formation. The soil in the district varies from sandy loam to clay. According to National Bureau of Soil Science & Landuse Planning (NBSS & LUP), ICAR, Nagpur, soils of the district are mainly classified as ochrepts (70) which are shallow black, brown and alluvial soils of northern region. Only in north–eastern extreme of the district Udalfs (20) soils are observed. The vegetation in the district varies from dry scrub forests at lower elevation to alpine pasture at higher altitudes. In between the two extremities occur distinctive vegetation zones of Chir, Ban, Oak, mixed coniferous (Kail, Spruce & Fir) and Kharsu Oak forests, scattered patches of forests are seen on the slopes of hills lying mostly in the central part of the district.

Culture and Social Brief

Fairs & Festivals

Kangra district is a land of gods and goddesses. Almost every village has a temple or shrine of the god, goddess or deity. Village folks are simple and religious in nature and love music. They participate in the fairs and the festivals, which are celebrated with gusto and devotion. Some of the important fairs and festivals held in the district are: *Jwalaji Fair,* Mela *Sujan Bharti, Champa Fair, Mela Shah Abdul Rehman,* Baba *Dayalgir Fair, Mela Pir Mahu, Dhamu Shah Fai and Naoni Fair.*



Places of Historical, Archaeological and Religious Importance and Tourist Interest

Besides nature's splendour, which manifests in imposing Dhauladhar, enchanting snow-clad peaks, abundant conifers, verdant green slopes, picturesque valleys, beautiful orchards, terraced fields and sparkling restless brooks, Kangra district has got rich heritage of art and culture. There are still a number of ancient temples and archaeological remains found all over the district. Some places of interest in the district have been briefly described below:

Dharamsala

Dharamsala, the district headquarters, lies on a spur of Dhauladhar amidst picturesque surroundings. With dense pine, deodar and rhododendron forests, numerous streams, cool healthy air and magnificent snow clad Dhauladhar ranges in the backdrop. Dharamsala is most popular tourist resort in the district. The town covers a wide area and overlooks the spread of the plains in the form of twin settlement. Lower Dharamsala (1,380 metres) is a busy commercial centre while upper Dharamsala (1,830 metres) with the suburbs of Mcleodganj and Farsyth

Ganj, retains a British flavour. The charming church of St. John in the Wilderness is situated here and this is the final resting place of Lord Elgin, the British Viceroy, who died here in the year 1836. Dharamsala has also become the headquarters of His Holiness the Dalai Lama and a large Tibetan community has settled here. There is also a Buddhist Monastery. Bhagsu Nag and Tirund are two beautiful picnic spots of Dharamsala.



Kangra

This town is at a distance of about 18 kms. from Dharamsala and serves as the headquarters of the sub-division, Tehsil and Panchayat Samiti. The place is famous for its fort, which was ruined in the earthquake of 1905. There is also a temple of Brejeshwari Devi. Navratra fairs during March-April and September-October attract a large number of visitors.

Baijnath

It is situated at a distance of about 18 kms. from Palampur on Dharamsala – Mandi road. The place is famous for its two Hindu temples bearing inscriptions of the 8th century A.D.



Jawalamukhi

This place is at a distance of about 54 kms. from Dharamsala and is famous for the temple dedicated to goddess Durga who manifests in the form of eternal flame from the rocks. The temple is built over natural jets of combustible gas. It is a renowned place of pilgrimage for the Hindus. There is no idol in the temple and the flaming fissures are the objects of worship. Fairs are held here during the Navratra days which attract a big crowd from all over the country.



Dadh

This place is at a distance of 15 kms. from Dharamsala and 5 kms. from Malan on the Pathankot – Baijnath road. The place is famous for the temple of Chamunda Devi, which is situated on the bank of *Baner* stream. As per legend Chamunda Devi is said to have killed two demons Chand and Mund. The place draws big crowds during

the Navratra days in March – April and September – October.

Palampur: It is at a distance of 50 kms. from Dharamsala. The Dhauladhar ranges rise just beyond Palampur.

Masrur: This place is at a distance of 35 kms. from Dharamsala. The place is famous for a group of well-known Shikara type monolithic rock cut temples of Indo-Aryan architecture and is quite ancient.



Nurpur: It is situated on the Kangra valley road and is about 66 kms. from Dharamsala. It's ancient name was Dhameri. Nurjahan, the famous queen of the Mughal emperor Jahangir, liked the place very much and renamed it as Nurpur. The remains of old fort built by Raja Basu about 1,000 years ago. The town is famous for its wool spinning industry and the shawls made here are highly prized.

Besides the places of religious importance and tourist interest, Kangra district is rich in antiquarian remains belonging to different religions. Most of the ancient temples in the hinterland escaped destruction at the hands of the foreign invaders because of the inaccessibility of the area from the plains. These are the rock cut temples of Masrur, Shiva temple of Baijnath. Indreshvara temple of Kangra. Brejeshwari temple of Bhawarna, a suburb of Kangra town, Bhimtila near Chetru, temple of Basheshar Mahadev in Upper Dharamsala, Thakurdwara at Fatehpur and the tomb of Lord Elgin in Upper Dharamsala.

Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables:

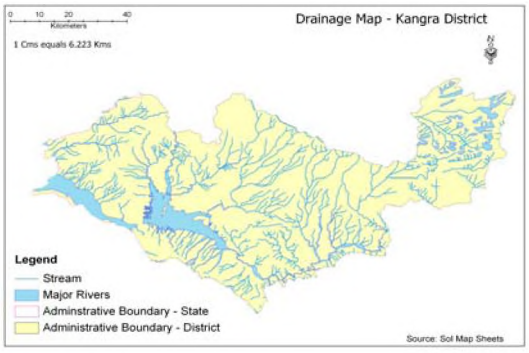
The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Kangra district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

The *Beas* is the principal river which receives almost the entire drainage of the district. The river rises from the *Pir Panjal* range near *Rohtang* pass at a height of over 4,000 metres from the mean sea level.

The river after flowing through Kullu and Mandi district enters Kangra district at Sanghol in Jaisinghpur Tehsil. From this point, the river takes a south–west turn and enters the valley of Nadaun in Hamirpur district. Here the Jaswan chain obstructs its further passage to south and the river flows in the north–west direction almost parallel to the strike of the hills. At Mirthal ghat beyond Hajipur the hills subside and the

liberated water flows in an uninterrupted direction towards the plains. The river is at its lowest during the winter months of December, January and February and at the highest during the rainy months of July and August.



The important tributaries of River Beas are:

Awa River: This rises from Dhauladhar range in Kangra valley of Himachal Pradesh. It flows in southwesterly direction before joining river *Beas*.

Baner River: It is the tributary of *Beas* river and drains central part of Kangra valley. It rises as small snow fed channel on Southern slopes of Dhauladhar range near Palampur. The general direction of River is towards South-West.

Gaj Khad: It rises as small stream from the snows on southern slope of Dhauladhar range in Kangra district. It joins *Beas* rver a little upstream of Pong Dam.

Luni River: It rises from south slopes of Dhauladhar in Kangra valley and merges with *Beas* river in central part of Kangra Valley.

Manuni River: It rises from southern slopes of Dhauladhar range and joins river *Beas*. Steep slopes form the upper catchment of Manuni River.

Suketi River: It is a tributary of river *Beas* in Kangra Valley. It rises from south facing slopes of Dhauladhar range. The river has formed huge terraces most of which are under cultivation.

Uhl River: It rises as two feeder channels to the north of Dhauladhar range and thereafter the two channels cross the gigantic mountain barrier and merge at base of Sothern slopes to form the main channel of *Uhl* river in Kangra area.

Climate

The climate in the district unfolds four broad seasons. The winter generally spreads over from December to February. The period from March to June is summer. Hot and rainy season generally extends from July to September. October and November exhibit autumn while the places at high altitudes are covered with deep snow during the winter months. The temperature during the winter months even in the lower areas is too cold because of the lashing cold breeze of the mountain ranges of *Dhauladhar* and *Hathi Dhar*. The places lying at higher altitudes are too wet in the rainy season and Dharamsala, the headquarters of the district receives the plentiful rains during the summer months. In the valleys and southern parts of the district the days are extremely hot. During the monsoon period the land becomes fresh and green and the small water channels in the hills begin to swell.

Precipitation/Rainfall

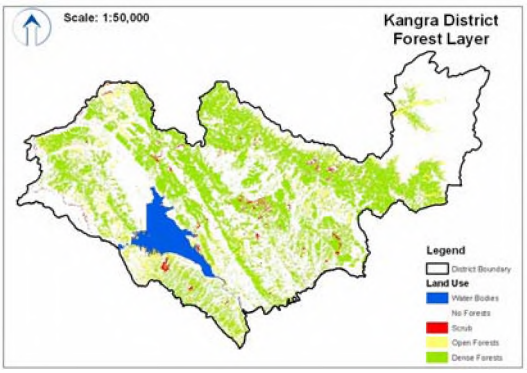
The maximum rainfall is observed in the district during July to September and minimum in the month of April and October. The climatic conditions prevailing in the Kangra district are most useful for the growing food crops, forestry, tea plantation, floriculture and other natural herbals. The district has an average annual rainfall of 2136 mm.

Precipitation/ Rainfall

Particulars	Maximum	Minimum
Rainfall	3000 mm	900 mm
Temperature	38°C	0°C

Forest & Wildlife

The forests of Kangra district have a great variety of vegetation due to variations in altitude, geological formations and climatic factors. The forests are situated for the most part on the northern slopes of the hill ranges and contain much useful timber. The vegetation varies from the tropical bamboo which clothes the lower hills to alpine vegetation, oak, pine and rhododendron of higher ranges. In between two extremities occur distinctive vegetation zones of chil, ban-oak, mixed coniferous (kail, spruce & fir) and Kharsu oak forests. The forests of Kangra can be classified into seven main groups.



Miscellaneous scrub forests: These forests are mainly found between 600 metres and 1,200 metres elevation and are composed mainly of tree/scrubs of Khair, Kachnar, Siris, Kakrain, Thingan bil etc. The under-growth consists of garna, mander, basuti, gandla etc. The forests are generally open, degraded and getting crowded due to over grazing and excessive exercise of various rights.

Chil forests: The chil forests occur between elevations of 800 metres to 1,700 metres. The best growth is however, between 1,200 metres to 1,700 metres.

Ban-oak forests: These forests occur at elevation from 1,600 metres to 2,300 metres. There are, however, a few exceptions like the oak forests of Dhalun near Yol cantonment, Shahpur, Manjgran and Khaniara where these forests have gone down to about 800 metres elevation.

Deodar forests: Deodar forests are only found in Dharam Kot forests near Mcleodganj town and are exclusively of artificial origin.

Mixed coniferous (Kail, spruce and Fir): These forests are only patchy between 2,100 metres to 3,000 metres elevation. Kail forests are practically absent. Towards the upper most extremities Kharsu oak is found intimately mixed with fir and spruce. The common associates are walnuts, horse chestnut, duri, *Acer* species, *Ulmus* species etc.

Kharsu Oak forests: These forests are found between the altitudinal zone of 2,300 metres to 3,800 metres, the upper most limit of tree growth. This Oak generally occurs as a pure crop, spruce and fir are found scattered individually or in small groups of sites suitable for these species.

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km. distance in a day and cover the scattered population.

Alpine Scrub and Alpine Pastures: This type extends in this region above 3,800 metres elevation and is represented by extensive alpine meadows with a few scattered patches of evergreen branchy scrub of junipers, *Acer* and rhododendron. The meadows are mostly composed of perennial herbs and grasses.

Kangra forests have a large number of aromatic and medicinal plants which can be utilized for the pharmaceutical and Ayurvedic medicines like dhoop, Karu/Kour, brahmi, kuth/khuth, bankakri etc.

Forest Area under Control of Forest Department

Type of Forest	Area (sq.km.)

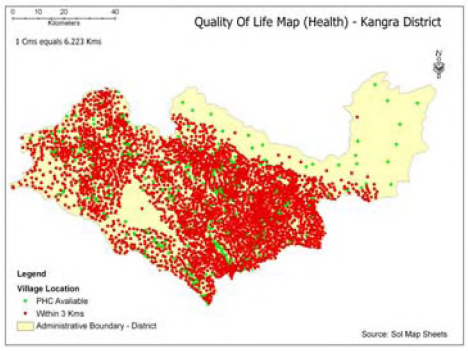
Reserve Forest	76.01
Protected Forest	549.51
Unclassified Forest	1644.34
Other Forest	571.97
Total	**2841.83**

Quality of Life (Health)

Availability of Health facilities is one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector. Of the total 3619 inhabited villages 3616 doesn't have hospitals while 3572 villages are devoid of primary health centres. Of these 439 villages have hospitals within 5 kms. 862 have these between 5-10 kms. while 2315 villages avail this facility at 10+ kms. As regard to primary health centres 1435 villages enjoy this facility as less than 5 kms. 1180 have it at 5-10 kms. while 939 villages have the primary health centres at 10+ kms.

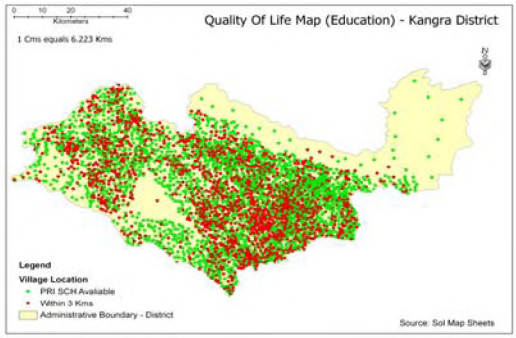
The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

In fact, to summarize, according to 2001 census, 51.08% villages doesn't have access primary health centre within 3 kms. 51.14 % villages doesn't have access to community health centre within 6 kms. and 63.24 % villages don't have hospital facility within 10 kms.



Quality of Life Education

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. A number of villages do not have educational facilities within the village at district level. They have to go out of their village to avail these facilities. Of the total 3619 inhabited villages, 1750 villages doesn't have primary schools; 2895 doesn't have middle schools and 3610 villages doesn't have degree colleges. Of these in case of primary schools 1712 villagers avail this facility at less than 5 kms. 35 villages have these at 5-10 kms. while in 3 villages it is at 10+ kms. With regards to secondary schools 2618 villages have this at less than 5 kms.; 250 villages have this at 5-10 kms. while 27 villages have this at 10+ kms. 480 villages have degree colleges at less than 5 kms. 976 villages have this at 5-10 kms. while 2154 villages avail this facility at 10+ kms.



To summarize, according to Census of India 2001, on an average across the district, 27.87 % villages do not have access to Primary School within a distance of 2 Kms (a distance which could be walked by the child), 44.50 % villages doesn't have secondary school within a distance of 6 kms.

57.86 % villages doesn't have colleges within a distance of 15 kms. and 95.3 % of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Kangra such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Kangra district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Kangra district is 1,339,030 comprising of 661,254 males and 677,776 females **(the Census of India, 2011 gives a provisional population figure of 1507223 with a density of 263 per sq.km. Data at tehsil level is not available)**. This population of the district forms 22.0 % of the State population and ranks at 1st place among the districts. Out of the total population of the district 94.6 % lives in rural areas while 5.4 % lives in urban areas. Rural population of the district is distributed among 19 Tehsil, sub-Tehsil and urban population is spread over in 9 towns. The total urban population in the district is 72,285 persons comprising 37,995 males and 34,290 females. The total rural population in this district comes to 1,266,745 persons and is composed of 623,259 males and 643,486 females. This rural population is distributed in 3,619 villages of 19 Tehsil. Out of the total 3,868 villages in the district, 3,619 are inhabited villages while 249 villages are uninhabited. The concentration of villages are mainly along the plain area, valleys of rivers and streams as well as on undulating slopes while higher altitude areas are mostly devoid of any habitation. Total number of households in the district is 272,487 and average size of household is 5 persons per household according to 2001 Census.

Population Growth

According to the 1991 Census the total population of the district was 1,174,072 which rose to 1,339,030 in 2001 Census. The decadal growth rate of district works out to be 14.1%. The growth rates for the rural and urban areas of the district are 13.6 and 21.8 % respectively.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001											
Tehsil/Sub Tehsil	Population						Percentage decadal variation 1991-2001			% urban population	
	1991			2001							
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
Nurpur	129884	129923	7961	151661	142595	9066	+16.8	+17	+13.9	+6.1	6
Indora	58655	58655	_	71479	71479	_	+21.9	+21.9	_	_	_
Fatehpur	47710	47710	_	53562	_	_	+12.3	+12.3	_	_	_
Jawali	85796	85796	_	98907	_	_	+15.3	+15.3	_	_	_
Harchakain)	11091	11091	_	12182	_	_	+9.8	+9.8	_	_	_
Shahpur	56677	56677	_	66010	_	_	+16.5	+16.5	_	_	_
Dharamsala	100159	73356	26803	117463	82330	35133	+17.3	+12.2	+31.1	+26.8	29.9
Kangra	127483	113961	13522	146601	131788	14813	+15	+15.6	+9.5	+10.6	10.1
Baroh	21924	21924	_	23452	23452	_	+7	+7	_	_	_
Dera Gopipur	131729	123854	7425	149091	139824	9267	+13.6	+12.9	+24.8	+5.7	6.2
Jaswan	28448	28448	_	30763	30763	_	+8.1	+8.1	_	_	_
Rakkar	25876	25876	_	27252	27252	_	+5.3	+5.3	_	_	_
Khundian	32159	32159	_	33858	33858	_	+5.3	+5.3	_	_	_
Thural	17111	17111	_	17754	17754	_	+3.8	+3.8	_	_	_
Dhira	18564	18564	_	20112	20112	_	+8.3	+8.3	_	_	_
Jaisinghpur	56830	56830	_	58263	58263	_	+3.2	+3.2	_	_	_
Palampur	142090	138452	3638	167961	163955	4006	+18.2	+18.4	+10.1	2.6	2.4
Baijnath	74474	74474	_	84801	84801	_	+13.9	+13.9	_	_	_
Multhan	7862	7862	_	7498	7498	_	-1.6	-1.6	_	_	_
District Total	**1174072**	**1114723**	**59349**	**1339030**	**1266745**	**72285**	**+14.1**	**+13.6**	**+21.8**	**5.1**	**5.4**

Density

The density of population in Kangra district is 233 persons per sq. km. against the state average of 109 persons. This district is most populous in the state. In rural areas, the density of population comes 222 persons per sq.km. while in urban areas it comes to 2,054 persons. At Tehsil/sub-Tehsil level, the density of population varies between 533 persons in Kangra Tehsil and 7 persons in Multhan sub-Tehsil. Among urban areas, the highest density of 5,816 persons has been recorded in Mant Khas C.T. and lowest 1,096 in Jawalamukhi N.P.

Sex Ratio

There are 1,025 females for every thousand males in Kangra district. The sex-ratio figures for rural and urban areas of the district are 1,032 and 902 respectively. It is also observed that, the proportion of females in rural areas is higher than that of urban areas. At Tehsil level, it varies between 1,094 females in Baroh Tehsil and 951 in Dharamsala Tehsil. Among urban the highest sex ratio of 983 females has been recorded in urban areas of Kangra Tehsil and lowest 857 in urban areas of Palampur Tehsil.

Work Participation rate

According to 2001 Census, the total workers including main and marginal workers constitute 44.0 % of the total population of the district. Of the total workers, the share of the main workers is 25.1 % and the marginal worker is 18.9 %. The remaining 56.0 % of population belongs to the category of non-workers. As per 2001 Census, among the main workers male participation rate in the district is 36.6 % and corresponding proportion of females is 13.9 %. Male and female marginal workers account for 14.1 and 23.5 % respectively. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or more economic activities in addition to their household duties to improve the family income. At Tehsil level the highest percentage of total workers has been recorded in Rakkar sub-Tehsil (66.7 %) and is followed by Khundian Tehsil (65.0 %). Nurpur Tehsil has lowest proportion of 32.3 %. It is observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than that of the female main workers.

Urban Population

The Urban population of the district is spread over 9 Urban Centres as follows:

Size Class of Town	Name & Civic Status of Town	Urban Population
VI	Deragopipur Nagar Panchayat	4336
IV	Dharamsala Municipal Council	19124
VI	Jwalamukhi Nagar Panchayat	4931
V	Kangra Municipal Council	9156
V	Mant Khas Cantonment Board	5234
V	Nagrota Bhawan Nagar Panchayat	5657
V	Nurpur Municipal Council	9066
VI	Palampur Municipal Council	4006
IV	Yol Cantonment Board	10775

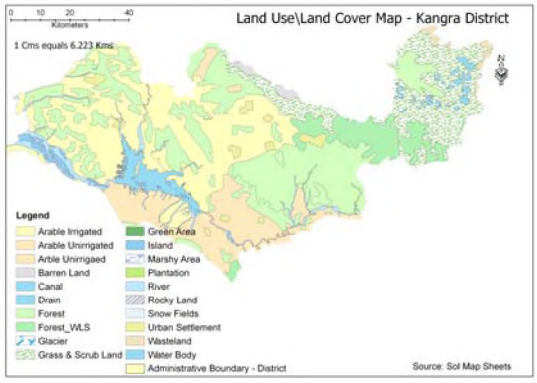
Literacy

As per 2001 Census Kangra district reported 940,505 persons as literates constituting 80.1% of the total population excluding 0-6 age-group population. The proportion of male and female literates in the district is 87.5 and 73.0 % respectively. The literacy rate of males is much higher than that of females. The difference of male and female literacy rate is 14.5 points in the district. The total literacy rates of rural and urban areas are 79.7 and 86.6 % respectively. The proportion of male and female literates in rural areas is 87.4 and 72.5 % respectively. In urban areas this proportion is 90.1 and 82.8 % respectively. Females are better educated in urban areas than their counterparts in rural areas. Rakkar sub-Tehsil ranks at the top with 83.4 literates. The lowest literacy of 56.9 % is found in Multhan (1 %) sub-Tehsil.

Land Use

Classification of Area	Land Utilization (sq.km.)
Total Geographical Area	5779.43
Forest	2231.50
Barren and unculturable land	986.31
Land put to non-agricultural uses	1269.05
Culturable waste	106.36
Total cropped area	2216.83

Source: District Statistical Abstract, Kangra-2000.



Agriculture

Agriculture is the main occupation of the people in the district. The agro-climatic conditions prevailing in the district are favorable for the growing of food crops such as wheat, paddy, maize, oil seeds, potato, sugarcane etc. Tea & potato are the two cash crops.

There are two types of crops, 'rabi' and 'kharif'. Rabi crop is sown before winter and harvested in the months of April & May. The popular Rabi crops are wheat, barley, gram and oil seeds. The Kharif crop is sown before the monsoon and is ready for harvesting in September-October. The main kharif crops are maize, paddy, oil seeds, pulses, spices & potatoes.

Tehsil-Wise Area under Principal Crops

Name of the crop	Tehsil wise Area (1998-99)						
	Kullu	Manali	Saini	Banjar	Ani	Nermad	Total

Cereals	18,573	2,562	3,424	5,667	6,804	8,492	45,522
Pulses	1,157	153	269	364	339	562	2,844
Others	834	59	209	179	418	133	1,512

A brief description of Rabi & kharif crops grown in the district is as follows:

Wheat: Wheat is grown in all parts of the district but the areas of tehsils of Dera Gopipur and Palampur are most suitable for the cultivation of wheat. Cultivation of Barley is done mostly in Dera Gopipur. It is sown with wheat or gram.

Maize: Maize is the major crop in the district and the staple food of majority of the people for almost half of the year.

Paddy: Paddy crop is grown in irrigated areas of Kangra only.



Potato: Potato is the major cash crop of Palampur and Kangra tehsils. The cultivation has also been extended to other Tehsil where the irrigation facilities have been provided. It is grown in both Rabi and Kharif crops. Out of the total 2216.83 sq.km. cropped area 1031.62 sq.km. are under double cropping pattern.

Tea plantation: Tea plantation in Kangra district is done at an elevation ranging from 800 metres to 1,600 metres above the mean sea level. The cultivation is done on well-drained medium loam soil on the slopes of hilly land with annual rain varying between 175 cms to 375 cms. Green and black tea is produced in the district. With the setting up of processing factory at village Bir in Palampur Tehsil the quality of production has improved considerably.

Irrigation

Kangra district is drained by several perennial rivers and khads which provide vast potential for development of irrigation facility to the cultivated area. But much headway has not been made to develop the sources of irrigation. Cultivated area is mainly irrigated by means of kuhls by diverting the water of streams through the kuhls. The net cultivated area in the district is 1185.21 sq. kms. and out of which 321.94 sq.kms. is irrigated. The proportion of net irrigated area is only 27.16 % of the total net cultivated area which shows that more than 70 % of area depends on rainfall for irrigation. The main source of irrigation in the district is lift canals, government canals, private canals, tube-wells and wells etc.

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

Irrigated area (source-wise) from 1998-99 to 1999-2000

Year	Source wise irrigated area (in hectares)				
	Canal/Kuhl	Tank	Well and Tube Well	Others	Total
1998-1999	30,128	-	2,056	-	32,194
1999-2000	30,128	-	2,056	-	32,194

Livestock

Livestock is the main wealth next to agriculture of rural population. The slopes of Dhauladhar have concentration of Gaddi population and rearing of sheep and goats is main occupation of people. Almost every household in rural areas keeps a few cows, buffaloes, sheep and goats. Besides, some also rear pigs and keep poultry birds. Animals are kept for milk, meat and providing manure for the fields. Kangra district has a large number of livestock.

Livestock and Poultry (according to 1992 Live stock Census)

Particular of Livestock and Poultry	Total
Cattle	399,398
Buffaloes	147,858
Sheep	154,590
Goats	206,039
Pigs	1,543
Others (including Horses and Ponies)	9,040
Total	918,468
Poultry	281,585

In Kangra district 6 chilling plants are functioning at Dagwar, Darkoti, Kotla, Bindraban, Milwa, and Raja-ka-Talab.

Horticulture

Climatic conditions prevailing in the district offer a great scope for growing of fruit plants, which improve the economy of the district. Kangra district has immense potential for growing of citrus fruits, mangoes, loquat, and pomegranate, papaya etc. Predominantly, Citrus and sub tropical fruits are produced in the district. Other temperate fruits and nuts/dry fruits are also grown. A small area grows Apples.

During the last 30 years, steps have been taken to gear up the tempo of progress and more area is being brought under fruits.

One fruit processing unit in the Kangra district have been established at Nagrota Bagwan for the manufacture of fruit product and providing training facilities in fruit preservation to the local orchardists.

Fisheries

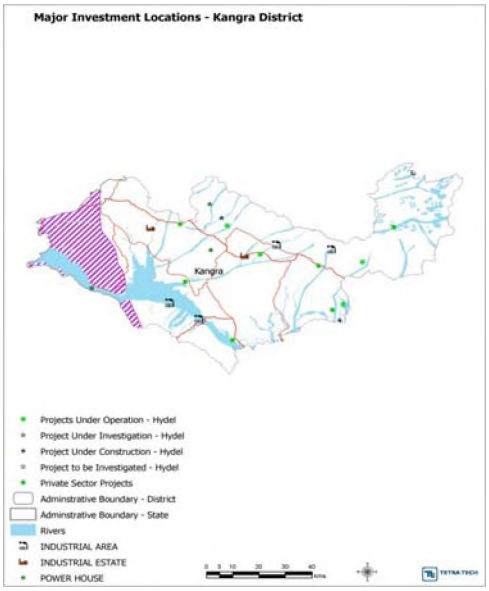
Kangra district is traversed by 500 – 600 kms. of rivers and streams which form major riverine fisheries resources for the rural masses and fishermen. Kangra district has about 400 hectares in the shape of rural ponds. The fish breeding farm is situated in Kangra town to meet the demand of the fish seed. There is about 40-50 kms. stretches of rivers namely *Boher, Neryal* and *Binwa* where the propagation of trout fish seed is done. A National fish seed farm has been established in village Meelavan in Indora Tehsil of the district.

There is a vast man-made lake in the district known as Pong Reservoir which has been formed by constructing dam on river *Beas* in the year 1974. It has a total area of 246.29 sq. kms.

Industries

District has many resources of water, hydropower, minerals, and forests, cool and dust free climate. All these factors provide favorable condition for setting up agriculture based food processing and electronic industries in the district. The chances of setting up of large scale industries are rare. However, there is much scope for the small and medium size industries. Kangra district has tea processing factory at Baijnath, Bir, Palampur and Sidhwari. Suraj industries at Sansarpur Terrace is engaged in the manufacturing of vanaspati ghee while another industrial unit at Kandori known as Him Ispat Ltd. is manufacturing cold rolled steel strips, Three industrial estates have been set up to provide infrastructure facilities to the entrepreneurs at Kangra, Jawali and Dera Gopipur-Gopipur in the district. Besides these, seven industrial areas namely Nagoya Bagwan, Nagri, Dhaliyara, Sansarpur Terrace, Baib Attariyan, Nagrala and Raja-Ka-Bagh have been set up to

attract the entrepreneurs from the different parts of the country.



Some other important small and cottage industries, based on local raw material are dhoop making (in Jwalamukhi & Kangra), Lac (in Nurpur & Deragopipur), Kattha (Kangra) and Slate (in Dharamkot, Bhagsu, Jia, Kangra Narwana, Chachoana, Deol, and Kanbari).

Apart from this, handloom and handicrafts are also an important cottage industry of the district. Handloom work, such as Floral Shawls, Carpet Weaving, Gudmas and Namdas, Bed Sheets, Woollen Sweaters and Mufflers are produced in various parts of the district, employing good number of local people, Wooden Work, Bamboo Work and Pottery is also providing gainful employment to the people.

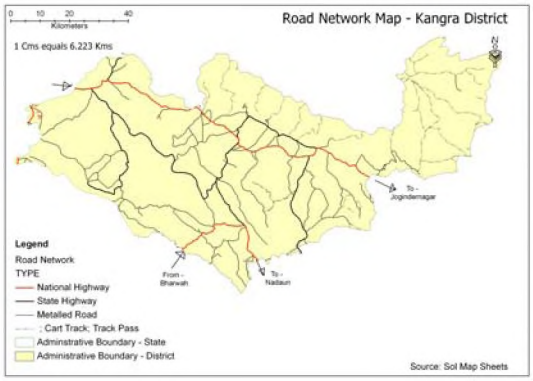
It is observed that the western part of the district especially parts of Jaswan, Fatehpur, Indora and Nurpur have been identified as part of the proposed Industrial Corridor that would extend from Paonta Sahib up to Nurpur through Sirmaur, Solan, Bilaspur and Una districts.

Minerals & Mining

Number of economic minerals are found in the district but except limestone and slate none have commercial significance.

Limestone: It is basic raw material for the manufacture of cement. The occurrences of lime stone at Dharam Kot studied by the Geological Survey of India has revealed 18.80 million tones of cement grade lime stone which is yet to be exploited for commercial use.

Slate: The roofing slates of good quality are in abundant. The slates are being quarried at Khaniara, Kharili, Bogsu and north of Yol Cantt.



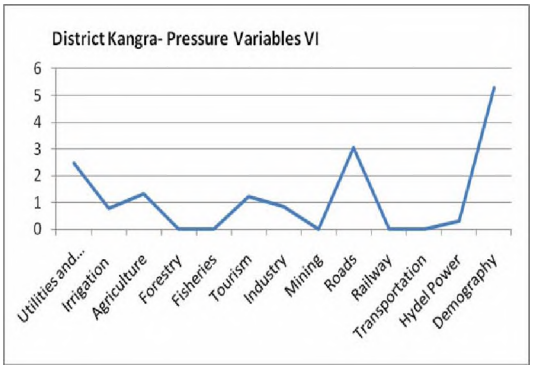
Natural Gas: The occurrences of natural gas in Jwalamukhi areas are known from very early times. The ever burning gas flame in the temple is still in existence. The drilling operations carried out by the Oil and Natural Gas Commission have established the existence of natural gas but has also concluded that the extraction is not economically viable.

Summary of State Variables at District Level

Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district

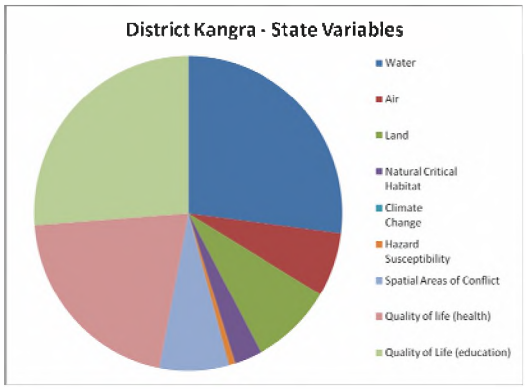
Kangra. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

The analysis of data indicates that the District has adequate water resources. A substantial portion of the District is also prone to Hazards. Inadequate Health and education infrastructure and services indicates the deficiencies in these sectors resulting in vulnerability.



Kangra District- State Variables – Analysis at the District Level

Kangra Variable Sector	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	20906.33
Air	5087.58
Land	6673.36
Natural Critical Habitat	2233.23
Climate Change	0.00
Hazard Susceptibility	525.61
Spatial Areas of Conflict	5616.37
Quality of life (health)	16070.23
Quality of Life (education)	20274.28

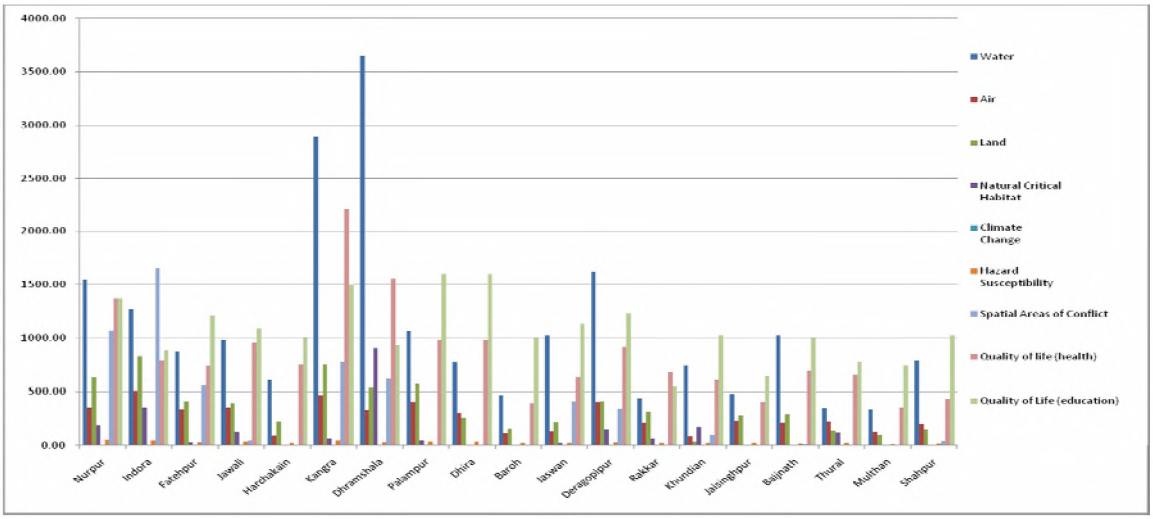


State Variables at Tehsil Level

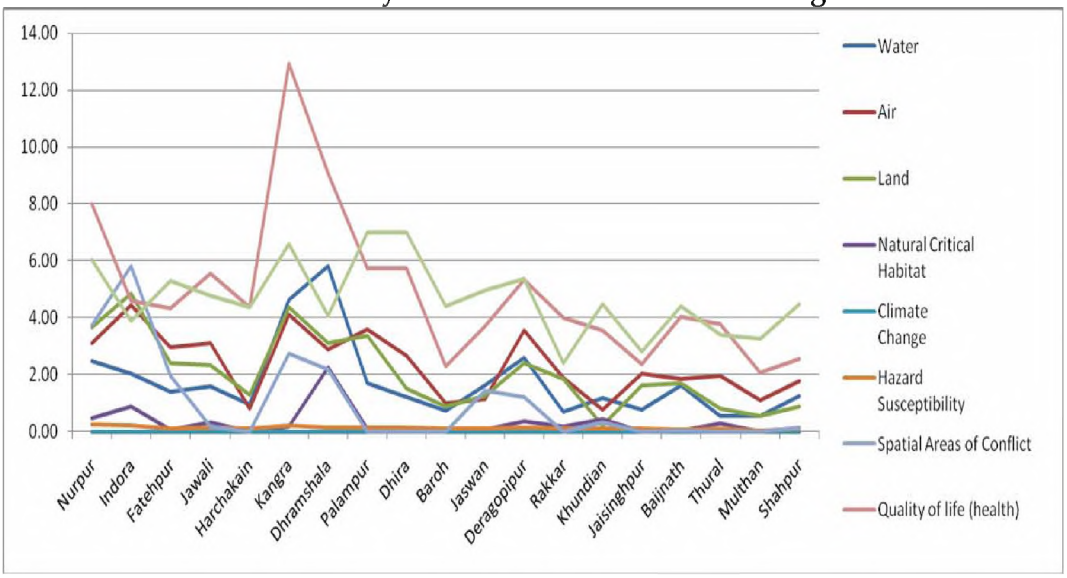
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

Quality of Life (education)	Quality of life (health)	Spatial Areas of Conflict	Hazard Susceptibility	Climate Change	Natural Critical Habitat	Land	Air	Water	State Variables
1371.54	1367.53	1066.01	53.09	0.00	185.32	628.35	355.10	1545.47	**Nurpur**
883.38	784.51	1656.20	47.84	0.00	352.35	825.78	506.39	1265.07	**Indora**
1210.06	737.68	553.00	25.98	0.00	27.03	412.49	338.40	872.42	**Fatehpur**
1085.16	950.19	46.43	32.63	0.00	127.73	396.02	355.80	982.03	**Jawali**
997.40	746.43	0.00	20.46	0.00	0.00	222.82	92.44	606.42	**Harchakain**
1501.62	2208.83	775.17	46.95	0.00	65.00	746.72	466.77	2894.33	**Kangra**
927.16	1550.78	617.20	27.94	0.00	902.74	533.85	330.12	3649.22	**Dharamsala**
1597.37	983.10	0.00	31.49	0.00	44.08	573.05	406.93	1060.73	**Palampur**
1597.37	983.10	0.00	31.49	0.00	0.00	258.46	302.39	771.73	**Dhira**
1006.12	392.56	0.00	20.38	0.00	0.00	151.22	112.00	468.14	**Baroh**
1130.53	634.27	411.20	21.06	0.00	23.03	214.99	131.00	1018.25	**Jaswan**
1224.86	911.17	344.66	30.48	0.00	147.01	411.07	404.91	1622.32	**Deragopipur**
545.96	680.02	0.00	20.05	0.00	62.43	314.70	212.79	438.52	**Rakkar**
1021.56	607.31	97.18	24.77	0.00	171.61	36.06	86.90	738.64	**Khundian**
638.22	405.29	0.00	24.95	0.00	0.00	279.98	230.43	480.01	**Jaisinghpur**
1003.66	691.87	8.96	17.22	0.00	6.50	288.27	209.37	1019.27	**Baijnath**
773.82	647.66	0.00	20.70	0.00	118.40	136.71	221.23	346.85	**Thural**
738.95	355.39	0.00	9.18	0.00	0.00	95.01	123.71	337.90	**Multhan**
1019.55	432.54	40.36	18.95	0.00	0.00	147.81	200.90	789.01	**Shahpur**
20274.28	16070.23	5616.37	525.61	0	2233.233	6673.36	5087.58	20906.33	**Vulnerability of State Sector** $V_{\text{State Sector}}$



State Variables vulnerability at Tehsil level in District Kangra



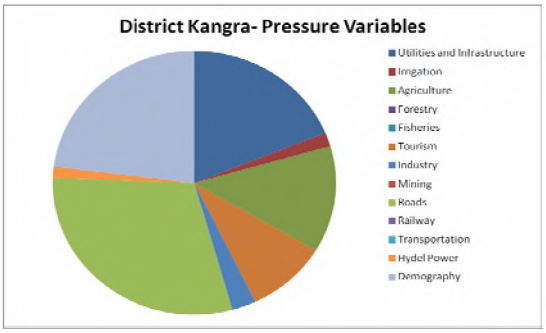
The analysis of data indicates that the Quality of Life variables have a high vulnerability. Especially the Quality of life (health) variable is in the high segment across all the Tehsils with the exception of Shahpur, Multhan, Jaisinghpur and Baroh, where it is in controllable stage. The district Headquarter Tehsil of Kangra and Dharamsala have crossed critical stage. Even in Education, Kangra, Palampur, Nurpur and Dhira have crossed the critical stage, while Indora, Fatehpur, Harchakain, Dharamsala, Baroh and Dera Gopipur are in the high segment in the education variable. Water as a state variable has a high vulnerability in Dharamsala. Nurpur and Indora display a high to very high vulnerability to the spatial areas of conflict which is understandable as these are border Tehsils adjoining neighboring state of Punjab and the major urban centre of Pathankot.

Summary of Pressure Variables at District Level

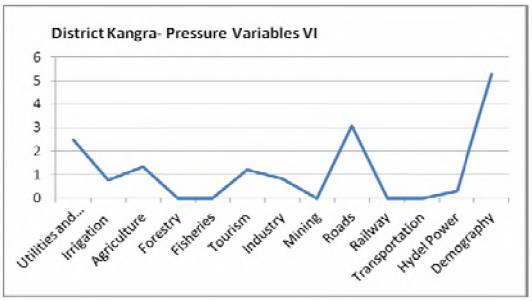
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of

quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kangra. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Variable Sector	Kangra **Vulnerability of Pressure Sector** $\mathbf{V}_{\text{Pressure Sector}}$
Utilities and Infrastructure	14119.25
Irrigation	1268.47
Agriculture	9870.7
Forestry	0
Fisheries	0
Tourism	6968.06
Industry	2067.89
Mining	0
Roads	22526.41
Railway	0
Transportation	0
Hydel Power	1039.67
Demography	17268.67



The analysis of data indicates that Roads sector followed by Demography, Utilities and Infrastructure puts pressure. The increase in Demographic pressures leads to the increase in Gaps in Utilities and Infrastructure. The VI graph also displays very clearly that while all the other variables have a controllable Vulnerability index, the Demographic variable has crossed the critical stage.



Pressure Variables at Tehsil Level

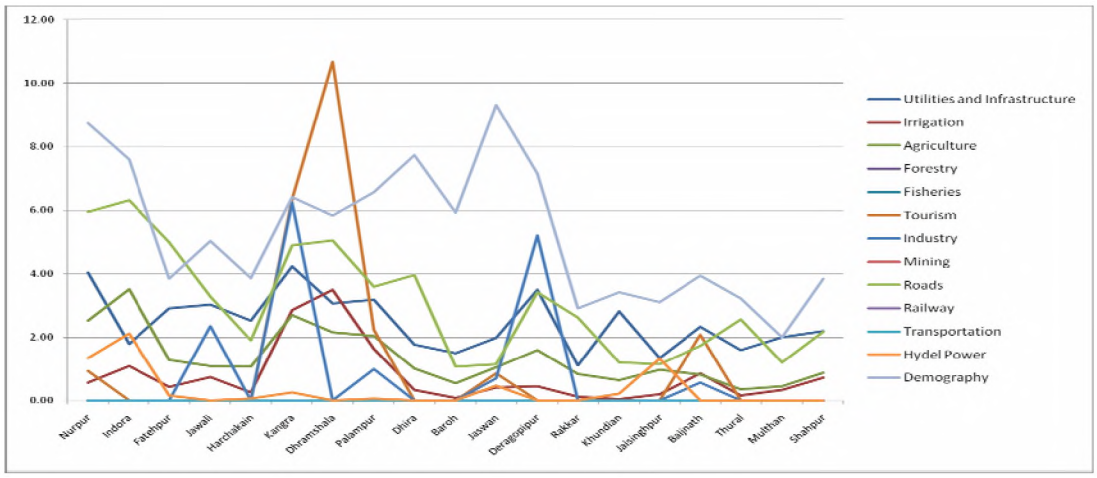
Similarly the pressure variables quantified at Tehsil level are given below:

Comparison of Pressure variables at Tehsil level:

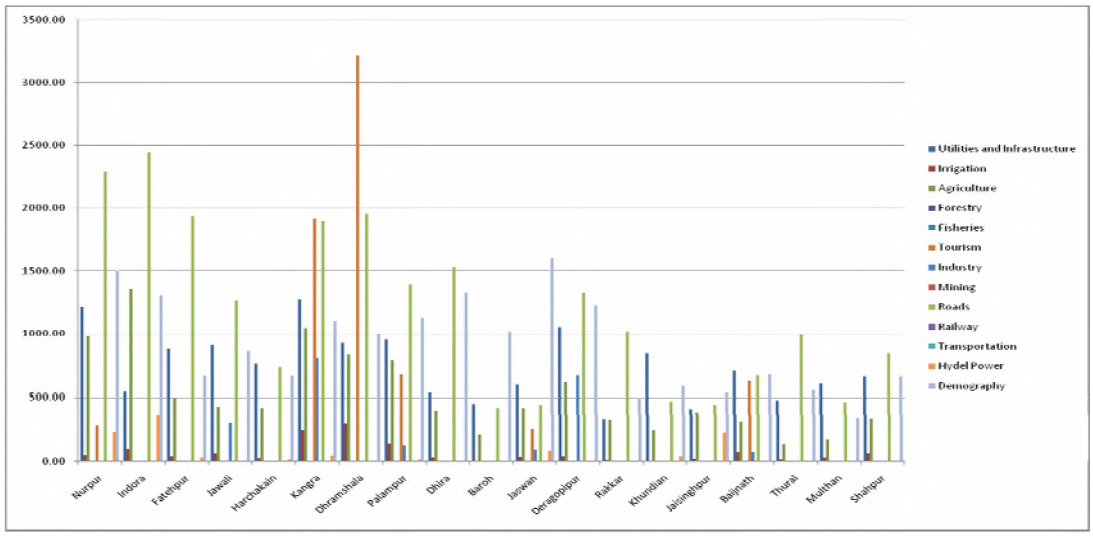
Pressure Variables	Nurpur	Indora	Fatehpur	Jawali	Harchakain	Kangra	Dharamsala	Palampur	Dhira	Baroh	Jaswan	Deragopipur	Rakkar	Khundian	Jaisinghpur	Baijnath	Thural	Multhan	Shahpur	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	1214.19	540.44	877.63	909.78	759.81	1271.94	926.41	956.60	534.77	449.95	599.62	1053.60	332.83	845.72	406.27	702.45	477.40	600.74	659.10	**14119.25**

Demography	Hydel Power	Transportation	Railway	Roads
1501.42	230.40	0.00	0.00	2296.46
1307.09	365.00	0.00	0.00	2444.29
662.84	28.41	0.00	0.00	1931.29
863.88	0.00	0.00	0.00	1268.64
664.32	11.92	0.00	0.00	734.90
1102.53	45.14	0.00	0.00	1893.34
1002.01	0.00	0.00	0.00	1951.07
1127.47	12.05	0.00	0.00	1392.94
1328.40	0.00	0.00	0.00	1534.19
1019.02	0.00	0.00	0.00	414.92
1602.52	80.55	0.00	0.00	445.67
1228.98	0.00	0.00	0.00	1325.81
502.29	0.00	0.00	0.00	1014.69
586.90	38.00	0.00	0.00	465.44
533.50	228.20	0.00	0.00	441.57
676.98	0.00	0.00	0.00	669.75
554.97	0.00	0.00	0.00	993.97
342.77	0.00	0.00	0.00	464.37
660.78	0.00	0.00	0.00	843.10
17268.67	**1039.67**	**0**	**0**	**22526.41**

Mining	Industry	Tourism	Fisheries	Forestry	Agriculture	Irrigation	Pressure Variables
0.00	0.00	283.70	0.00	0.00	978.34	47.90	**Nurpur**
0.00	0.00	0.00	0.00	0.00	1357.72	94.50	**Indora**
0.00	0.00	0.00	0.00	0.00	498.57	36.31	**Fatehpur**
0.00	303.75	0.00	0.00	0.00	421.99	62.92	**Jawali**
0.00	0.00	0.00	0.00	0.00	413.25	21.45	**Harchakain**
0.00	802.90	1912.01	0.00	0.00	1045.68	246.00	**Kangra**
0.00	0.00	3214.03	0.00	0.00	832.44	300.33	**Dharamsala**
0.00	127.36	673.09	0.00	0.00	787.18	140.13	**Palampur**
0.00	0.00	0.00	0.00	0.00	392.22	28.22	**Dhira**
0.00	0.00	0.00	0.00	0.00	212.64	6.90	**Baroh**
0.00	90.93	256.84	0.00	0.00	409.72	35.49	**Jaswan**
0.00	670.23	0.00	0.00	0.00	616.23	38.47	**Deragopipur**
0.00	0.00	0.00	0.00	0.00	325.67	9.69	**Rakkar**
0.00	0.00	0.00	0.00	0.00	245.86	4.30	**Khundian**
0.00	0.00	0.00	0.00	0.00	377.10	17.50	**Jaisinghpur**
0.00	72.72	628.39	0.00	0.00	313.10	72.96	**Baijnath**
0.00	0.00	0.00	0.00	0.00	132.65	13.55	**Thural**
0.00	0.00	0.00	0.00	0.00	171.22	29.13	**Multhan**
0.00	0.00	0.00	0.00	0.00	339.12	62.72	**Shahpur**
0	**2067.89**	**6968.06**	**0**	**0**	**9870.7**	**1268.47**	**Vulnerability of Pressure Sector** $V_{\text{Pressure Sector}}$



Pressure Variables vulnerability at Tehsil level in District Lahaul and Spiti



While Demography is in a high segment of Vulnerability in the western and central Tehsils of the District, it appears to be in a controllable stage in the eastern Tehsils. This is understandable as the State of Punjab adjoins the western Tehsils and the middle segment is the core of Tourism. Tourism creates high pressure in Kangra and Dharamsala where it has crossed the critical stage. Roads display a lot of work across all Tehsils. Utilities and Infrastructure have crossed the critical stage in Kangra.

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Kangra. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

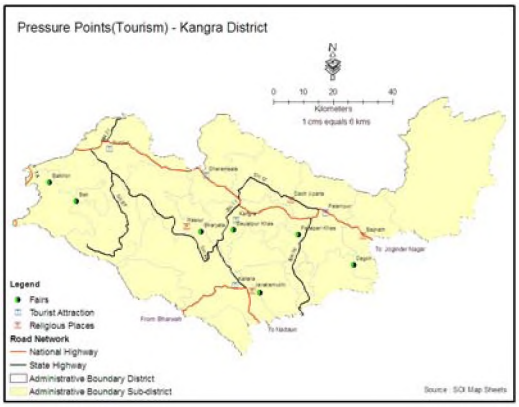
$$\sum V \text{ Pressure Sectors} : V \text{ State Sectors}$$

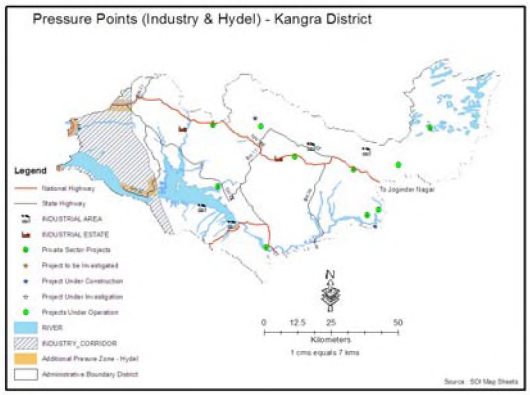
Total no. of State variables x total no. of Pressure variables

Vulnerability Index

$\sum V$ State and Pressure	Nurpur	Indora	Fatehpur	Jawali	Harchakain	Kangra	Dhramshala	Palampur	Dhira	Baroh	Jaswan	Deragopipur	Rakkar	Khundian	Jaisinghpur	Baijnath	Thural	Multhan	Shahpur
VI	6552.41	6109.03	4035.05	3830.96	2605.65	8319.54	8254.22	5216.81	5168.96	2103.43	3521.32	4933.32	2185.18	2186.23	2004.14	3136.35	2172.34	1608.23	2564.81
denominator = 57x43	**2451**																		
Normalized VI	**2.67**	**2.49**	**1.65**	**1.56**	**1.06**	**3.39**	**3.37**	**2.13**	**2.11**	**0.86**	**1.44**	**2.01**	**0.89**	**0.89**	**0.82**	**1.28**	**0.89**	**0.66**	**1.05**

Analysis of data indicates higher Vulnerability in Kangra and Dharamsala Tehsils, being tourist destinations and seat of administration. Similarly for Nurpur Tehsil bordering the neighbouring state, and important town of Pathankot. However, the comparatively lower scores for Indora and Fatehpur, and very low score for Jaswan, also bordering the neighbouring State, gives an interesting variation.

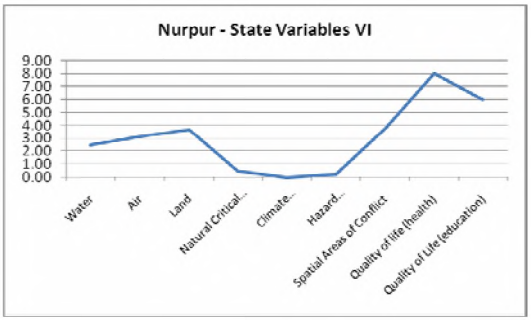




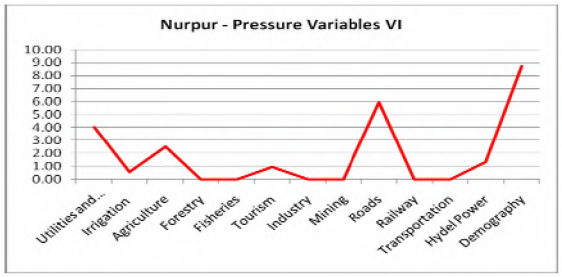
Description of Sectoral Vulnerability at Tehsil Level:

State & Pressure variables have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Tehsil Nurpur- Overall Vulnerability Index- 2.67

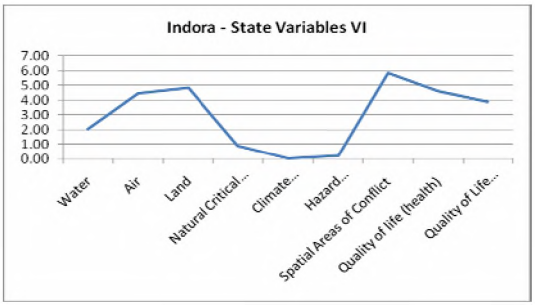


The analysis of the data indicates that the Quality of Life variables, both in terms of Health and Education have crossed the critical vulnerability stage. Since Nurpur borders Punjab, the land is under pressure and has attained a Moderately High Vulnerability status. The Spatial Areas of Conflict are also in a Moderately Low Vulnerability segment. Other State variables are in a low or very low vulnerability segment.

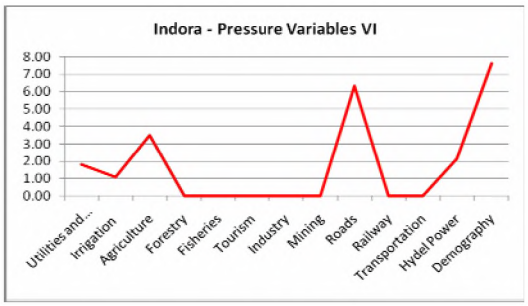


The analysis of the data indicates that Demography has already crossed the critical stage of vulnerability. This is indicative of high level of in-migration. As a result of demographic growth, the Utilities and Infrastructure have also come under Pressure. Though road sector is also critical, but the work has already been done. Improvement in Utilities and Infrastructure by addressing the gaps would reduce the vulnerability.

Tehsil Indora- Overall Vulnerability Index- 2.49

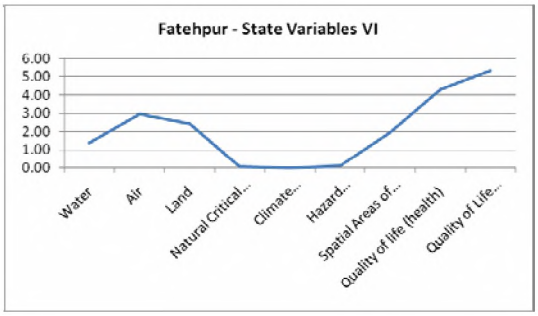


The analysis of the data indicates that the Spatial Areas of Conflict are in the critical stage. Land is also approaching the critical stage. The Quality of Life variables, though not yet critical, are also in the high vulnerability segment. Land based issues need consideration in future development plans to address and control the spatial areas of conflict including the border region. A programme for addressing the gaps in the Quality of Life variables can be developed in coordination with the concerned departments so that the VI is reduced.

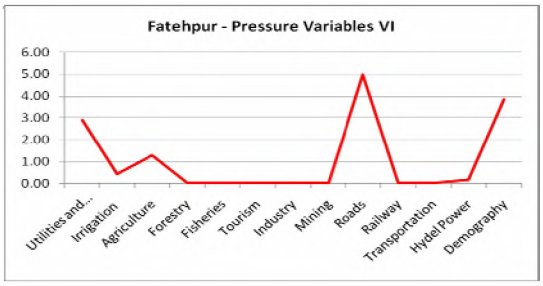


The analysis of the data indicates that Demography has already crossed the critical stage of vulnerability. This is indicative of high level of in-migration. As a result of demographic growth, the Utilities and Infrastructure have also come under Pressure. Though road sector is also critical, but the work has already been done. The Pressure on land is on account of agriculture which has attained Moderately High vulnerability segment. As suggested, a plan to plug the gap of Utilities and Infrastructure, and agriculture development as per the State Agriculture Plan/ District Agriculture Plan could address these issues and reduce vulnerability.

Tehsil Fatehpur- Overall vulnerability index- 1.65

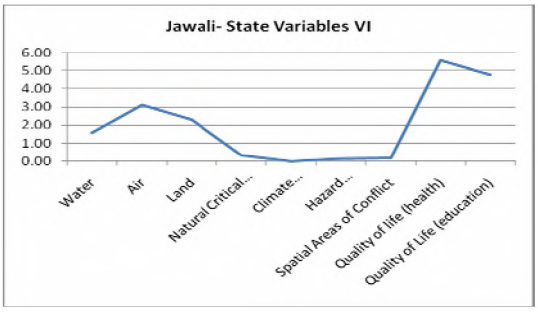


Other than the Quality of Life variables, both of which are in the high vulnerability segment, all other variables are in controllable segments. A programme for covering the gaps in the Quality of Life variables should be developed in coordination with the concerned departments so that the VI is reduced.

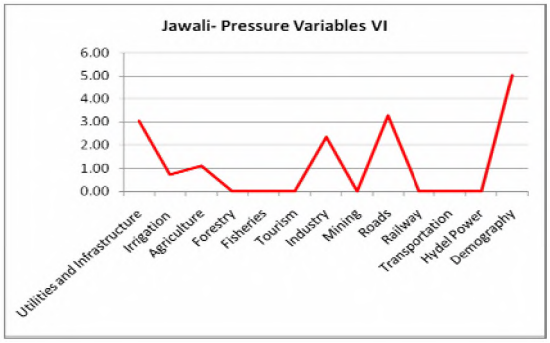


The analysis of the data indicates that Demography is approaching the high stage of vulnerability. This is indicative of high level of in-migration. As a result of demographic growth, the Utilities and Infrastructure have also come under Pressure. Though road sector is also critical, but the work has already been done. The vulnerability could be reduced by covering the gaps in Utilities and Infrastructure.

Tehsil Jawali- Overall Vulnerability Index- 1.56

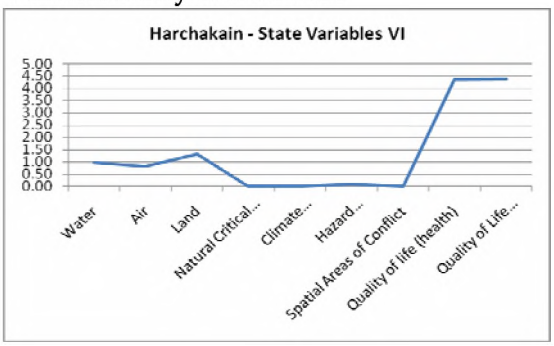


Apart from the Quality of Life variables, which are in the high vulnerability segment, all other variables are within controllable limits. A programme for covering the gaps in the Quality of Life variables should be developed in co-ordination with the concerned departments so that the VI is reduced.

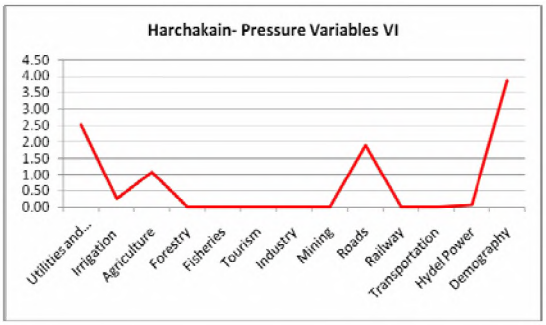


The analysis of the data indicates that Demography is approaching the high stage of vulnerability. As a result of demographic growth, the Utilities and Infrastructure have also come under Pressure. Industry has also made a mark in the Tehsil. Though road sector is moderately low, but the work has already been done. However, development of new roads / expansion of existing roads (including maintenance works) can be in line with concerned sectoral guidelines. An improvement could be made through covering the gaps in Utilities and Infrastructure. Current and future Industrial growth can be in accordance with development needs, availability of natural resources, raw materials, skills, etc. Current and future Industries should follow Environment, Health and Safety norms as well as CPCB/HP-PCB regulations. Industries can obtain prior environment clearance in the context of State.

Tehsil Harchakain- Overall Vulnerability Index- 1.06

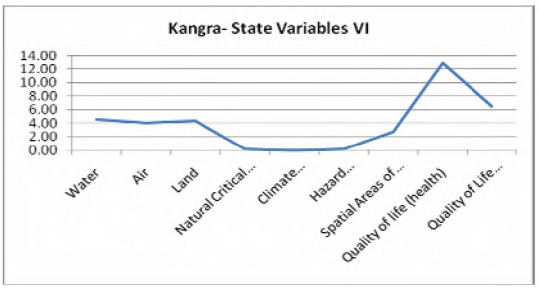


The Quality of Life Variables have reached a high vulnerability and may cross over to criticality. All other variables are in the very low vulnerability segment. A programme for covering the gaps in the Quality of Life variables can be developed in co-ordination with the concerned departments so that the VI is reduced.



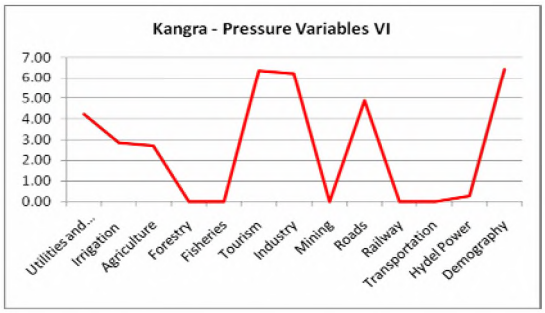
Except for Utilities & Infrastructure, which also is in the low vulnerability segment, no other variable is a cause of immediate concern. Covering gaps in Utilities & Infrastructure would pre-empt any possibility of increasing the Vulnerability Index of the Tehsil.

Tehsil Kangra- Overall Vulnerability Index- 3.39



All the three major components of State, Water Land and Air are in the moderately low segment of vulnerability. This may be due to excessive drawl of groundwater, heavy vehicular movement on the NH and in urban areas and the change of agriculture land to non agriculture uses. Tehsil housing the District Headquarters has crossed the critical stage of vulnerability in the Quality of Life variables.

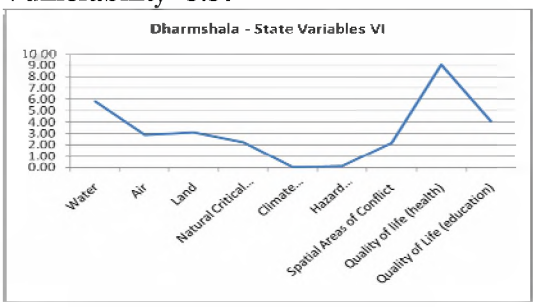
A programme for addressing the gaps in the Quality of Life variables should be developed in co-ordination with the concerned departments to improve infrastructure and services in health and education sectors so that the VI is reduced.



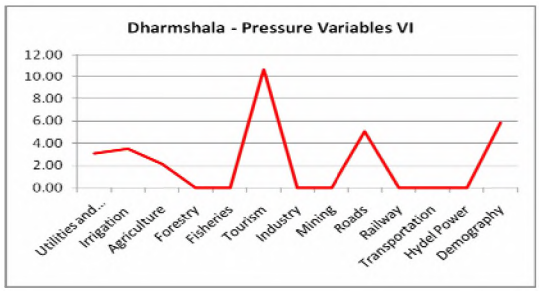
Tourism, Industry and Demography have crossed the critical segment of vulnerability. Utilities & Infrastructure show a moderately low vulnerability. Agriculture shows low vulnerability. Since Tourism is the mainstay of the economy of the state, a Tourism plan in line with Tourism Master Plan for the Tehsil can be made so as to take the environmental factors in consideration. Current and future Industrial growth can be in accordance with development needs, availability of natural resources, raw materials, skills, etc. Current and future Industries should follow Environment,

Health and Safety norms as well as CPCB/HP-PCB regulations. Industries can obtain prior environment clearance in the context of State. The gaps in the Utilities and Infrastructure can be addressed to reduce vulnerability.

Tehsil Dharamasala- Overall Vulnerability- 3.37

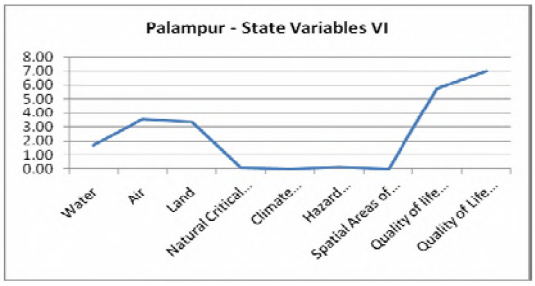


The Quality of Life Health variables are well beyond the critical stage. Water sources have reached the critical stage. Quality of Life & Education variables are on a moderately low vulnerability segment. A programme for filling the gaps in Quality of Life variables should be undertaken in co-ordination with concerned departments to improve infrastructure and services in health and education sectors. Conservation Plans for water bodies can be prepared.

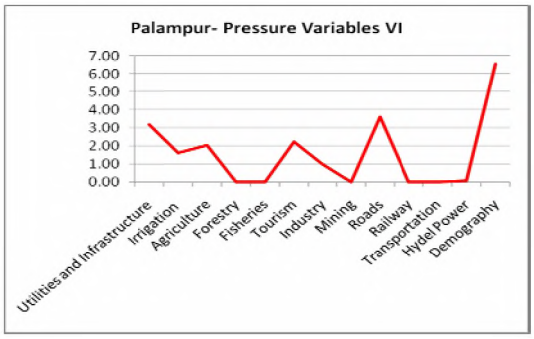


Tourism has crossed the critical vulnerability stage and demography has become critical. A Tourism Plan -with environmental and Infrastructural considerations- in line with Tourism Master Plan is recommended.

Tehsil Palampur- Overall Vulnerability Index-2.13

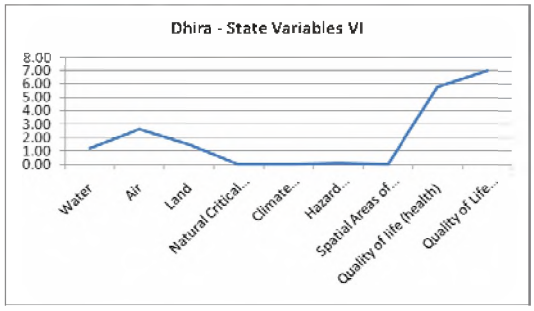


Quality of Life variables, both for Health and Education have crossed the critical vulnerability segment. Other than these, all the other variables are under controllable stages. A programme for filling the gaps in Quality of Life variables can be undertaken in co-ordination with concerned departments to improve infrastructure and services in health and education sectors and reduce vulnerability.



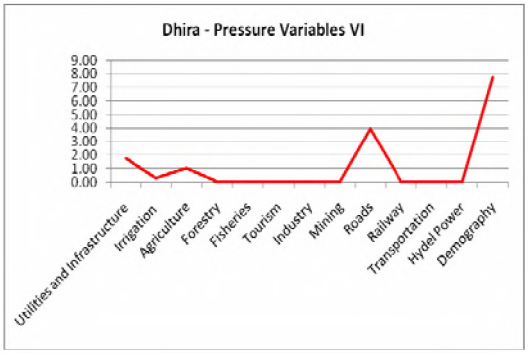
Except for Demography, which has reached a critical stage, no other variable is a cause of immediate concern.

Tehsil Dhira- Overall Vulnerability Index- 2.11



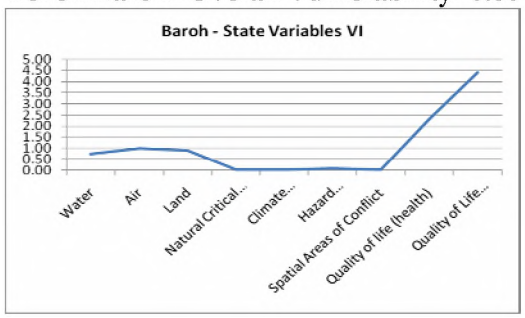
The Quality of Life variables, both Health and Education have crossed the critical vulnerability segment. Other than these, all the other variables are under controllable stages. A programme for filling the gaps in

Quality of Life variables can be undertaken in co-ordination with concerned departments to improve infrastructure and services in health and education sectors.



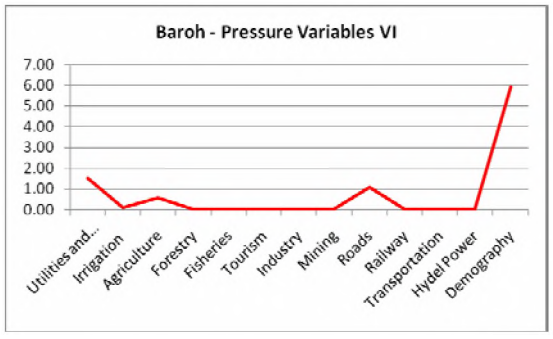
Except for Demography, which has reached a critical stage, no other variable is a cause of immediate concern.

Tehsil Baroh- Overall Vulnerability- 0.86



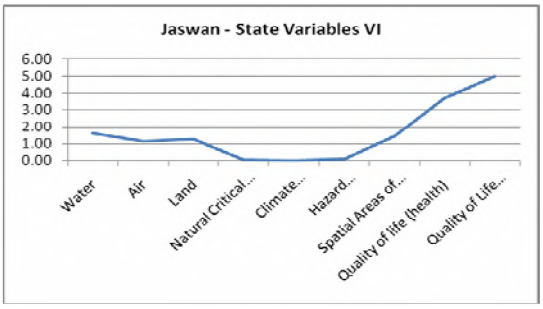
The Quality of Life (Education) has reached the moderately high vulnerability segment. Rest all the other variables are either in the very low or low vulnerability segment.

A programme to cover the gaps in the Quality of Life (Education) in coordination with the Education department is recommended to improve infrastructure and services in health and education sectors.



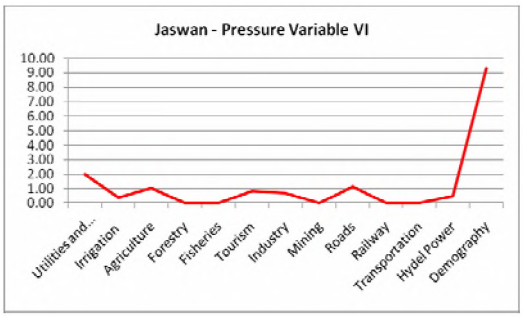
Demography is the only variable that is a cause of concern, Rest all variables are in the very low vulnerability segment.

Tahsil Jaswan- Overall Vulnerability Index- 1.44



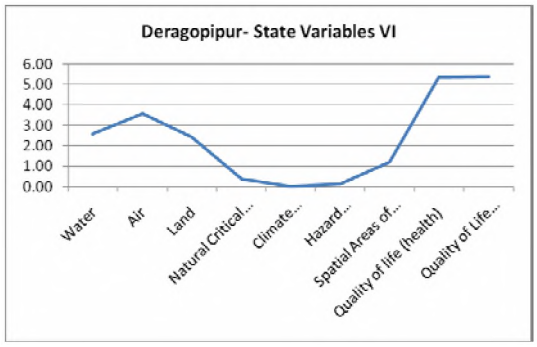
The high vulnerability of Quality of Life (Education) and the moderately high vulnerability of Quality of Life (Health) need attention.

A comprehensive programme to address the gaps in these sectors- in co-ordination with the concerned department to improve infrastructure and services in health and education sectors- would help in further reducing the very low vulnerability.



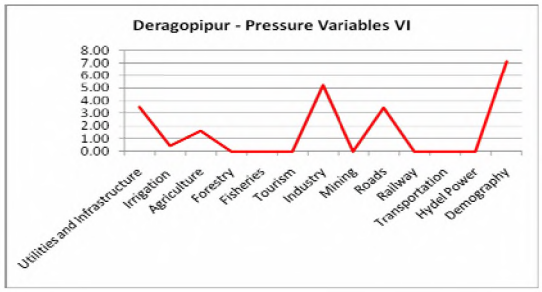
Apart from Demography, no other variable is a cause of immediate concern.

Tehsil Dera Gopipur- Overall Vulnerability Index- 2.01



The high, almost approaching criticality, vulnerability of Quality of Life (Education) and the Quality of Life (Health) need attention.

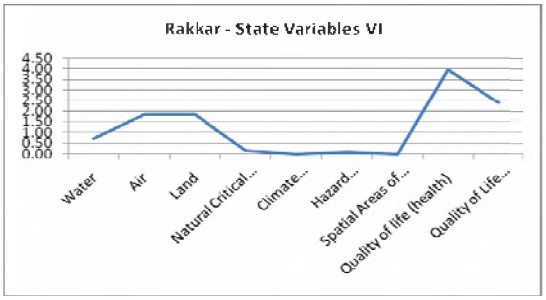
A comprehensive programme to address the gaps in these sectors- in co-ordination with the concerned department to improve infrastructure and services in health and education sectors -would help in further reducing the present very low vulnerability further.



Demography has crossed the critical stage of vulnerability. The Utilities and Infrastructure are in the moderately high vulnerability segment which is the direct impact of the demography. Industry is reaching the critical stage.

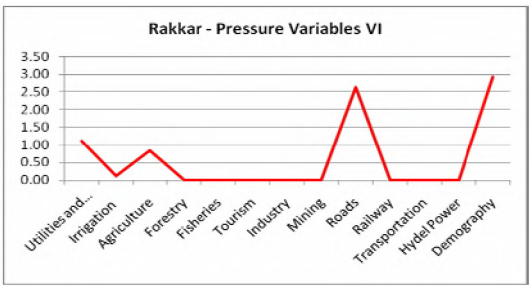
Current and future Industrial growth can be in accordance with development needs, availability of natural resources, raw materials, skills, etc. Current and future Industries should follow Environment, Health and Safety norms as well as CPCB/HP-PCB regulations. Industrial development in future can be in accordance with Siting Atlas and can obtain prior environment clearance in the context of State. Rationalization of sick units based on the current and future development needs is recommended.

Tehsil Rakkar- Overall Vulnerability Index- 0.89



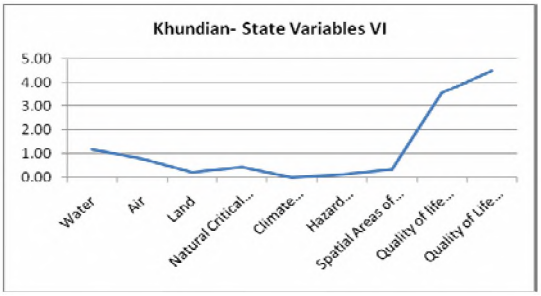
The Quality of Life (Health) variables are in the moderately high vulnerability segment. All other variables are in low or very low vulnerability segments.

A programme in collaboration with the Health Department, to address the gaps and improve infrastructure and services in health sector would help to reduce the overall vulnerability which as of now is very low.



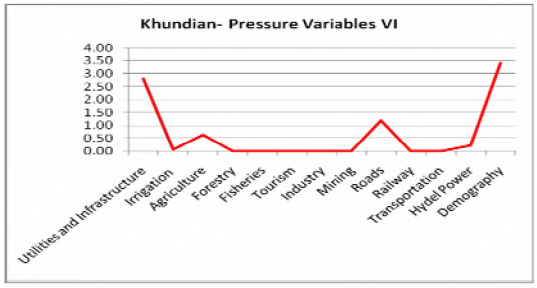
All the variables are in the low or very low vulnerability segment.

Tehsil Khundian – Overall Vulnerability Index – 0.89



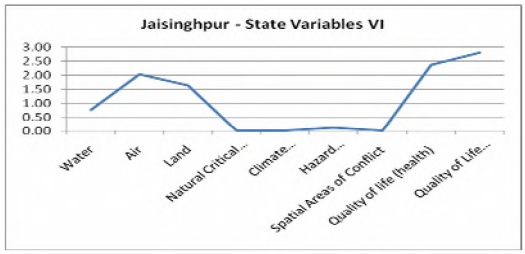
The Quality of Life (Education) variables and (Health) are in the moderately high vulnerability segment.

A programme is recommended to cover the gaps in co-ordination with the concerned departments would help improve infrastructure in education sector would reduce the VI further.

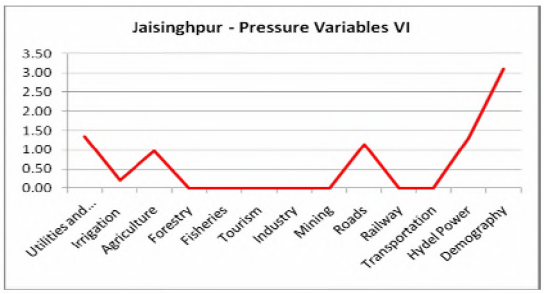


All the variables are in the low or very low vulnerability segments. A plan to cover the gaps in Utilities & Infrastructure would further reduce the VI.

Tehsil Jaisinghpur- Overall Vulnerability Index- 0.82

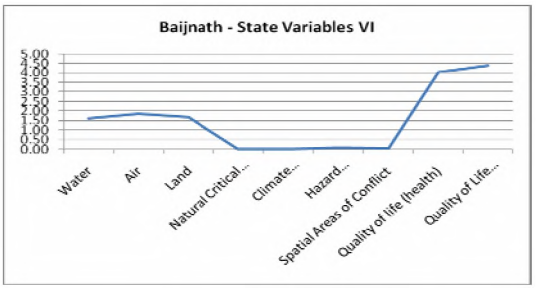


All the variables are in the low or very low vulnerability segment. Quality of Life (Education) has crossed over to moderately low vulnerability segment. A programme with Education Department to address the gaps and improve infrastructure in education sector is recommended to help reduce the VI further.

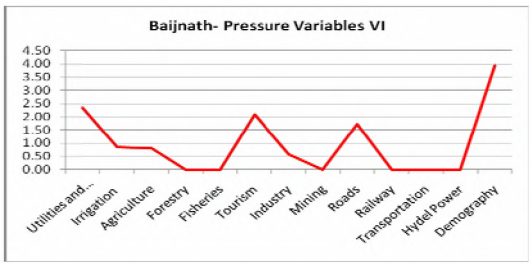


No variables are a cause for immediate concern.

Tehsil Baijnath - Overall Vulnerability Index- 1.28

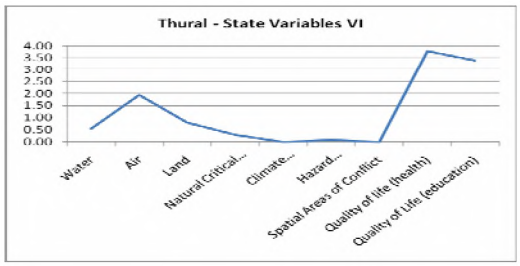


The Quality of Life (Education) variables and (Health) are in the moderately high vulnerability segment. A programme to cover the gaps in co-ordination with the concerned departments to address gaps and improve infrastructure and services in health and education sector would help reduce the VI further.

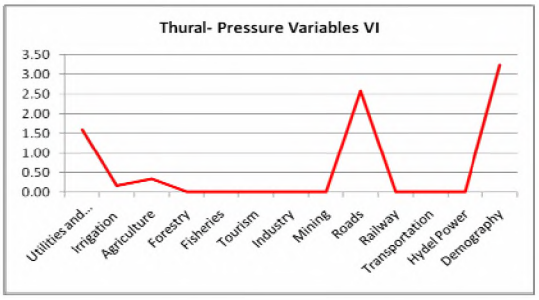


All controllable variables are in the low or very low vulnerability segments.

Tehsil Thural- Overall Vulnerability Index- 0.89

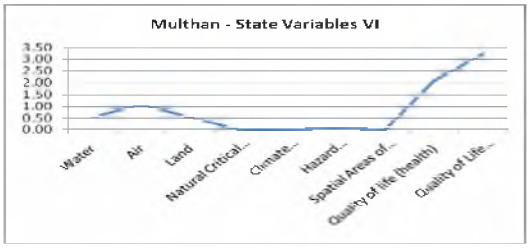


The Quality of Life (Education) variables and (Health) are in the moderately high & low vulnerability segments respectively. A programme to cover the gaps in co-ordination with the concerned departments would improve infrastructure and services in health and education sector and help reduce the VI further.

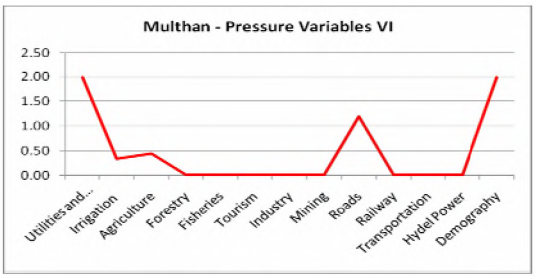


All controllable variables are in the low or very low vulnerability segment.

Tehsil Multhan- Overall Vulnerability Index- 0.66

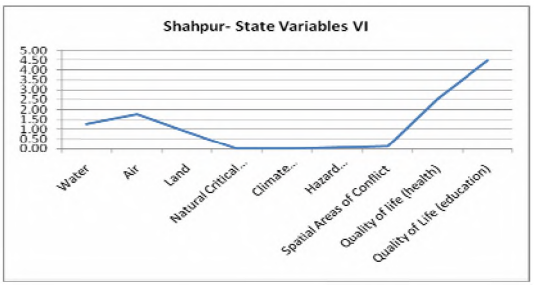


Only the Quality of life (education) variables are in the moderately low vulnerability segment. All the other variables are in the low or very low vulnerability segment. A programme with Education department to address the gaps and improve infrastructure in education sector would help reduce the VI further.

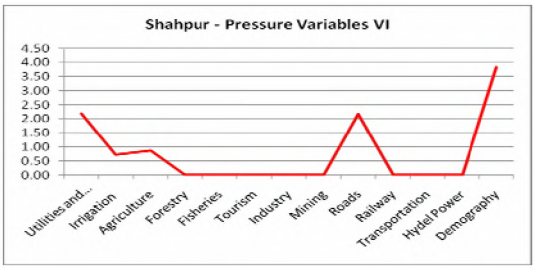


All the variables are in the low or very low vulnerability segment.

Tehsil Shahpur- Overall Vulnerability Index- 1.05



Apart from Quality of Life (education) variables, all the other variables are in the low or very low vulnerability segments. A programme with Education department to address the gaps and improve infrastructure in education sector would help reduce the VI further.



All the controllable variables are in the low or very low vulnerability segments.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are

impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

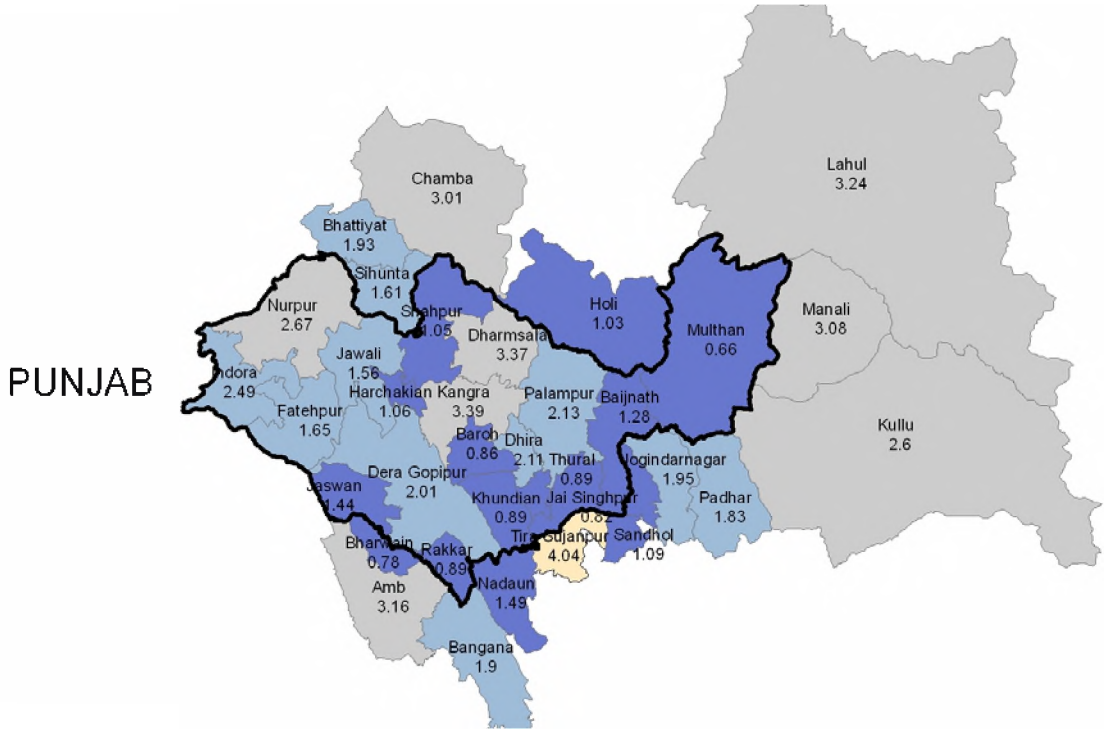
Kangra

S.No.	Tehsil	VI	Adjoining Tehsil in Kangra District	VI	Adjoining Tehsil in Other District	District	VI
1	Nurpur	2.67	Indora	2.49	Sihunta	Chamba	1.61
			Fatehpur	1.65	Bhattiyat	Chamba	1.93
			Jawali	1.56			
2	Indora	2.49	Nurpur	2.67			
			Fatehpur	1.65			
3	Fatehpur	1.65	Nurpur	2.67			
			Jawali	1.56			
			Deragopipur	2.01			
			Indora	2.49			
4	Jawali	1.56	Shahpur	1.05	Sihunta	Chamba	1.61
			Harchakain	1.06			
			Deragopipur	2.01			
			Fatehpur	1.65			
			Nurpur	2.67			
5	Harchakain	1.06	Shahpur	1.05			
			Kangra	3.39			
			Deragopipur	2.01			
			Jawali	1.56			
6	Shahpur	1.05	Dhramshala	3.37	Sihunta	Chamba	1.61
			Kangra	3.39			
			Harchakain	1.06			
			Jawali	1.56			
7	Dharamsala	3.37	Palampur	2.13	Holi	Chamba	1.03
			Kangra	3.39	Chamba		3.01
			Shahpur	1.05			
8	Kangra	3.39	Palampur	2.13			
			Dhira	2.11			
			Baroh	0.86			
			Deragopipur	2.01			
			Harchakain	1.06			
			Shahpur	1.05			
			Dharamsala	3.37			
9	Baroh	0.86	Dhira	2.11			
			Khundian	0.89			
			Deragopipur	2.01			
			Kangra	3.39			
10	Deragopipur	2.01	Fatehpur	1.65	Nadaun	Hamirpur	1.49
			Jawali	1.56	Bharwain	Una	0.78
			Harchakain	1.06			
			Kangra	3.39			
			Jaswan	1.44			
			Baroh	0.86			
			Khundian	0.89			
			Rakkar	0.89			
			Jaswan	1.44			
11	Jaswan	1.44	Deragopipur	2.01	Bharwain	Una	0.78
					Amb	Una	3.16
12	Rakkar	0.89	Deragopipur	2.01	Nadaun	Hamirpur	1.49
					Bangana	Una	1.90
					Amb	Una	3.16
13	Khundian	0.89	Baroh	0.86	Tira Sujanpur	Hamirpur	4.04
			Dhira	2.11	Nadaun	Hamirpur	1.49
			Thural	0.89			

S.No.	Tehsil	VI	Adjoining Tehsil in Kangra District	VI	Adjoining Tehsil in Other District	District	VI
			Jaisinghpur	0.82			
			Deragopipur	2.01			
14	Thural	0.89	Dhira	2.11			
			Palampur	2.13			
			Jaisinghpur	0.82			
			Khundian	0.89			
15	Dhira	2.11	Kangra	3.39			
			Palampur	2.13			
			Thural	0.89			
			Khundian	0.89			
			Baroh	0.86			
16	Jaisinghpur	0.82	Baijnath	1.28	Sandhol	Mandi	1.09
			Khundian	0.89	Ladbharol	Mandi	1.02
			Thural	0.89	Tira Sujanpur	Hamirpur	4.05
			Palampur	2.13			
17	Palampur	2.13	Dharamsala	3.37	Holi	Chamba	1.03
			Baijnath	1.28			
			Jaisinghpur	0.82			
			Thural	0.89			
			Dhira	2.11			
			Kangra	3.39			
18	Baijnath	1.28	Multhan	0.66	Holi	Chamba	1.03
			Jaisinghpur	0.82	Jogindernagar	Mandi	1.95
			Palampur	2.13	Ladbharol	Mandi	1.02
19	Multhan	0.66	Baijnath	1.28	Holi	Chamba	1.03
					Bharmaur	Chamba	1.96
					Lahaul	L & S	3.24
					Kullu	Kullu	2.60
					Manali	Kullu	3.08
					Padhar	Mandi	1.83
					Jogindernagar	Mandi	1.95

Range

Vulnerability Categorization	Color
Very low vulnerability	Upt0 1.5
Low vulnerability	1.51 -2.5
Moderate low vulnerability	2.51-3.5
Moderate high vulnerability	3.51=4.5
High vulnerability	4.51-5.5
Very High Vulnerability	5.51+



District Kangra is surrounded by various Tehsils of District Chamba, Hamirpur, Una, Kullu, Mandi and Lahaul and Spiti. The vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils of District Kangra except for Jawali whose neighbouring tehsil Sihunta (Chamba district) , Khundian whose neighbouring tehsil Tira Sujanpur (Hamirpur District), Baijnath whose neighbouring tehsil Sandhol (Mandi district), Multhanpur whose neighbouring tehsil Holi (Chamba district) have higher VI. The transitional impact of vulnerability possibly will give rise to vulnerability levels in Jaswan and Khundian tehsils when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.

On an overall basis, if gaps in quality of life indicators in terms of health and education, gaps in utilities and infrastructure, the issue of diversion of land for non-agricultural use, and a carrying capacity based tourism plan can be addressed, Vulnerability Index would be reduced. Further, conflict resolutions at the Spatial Areas of Conflict, would not only reduce the vulnerability but also help in making the district sustainable.

As is observed from the analysis of the data available, Tehsils identified for priority action are Nurpur, Kangra, Dharamsala, Palampur, and Indora, which are on the verge of crossing over to a higher vulnerability segment.

Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the programme as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and Rationalization of distribution of water resources for various usage can be undertaken including the hydel power projects under consideration, development or operation. The groundwater may be recharged through the creation of small check dams on the non perennial khuds, which could also improve the irrigation scenario.

(ii) As is observed from the analysis of the data available, the quality of life parameters in terms of health and education need to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometers, Community Health Centre within a distance of 6 kms. and a hospital within a distance of 10 kms.
Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order): Kangra, Palampur, Nurpur, Dharamshala and Dhira. Similarly, for the quality of life parameters for education, the district has a excellent network up-to the college level but intensive efforts are needed in establishment of Vocational training Institutions, so that villages within 25 kms. radius have accessibility.

Priority Tehsils (in descending order): Dhira, Kangra, Palampur, Nurpur, Fatehpur and Dera Gopipur. The benchmarking of the norms has been done with a view of the terrain in the State. A programme in collaboration with the Health and Education Departments of the State Government would reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(iii) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats, i.e. Reserve forests etc can be done through a series of plans culminating into projects.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(iv) Six of the Tehsils in the district, the border Tehsils of Nurpur, Indora, Fatehpur and the core districts of Kangra, Dharamsala, and Palampur reveals a series of Probable Spatial Areas of Conflict. Most of these are primarily related to conflict with water, some relate to conflict with air, which are a result of tourism and vehicular operations in the area. A couple of Spatial Areas of conflict are identified with land with green cover, as the proposed Industrial Corridor is proposed to be established in this area.

Pressure Parameters

(i) From the analysis of the data available, it is inferred that a lot of work has been done in the road sector, which is a good sign for developmental scenarios, yet, it also raises a concern as development of roads open up hitherto inaccessible areas. The improved access endangers the State components like Forests, green cover, wildlife and biodiversity of the area. Care must be taken of the

environmental concerns expressed in the concerned Sectoral guidelines through a policy.

(ii) Tourism puts the second highest pressure in the district pressure parameters. However, tourism is one of the mainstays of economy in the State and thus has to develop further. The growth in the sector is welcome,as it boosts the economy, but the rate at which it is growing demands a definite and specific plan for the district in terms of growth of tourism. For a sustainable coexistence of Tourism and Environment, a broad State Level Plan and Detailed District Level Plans for Tourism in line with Tourism Master Plan can be prepared. Religious tourist places like Baijnath, Chamunda Devi, Dharamsala, Mcleodganj, and Jwalaji need priority.

(iii) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has decreased by approximately 25% on an average in the entire district. The land which was earlier under agriculture has been diverted to non agricultural purposes, to industries in some cases, to horticulture in others and to commercial activities in Kangra and Dharamsala. Rationalization of land requirement for non agricultural uses must be done as per development plan/landuse plan/State Agriculture Plan and District Agriculture Plan. Further, rationalization of land requirement for non agricultural can be considered on the basis of proposed land use and its planned output including employment potential. Major changes in livestock also impact the agricultural sector which together creates higher pressures.

(iv) Utilities and Infrastructure form the second highest pressure in the district. The Pressure exists because there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted. A Utilities and Infrastructure Plan can be prepared for each Tehsil and implemented through comprehensive projects for the clusters.

(v) The proposal to establish existing Industrial corridor may be considered after taking prior environment clearance. The proposal to establish Industrial Corridor should be carefully analyzed to prevent any adverse environmental impact and an Environmental Impact Assessment Study can be made mandatory in the State context.

(vi) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Water		*	*		Water Utilization Plan
2	Quality of life (Health)			*		Programme to improve access
3	Quality of life (Education)			*		Programme to improve access
4	Natural critical habitat		*			Creation of Buffer Zones
Pressure						
1	Roads	*				Policy to take care of State variables
2	Tourism		*			Tourism Plan at State, District, and Destination Level
3	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
4	Agriculture	*				Policy regarding Diversion of land for non-agricultural use
5	Industrial Corridor		*			Detailed EIA and EMP
6	Hydel power	*				

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Nurpur	Indora	Fatehpur	Jawali	Harchakain	Kangra	Dhramshala	Palampur	Dhira	Baroh	Jaswan	Deragopipur	Rakkar	Khundian	Jaisinghpur	Baijnath	Thural	Multhan	Shahpur
VI	6552.41	6109.03	4035.05	3830.96	2605.65	8319.54	8254.22	5216.81	5168.96	2103.43	3521.32	4933.32	2185.18	2186.23	2004.14	3136.35	2172.34	1608.23	2564.81
denominator = 57x43	**2451**																		
Normalized VI	**2.67**	**2.49**	**1.65**	**1.56**	**1.06**	**3.39**	**3.37**	**2.13**	**2.11**	**0.86**	**1.44**	**2.01**	**0.89**	**0.89**	**0.82**	**1.28**	**0.89**	**0.66**	**1.05**

Population Projections

Tehsil	Population 2001	Proj. Pop 2011	Proj.Pop 2021	Proj. Pop 2031	Proj Pop. 2041
Nurpur	151661	189453	234165	285055	341452
Indora	71479	86560	104633	125376	148485

Tehsil	Population 2001	Proj. Pop 2011	Proj.Pop 2021	Proj. Pop 2031	Proj Pop. 2041
Fatehpur	58562	59492	60633	61983	63535
Jawali	98907	126733	157687	191556	228131
Harchakain	12182	14471	17024	19824	22856
Kangra	131788	148098	168616	192897	220478
Dharamsala	82330	100906	121636	144380	168996
Palampur	163955	199635	241327	288469	340526
Dhira	20112	26649	33563	40841	48467
Baroh	23452	31141	39203	47627	56402
Jaswan	30763	32065	33917	36275	39087
Deragopipur	139824	160042	184067	211580	242239
Rakkar	27252	30940	34965	39313	43970
Khundian	33858	37305	41168	45429	50065
Jaisinghpur	58623	59904	61627	63776	66330
Baijnath	84801	89811	97260	106864	118295
Thural	17754	19045	20494	22095	23842
Multhan	7498	7324	7056	6688	6209
Shahpur	66010	79288	94776	112277	131598

Calculation of Per Capita Share of VI

Tehsil	Population 2001	VI 2001	VI share
Nurpur	151661	2.67	1.76
Indora	71479	2.49	3.48
Fatehpur	58562	1.65	2.81
Jawali	98907	1.56	1.57
Harchakain	12182	1.06	8.70
Kangra	131788	3.39	2.57
Dharamsala	82330	3.37	4.09
Palampur	163955	2.13	1.29
Dhira	20112	2.11	0.01
Baroh	23452	0.86	3.66
Jaswan	30763	1.44	4.68
Deragopipur	139824	2.01	1.43
Rakkar	27252	0.89	3.26
Khundian	33858	0.89	2.62
Jaisinghpur	58623	0.82	1.39
Baijnath	84801	1.28	1.50
Thural	17754	0.89	5.01
Multhan	7498	0.66	8.80
Shahpur	66010	1.05	1.59

Calculation of Projected VI

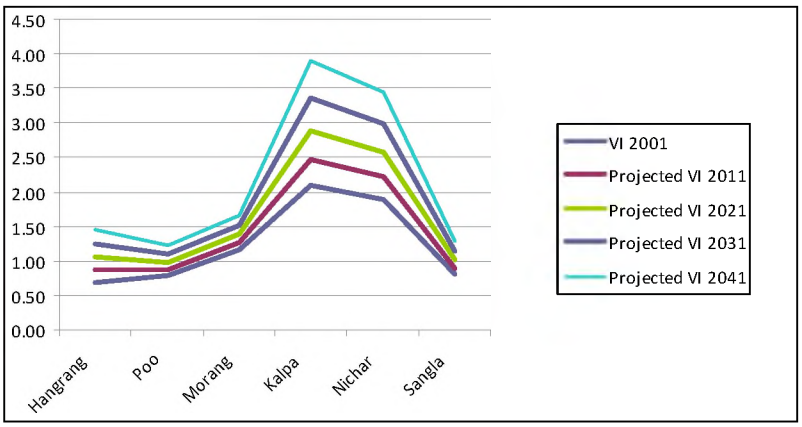
Tehsil	Population 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj.Pop2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Nurpur	151661	2.67	1.76	189453	3.34	234165	4.12	285055	5.02	341452	6.01
Indora	71479	2.49	3.48	86560	3.02	104633	3.64	125376	4.37	148485	5.17
Fatehpur	58562	1.65	2.81	59492	1.68	60633	1.71	61983	1.75	63535	1.79
Jawali	98907	1.56	1.57	126733	2.00	157687	2.49	191556	3.02	228131	3.60
Harchakain	12182	1.06	8.70	14471	1.26	17024	1.48	19824	1.72	22856	1.99

Tehsil	Population 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj.Pop2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Kangra	131788	3.39	2.57	148098	3.81	168616	4.34	192897	4.96	220478	5.67
Dharamshala	82330	3.37	4.09	100906	4.13	121636	4.98	144380	5.91	168996	6.92
Palampur	163955	2.13	1.29	199635	2.59	241327	3.14	288469	3.75	340526	4.42
Dhira	20112	2.11	0.01	26649	2.80	33563	3.52	40841	4.28	48467	5.08
Baroh	23452	0.86	3.66	31141	1.14	39203	1.44	47627	1.75	56402	2.07
Jaswan	30763	1.44	4.68	32065	1.50	33917	1.59	36275	1.70	39087	1.83
Deragopipur	139824	2.01	1.43	160042	2.30	184067	2.65	211580	3.04	242239	3.48
Rakkar	27252	0.89	3.26	30940	1.01	34965	1.14	39313	1.28	43970	1.44
Khundian	33858	0.89	2.62	37305	0.98	41168	1.08	45429	1.19	50065	1.32
Jaisinghpur	58623	0.82	1.39	59904	0.84	61627	0.86	63776	0.89	66330	0.93
Baijnath	84801	1.28	1.50	89811	1.36	97260	1.47	106864	1.61	118295	1.79
Thural	17754	0.89	5.01	19045	0.95	20494	1.03	22095	1.11	23842	1.20
Multhan	7498	0.66	8.80	7324	0.64	7056	0.62	6688	0.59	6209	0.55
Shahpur	66010	1.05	1.59	79288	1.26	94776	1.51	112277	1.79	131598	2.09

Projected VI

Tehsil	VI 2001	Proj.VI 2011	Proj.VI 2021	Proj.VI 2031	Proj.VI 2041
Nurpur	2.67	3.34	4.12	5.02	6.01
Indora	2.49	3.02	3.64	4.37	5.17
Fatehpur	1.65	1.68	1.71	1.75	1.79
Jawali	1.56	2.00	2.49	3.02	3.60
Harchakain	1.06	1.26	1.48	1.72	1.99
Kangra	3.39	3.81	4.34	4.96	5.67
Dharamsala	3.37	4.13	4.98	5.91	6.92
Palampur	2.13	2.59	3.14	3.75	4.42
Dhira	2.11	2.80	3.52	4.28	5.08
Baroh	0.86	1.14	1.44	1.75	2.07
Jaswan	1.44	1.50	1.59	1.70	1.83
Deragopipur	2.01	2.30	2.65	3.04	3.48
Rakkar	0.89	1.01	1.14	1.28	1.44
Khundian	0.89	0.98	1.08	1.19	1.32
Jaisinghpur	0.82	0.84	0.86	0.89	0.93
Baijnath	1.28	1.36	1.47	1.61	1.79
Thural	0.89	0.95	1.03	1.11	1.20
Multhan	0.66	0.64	0.62	0.59	0.55
Shahpur	1.05	1.26	1.51	1.79	2.09

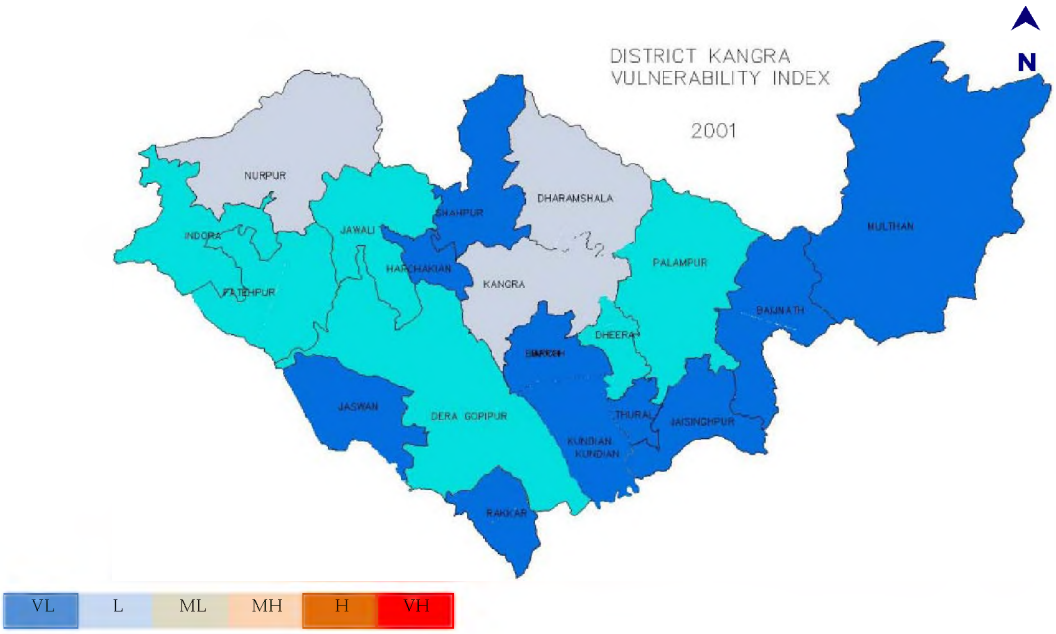
Vulnerability Index Scenarios – District Kangra at Tehsil Level



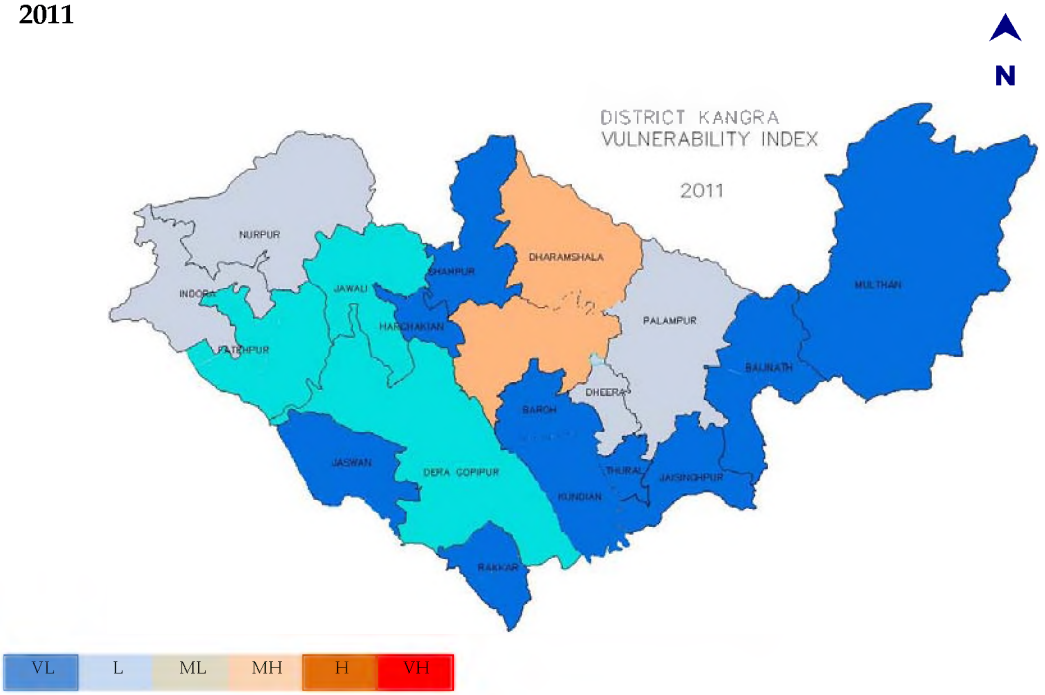
Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

2001

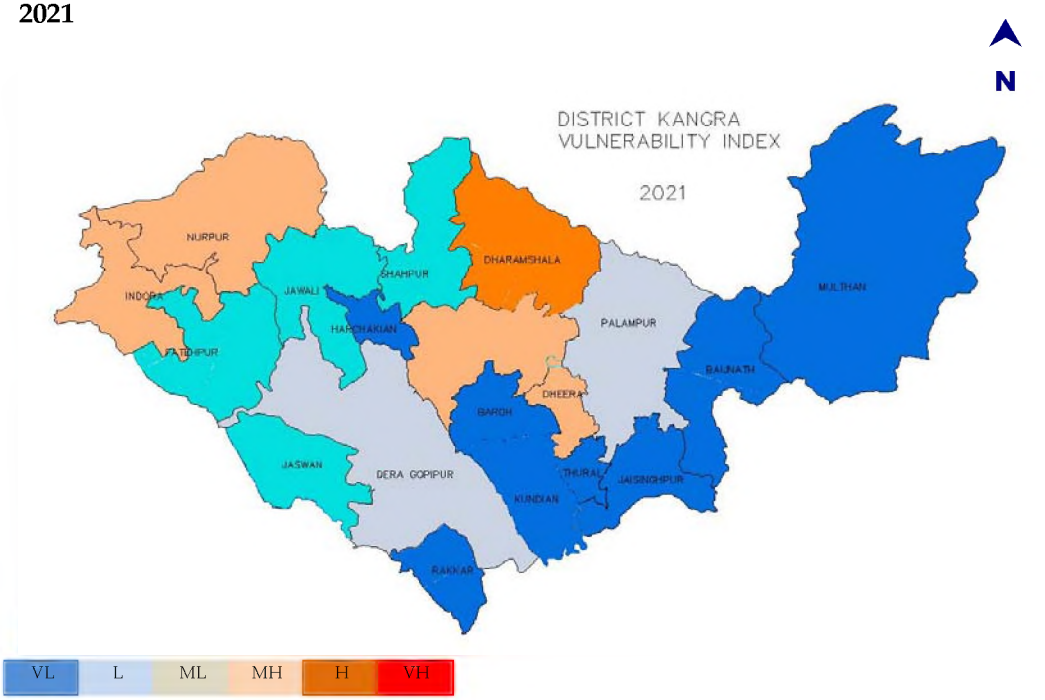


2011



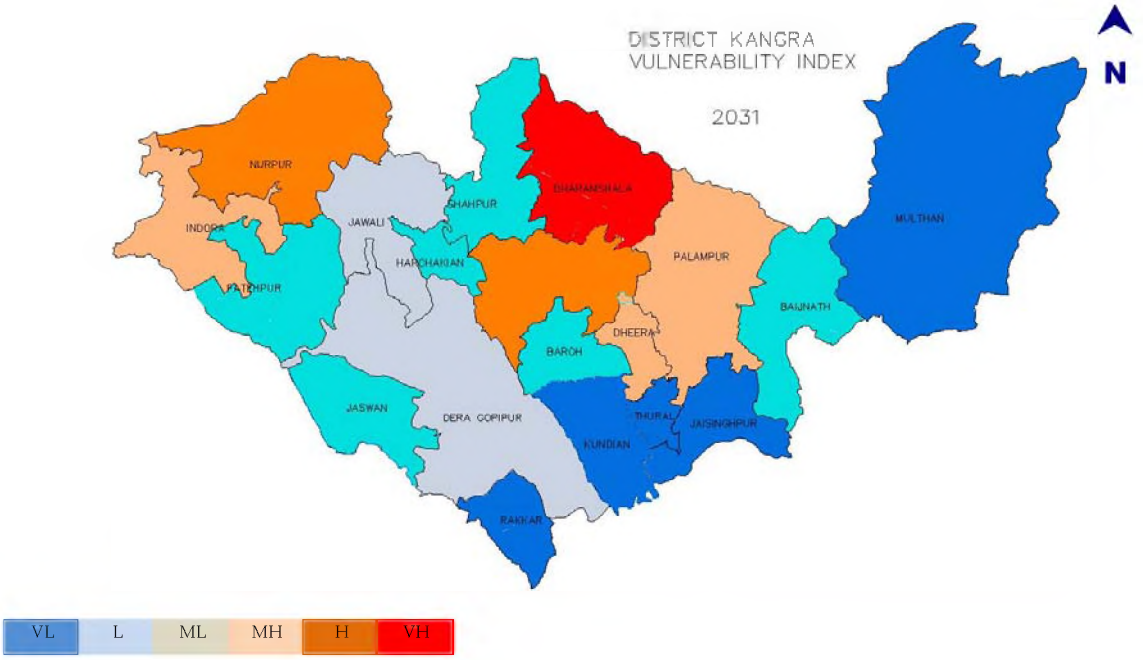
As can be observed, Kangra and Dharamsala have moved from the moderately low vulnerability segment to moderately high vulnerability segment. Palampur, Dhira and Indora have moved from low vulnerability segment to moderately low vulnerability segment. All other Tehsils retain their low or very low vulnerability segments.

2021



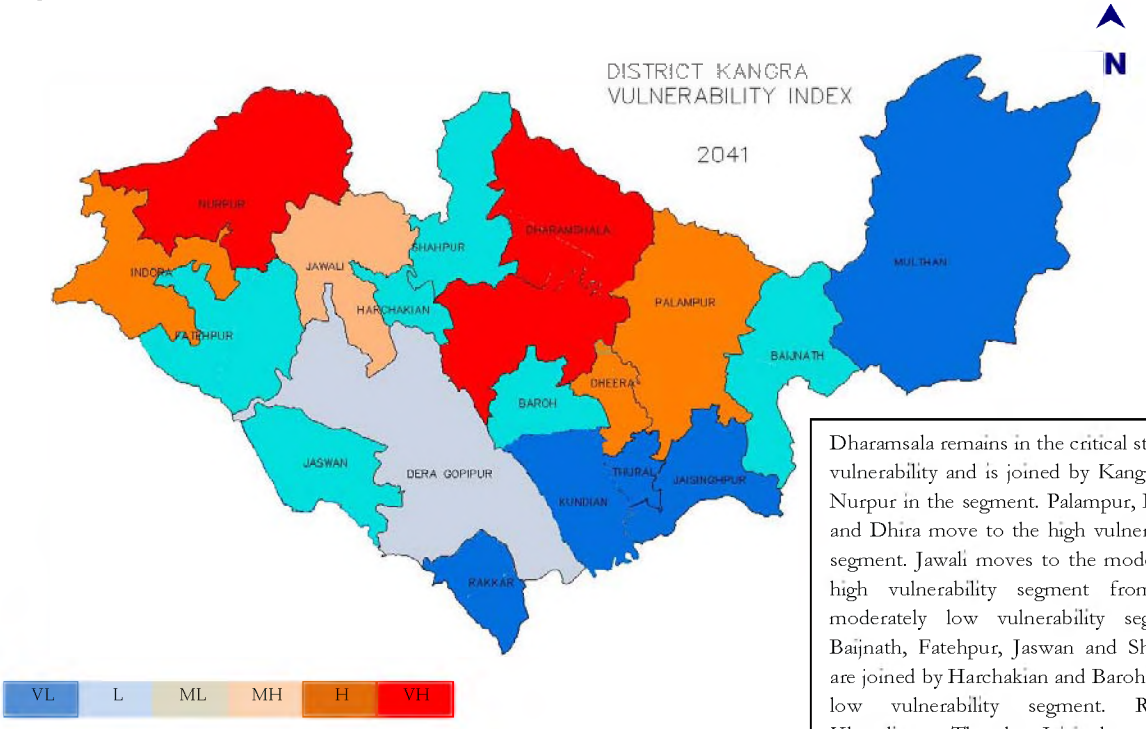
While Kangra retains its moderately high vulnerability, it is joined in the segment by Nurpur, Indora and Dhira. Dharamsala have moved from the moderately high vulnerability segment to high vulnerability segment. Palampur, in the moderately low vulnerability segment is joined by Dera Gopipur. Shahpur joins in the low vulnerability segment. All other Tehsils retain their low or very low vulnerability segments.

2031



Dharamsala moves to the critical stage of vulnerability. Kangra and Nurpur move to high vulnerability. Palampur joins Indora and Dhira in the moderately high vulnerability segment. Jawali joins Dera Gopipur in the moderately low vulnerability segment. Baijnath moves from the very low vulnerability segment to the low vulnerability segment. All other Tehsils retain their low or very low vulnerability segments.

2041

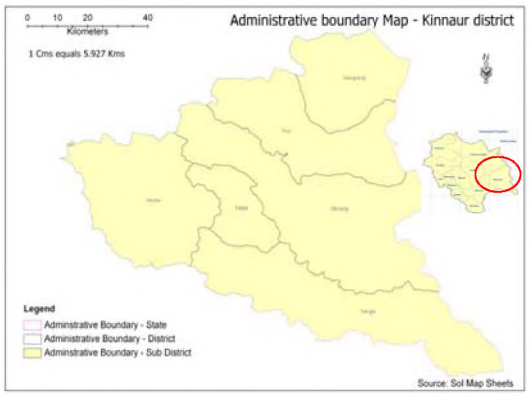


Dharamsala remains in the critical stage of vulnerability and is joined by Kangra and Nurpur in the segment. Palampur, Indora and Dhira move to the high vulnerability segment. Jawali moves to the moderately high vulnerability segment from the moderately low vulnerability segment. Baijnath, Fatehpur, Jaswan and Shahpur are joined by Harchakian and Baroh in the low vulnerability segment. Rakkar, Khundian, Thural, Jaisinghpur and Multhan remain in the very low vulnerability segment.

KINNAUR

General Background

Kinnaur district constitutes the southern part of Trans Himalayas Zone. It lies between 31°05′ 55″ and 32°5′ 20″ north latitudes and 77^0 45′ 0″ and 79^0 10′ 50″ east longitudes. The district is bounded by the Spiti Tehsil of Lahaul & Spiti district in the north, Kullu and Banjar Tehsils of Kullu district in the north-west, Rampur, Chirgaon and Dodra Kwar Tehsils of Shimla district in the west, State of Uttaranchal in the south while the International boundary with China is its eastern boundary. The total area of the district is 6,401 sq. kms. and ranks 3rd in terms of area in the State. Kinnaur is called the Dev Bhumi, or the land of the gods in local belief and parlance.



Kinnaur has been a district since long. Since its borders coincide with the International Border with China, it achieves a strategic importance. The district is divided into 6 administrative units as Tehsil/Sub-Tehsil (area in descending order) as follows:

Tehsil/Sub Tehsil	Area (sq.km)
Morang	1628.6
Sangla	1282.2
Nichar	1183.6
Poo	1021.70
Kalpa	390.9
Hangrang	72.4

Physiography

The physiography of the district is characterized by a series of high mountain ranges, deep and narrow valley and river basins. There are three parallel mountain ranges viz., the *Zaskar*, the Great Himalaya and the *Dhauladhar* through the district. The mountain peaks are covered with perpetual snow. There are many glaciers over the *Zaskar* and the great Himalaya ranges. On the basis of physiography, climate, geology, soil and natural vegetation, Kinnaur district is divided into 5 sub-micro regions as follows:



Lower *Spiti* Basin

This region covers the north-eastern extreme of the district, including whole Hangrang sub-Tehsil. It is bounded by Spiti Tehsil of the Lahaul & Spiti district in the north and north-west, western Kinnaur Greater Himalaya region in the south-west, *Sutlej* Basin region in the south-east and Tibet in the east. This region of Kinnaur district is formed by *Spiti* river which is the main tributary of *Sutlej* river. This region is very rugged and mountainous. Altitude in the region varies between 3,624 metres to 6,791 metres above the mean sea level. Elevation rises steeply from the bed of *Spiti* river. This region consists of very lofty peaks covered with perpetual snow. Highest peak in this region is *Leo Pargial* with an elevation of

6,791 metres and is located in the *Zaskar* range. In the western part of this region, highest peak is *Thinga* with an altitude of 5,008 metres. *Spiti* river originates in the Lahaul & Spiti district, and enters the district as well as the region from north-west direction and forms the boundary between Kinnaur and Lahaul & Spiti districts until it takes a turn towards south near Samdo. After flowing in a zig-zag manner almost in the centre of this region from north to south direction, it ultimately joins *Sutlej* river on its right bank, a few kilometers south of this region in Poo Tehsil at Khab. Several small streams/rivulets, namely *Mardung*, *Talung*, *Lipak Gad*, *Kirasang Gad*, *Parang* or *Pare Chu* and *Chaladdokpo* join it in this region from both sides. *Spiti* river is also known as *Lee* and is a lifeline of this region. The climatic conditions are severe in winter while summers are comparatively hot and without rainfall. During winters, some rainfall is received in the form of snow-fall. The region remains cut of from outer world for about 6 months in a year. This region has the geological structure of *Blaini/Infra-Krol* formations, *Haimanta* group and Triassic formations. *Udalfs* type of soils is mainly found in this region while in the north-western fringe soil is of *Orthents-ochrepts* type. The region is without vegetation cover as climatic conditions and topography are not favorable.

Eastern Kinnaur Greater Himalaya



This region comprises eastern and southern parts of the district occupying large parts of Sangla and Morang Tehsil and some areas of Kalpa and Poo Tehsil. The region is enclosed by *Sutlej* Basin from west to north, *Dhauladhar* from south-west, State of Uttaranchal from south and Tibet (China) from east. In terms of area, it is the largest sub-micro region of the district. The region is very rugged and mountainous with an altitude ranging from 4,075 metres to 6,473 metres above the mean sea level. It has many peaks which remain covered with snow. The highest peak (6,473 metres) of this region is *Kinnaur Kailash* (Jorkanden). Many passes viz. *Keobarang* (5,642 metres), *Shipki* (5,571 metres), *Raniso*, *Shimdang*, *Gumrang* and *Yamrang* are located in the eastern part of Indo-Tibetan border. *Saro glacier*, *Gara* glacier and *Lambar* glacier are also located in southern part of this region. Several tributaries of *Sutlej* river like *Gyamthing Gad*, *Tidong Gad* and *Baspa* river have their origin from this region. The region is comparatively higher on account of its topography than the Western Kinnaur Greater Himalaya region. It is very dry and does not receive rainfall even during monsoon. The geology of the region is mainly categorized as unclassified. The soils of this region are mainly Glaciers and Snow Cap (103) while *Ochrepts-Orthents-udalfs* (82) type of soils is also observed in the south-eastern fringe. The region is without vegetation cover due to extreme climatic conditions.

***Sutlej* Basin**

This basin covers the central part of district Kinnaur and areas around *Sutlej* river and its tributaries. It includes central part of Poo, Morang and Nichar Tehsil and large area of Kalpa Tehsil excepting its north-western and south-eastern portions and area along *Baspa* river (tributary of *Sutlej* river) in Sangla Tehsil. This region makes its limits with the Lower *Spiti* Basin and Western Kinnaur Greater Himalaya in the north, Eastern Kinnaur Greater Himalaya and *Dhauladhar* regions in the south, while Tibet (China) and Shimla district form the eastern and western direction, respectively. This basin is formed by *Sutlej* river and its tributaries which is a

little flat and fertile valley and has lower slopes. This basin is the populous area in the district. The upper catchment area of the *Sutlej* is located above the permanent snow line at an elevation of 4,500 metres. Elevation of this basin varies between 1,973 metres and 5,439 metres above the mean sea level. *Lakhma* attains a maximum height of 5,439 metres which is located in the north-eastern part of this region. *Sutlej* river which is the lifeline of this region enters the region near *Shipki La* in the north-east and passes through this region from north-east to south-west direction. It leaves the region in the west at Kapaur village and enters Shimla district. Major tributaries of *Sutlej* river are *Spiti*, *Baspa* and *Tidong* while minor tributaries are *Sorang*, *Salaring*, *Wangar*, *Raura*, *Ropa*, *Panwi*, *Melam* and *Tagla*. These rivers/khads join *Sutlej* river in this region from both sides. *Baspa* river which is the main tributary of *Sutlej* river joins it from left bank at Karchham. The valley formed by *Baspa* river in Sangla Tehsil is also known as *Baspa* or *Sangla* valley. In this region, slopes rise steeply from the banks of *Satluj* and *Baspa* rivers. The climate in summer is fairly warm at lower elevation while winter is severe. Lower portion of the basin receives a little rainfall during monsoon. The geology of this basin is formed by *Haimanta* group, *Nagthat* group, *Muth* quartzite, *Manikaran* quartzite, Triassic, *Blaini* formations and Granites (unclassified). *Udalfs* (20), *Orthents-Ochrepts* (58) and glaciers and Snow Cap (103) types of soils are found in this region. Green patches of scattered vegetation are seen on the lower slopes and near the river/*khad* banks. Main species are Chir, deodar, kail, silver, fir, spruce and chilgoza pine etc. Chilgoza pines (Nioza) are commercially very important as it produces costly nuts. Upper slopes are covered with alpine scrubs or grasslands which attract flock of sheep and goats during summer while higher elevations are rugged.

Western Kinnaur Greater Himalaya

This region in Kinnaur district embraces its north-western part including mountainous part of Poo, Morang, Kalpa and Nichar Tehsil which fall on the right bank of *Sutlej* river. It is bounded by Lahaul & Spiti district in the north, districts of Kullu and Shimla in the north-west and west, respectively, *Sutlej* basin in the south while Lower Spiti basin makes its eastern limit. This region has very high mountains with snow covered peaks which have steep slopes towards *Sutlej* River. The mountains of this region are always lesser in height than the mountains which are in eastern Kinnaur Greater Himalaya region. Elevation of the region varies between 3,963 metres and 6,593 metres above the mean sea level. It has several permanent glaciers viz., *Sankarishul*, *Mana Dani*, *Drimiling*, Phuldhang and Zangsu. Many tributaries of Sutlej river like Ropa gad, Taiti gad or *Kirang khad*, *Kashang gad*, *Raura gad*, *Wangar khad* and *Salaring khad* which join it from its right bank originate from this region. *Wangar khad* is an important source of hydel power potential. The climate of this region in winter is very cold and during summer also the temperature does not rise very high. Upper reaches receive snowfall during winter. Lower areas receive rainfall during monsoon. In this region, the intensity of rainfall decreases as one move from west to east direction. The geological structure of this region consists of Triassic and *Blaini* formations, *Nagthat* group, *Haimanta* group and Granites (unclassified). The region has *Udalfs* (20), *Orthents-Ochrepts* (58) and Glaciers and Snow Cap (103) types of soil cover. The region does not contain any vegetation cover.

Dhauladhar

This region falls in the south-western part of the district. It covers the southern part of Nichar Tehsil and south–western part of Sangla Tehsil. It is surrounded by *Sutlej* basin from north, Eastern Kinnaur Greater Himalaya from east while from west to south it is enclosed by Shimla district and State of Uttaranchal. This region has many mountain chains ranging from 3,400 metres to 5,682 metres high above the mean sea

level. *Dhauladhar* range in its western half runs parallel to *Satluj* river and its eastern half to *Baspa* river. *Dhauladhar* range separates



Kinnaur district from Shimla district and this range has originated some streams/rivulets viz. *Hurla Khad, Singan khad, Rukti Khad, Shaune Garang* which join the *Baspa* river. *Melam khad, Panwi Khad, Duling Khad, Solden Khad, Chaunda Khad* and *Panchhot Khad* are the tributaries of *Sutlej* river, also originate from this region. This region contains many passes like *Shathal, Sharang, Chu, Shusarang, Nalgan, Lami, Kimolay* and *Borasu* which are on the southern limit of this region. *Hania* and *Bilare* glaciers are also located in this region. The climatic condition of this region is very severe. Higher peaks of mountains are covered with snow for most part of the year. A few green patches of mixed forests but mainly of Pine trees grow on the bank of streams/*khads*. The geology of this region is formed by *jutogh* group/ *vaikrita* group/ central gneiss. *Udalfs* (20), *Orthents-Ochrepts* (58) and glaciers and snow cap (103) types of soil cover are found in this region.

Culture and Social Brief

Fairs & Festivals

In Kinnaur district various fairs, festivals and community dances are the traditional means of amusement and recreation for the villagers. The fairs are held on festival days and are accompanied by dancing all around the year in different parts of Kinnaur. During these fairs and festivals, they drink and dance in joyful mood. The women dancers sing songs which consist of some old or contemporary local legends. Musicians, which mostly belong to Scheduled Castes, with drums, wind-instruments and cymbals accompany the dancers as they circle, arms entwined-with slow, rhythmic steps round their villages deity in the temple court yard. Fairs in Kinnaur district do not always signify commercial or trade activities of the region. These are organized generally in the festivals. Different fairs and festivals which are by and large celebrated all over the district are: *Sazo, Phagul/ Suskur, Baisakhi* or *Beesh, Dakhraini, Flaich* or *Do-khayang, Losar* and *Kinnaur Lavi* Tribal festival.

Places of religious, historical or archeological and tourist interest

There are many places in Kinnaur district which can be historically, archeologically considered as significant. Some of these are:

Kalpa: It is situated at an altitude of 2759 m from the sea level. There are various Buddhist monasteries at Kalpa.

Reckong Peo: It is situated at an altitude of 2670 m above mean sea level. It is the district headquarter having a panoramic view of Kinner Kailash. A Buddhist monastery is also located here.

Sangla: It is highly populated village and is situated on right bank of *Baspa* river and is famous for its fertile soil. It is situated at an elevation of 2621 metres above mean sea level. It is located in famous *Baspa* valley.

Chango: It is situated at distance of 122 kms. from Kalpa. It is encircled on every side by high hills.

Chhitkul: This is the highest village in *Baspa* valley situated on right bank of *Baspa* river.

Kothi: It is a large village in Kalpa Tehsil The village has attractive temples, tanks & willow.

Kamru Fort: There is a Kamru fort where the Raja of the erstwhile State of Bushahr used to take shelter at the time of need.

Temples : Almost every village in Kinnaur district has a temple which is taller in size than local houses and are famous for immaculate wood carvings on these temples which are centuries old.

Gompa: In the upper Kinnaur, almost all villages have the Buddhist monasteries called Gompa. These monasteries have clay statues of Lord Buddha and their walls are decorated with rare religious paintings.

Kinner-Kailash: Kinner- Kailash is very ancient religious place dedicated to God Shiva. It is situated at an altitude of 6,473 metres above mean sea level. This region is very rugged and mountainous. People performed religious journey around the hills during the summer.

Assessment of District Vulnerability

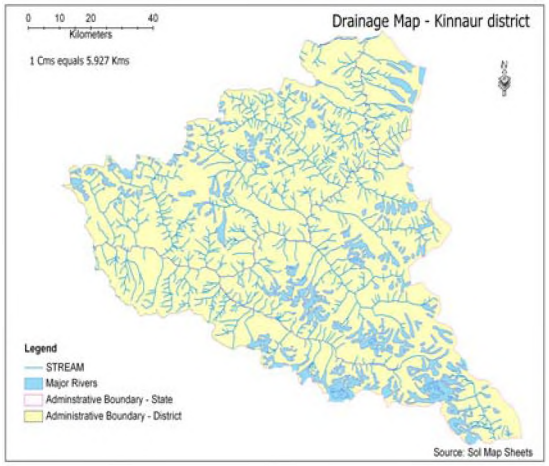
As explained above the '*Pressure*' and '*State*' variables together when analysed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability vis-a-vis utilization, which in turn when further analysed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Kinnaur district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

The important rivers and streams draining various parts of Kinnaur district is *Sutlej* and its tributaries.



***Sutlej* River**

This is the principal river of district almost dividing the district into two parts. It runs within the Himalayan Mountains for about 450 kms. and first part of its course is west-north-west. Up to village Khab, it is a raising torrent where it receives the *Spiti* river. The tributary of river in district are *Spiti*, *Ropa*, *Taiti*, *Kashang*, *Mulgoon*, *Yula*, *Wanger*, *Shorang* and *Rupi* on right bank and *Tirung*, *Gyanthing*, *Baspa*, *Duling* & *Solding* on left bank.

***Spiti* River**

It is the second major river in district which has its source far north on eastern slopes of mountain range which run between Lahaul & Spiti. The river is formed at base of Kunzum range by confluence of *Kunzum La Togpo* and the streams *Kabzima* & *Pinglung*. It

flows eastward till Kaurik and then turn southward to join *Sutlej* river at Khab at an altitude of 2589 metres. *Spiti* is joined by several feeders which meet the river both at right & left bank. *Chalodgopo* is on left bank while *Yulang, Lipak* & *Tirasang* are on right side.

Baspa **River**

It is another feeder of *Sutlej* river which rises on north eastern declivity of outer *Dhauladhar*. It is bounded on south west by *Dhaualdhar* and on North east by *Raldang* peak of Greater Himalaya. The river is about 72 kms. in length. Its entire course lies within the district. *Zupkia, Thatang, Bering* & *Rukti* are the tributaries on left bank while *Suthi* is on right bank.

Lakes & Springs

Nako lake is a high altitude lake located in Poo subdivision of Kinnaur district. The lake is surrounded by poplar & willow trees. It is situated on western slopes of *Leo Parginal* above 1.6 kms. above left bank of *Spiti* river. *Sorang* lake is situated above village Ramni & Jamni in Nichar Tehsil. *Tomchoo* lake is situated above Labrang village of Poo Tehsil. Springs are scattered all over the district. Various hot water springs are also found in district. One such spring is found at Nathpa and one at Joktiaring hamlet about five kilometres towards east of Nichar.

Climate

Kinnaur, due to its geographical situation has a long winter from October to May and a short summer from June to September. It has two distinct climatic zones, the wet and the arid. Only the area south of the Great Himalaya receives monsoon rains. This area roughly covers *Baspa* valley and the lower reaches of the *Sutlej* valley. In the upper reaches of the district, the monsoon showers decline progressively and beginning of the complete arid zone from the place called Spilo at a distance of 255 kms. from Shimla situated at an elevation of about 2,276 metres above the sea level. The vegetation above Kalpa rapidly becomes sparser and ultimately confines along the river.

Precipitation/Rainfall

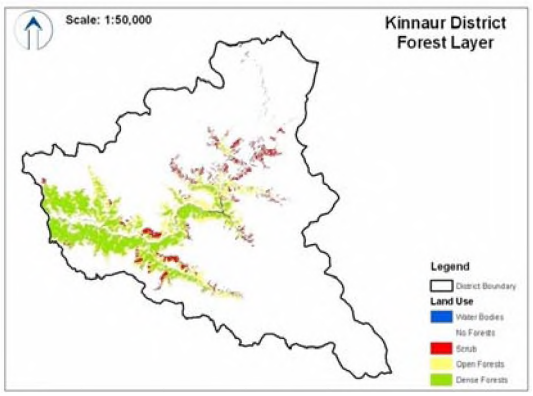
Along the valley of the *Sutlej* as for east as Wangtu, the rainfall does not vary much from Shimla, but beyond Wangtu the difference is considerable. The rainfall becomes less and less as Shipki is approached so that the climate of the upper Kinnaur is semi-arid. West of Wangtu, in the lower portion of Kinnaur, June is the warmest month and in the upper region July and August are the warmest months. Clouding is more heavy persistent and prolonged in the long winter season. There are strong winds in the winter months. The total average annual rainfall recorded in the district is 502 millimetres and total rainfall period on an average is 47 days.

Particulars	Maximum	Minimum
Rainfall	83.5 mm	04.9 mm
Temperature	25.7° C	-7.2° C

Forest & Wildlife

Forests have a vital role in the economy of the district. The demarcated protected forest area is spread over in 236.86 sq. kms. whereas un-demarcated protected forest area is spread over in 3535.33 sq. kms. With the increase in human population, there is a pressure on the forests for timber, firewood and fodder for cattle. The forests play a vital role in conserving the soil and ensure timely rains. Kinnauries are primarily agro-pastoral people and their land utilization and management practices are crude and primitive. Large scale felling of forest tracts within and outside reserved and demarcated forests take place in an unrestricted manner for house construction, for the extension of cultivation and for finding grazing grounds for the ever increasing cattle. These felling combined with fires, and overgrazing resulted in the destruction of large area of forests and pasture lands. To overcome this problem, the Forests Department has closed certain areas in Nichar and Poo for grazing

throughout the year. Besides, it is also being ensured that there is no breach of Forest Rules.



The forest types can be classified into three main divisions in Kinnaur district:

The **moist zone** forests are found on the left side of the *Sutlej* valley with northern exposure up to Nichar. They comprise the Tranda range of forests. The forests are particularly continuous. From the river side at 3,500 feet to alpine pasture at 12,000 feet on the right base consists of grass lands and higher up are the forest belts. Along the side stream the forest are well developed and *Pinus longifolia*, *Pinus wallichiana*, *Cedrus deodara*, *Picea smithiana*, *Abies pindrow*, *Pinus gerardiana* form a broad belt of forests along with sides of the *Sutlej* valley and the side streams between the cliffs of the gorge below and alpine pastures. On the lower slopes up to 1,500 metres, Chir pines occur in pure form and in higher up reach give way to *Quercus incana* and *Rhododendron arboreum*. On shelter ravine bank between 1500 to 3600 metres *Cedrus deodara* and *Pinus wallichiana* form intervening forest. Above 2100 to 3000 metres, *Picea smithiana* with mixture of broad leaf species predominate.

The **dry zone** is spread in middle Kinnaur where the Deodar reaches its optimum development and form large areas of pure forests. It extends from Nichar to Chini and also found in Sangla valley. At the lowest levels, pine trees abound while in the higher tracts blue pine, spruce and silver trees are found. Neoza pines (Chilgoja) which produce edible nuts grow in this zone and are the only forest of neoza in India, barring the Peer Panjal range.

The **arid zone** includes the parts adjoining Tibetan border where the deodar develops well only on cool aspects and comparatively at higher elevations than else where. In this zone, the forest consist dwarf bushes and vast barren, desolate and rocky areas are devoid of tree cover.

The tract of Kinnaur district, due to great variation in its elevation, climate and topography represents varied fauna and flora. Because of ecological, faunal, floral and geomorphologic importance, three wildlife sanctuaries have been created in this district which are as follows:

1 *Rakchham-Chitkul Sanctuary*
2 *Lippa-Asrang Sanctuary*
3 *Rupi-Bhabha Sanctuary*

The main objective of creation of these sanctuaries is protection, propagation and development of wildlife therein and its environment. The other two wildlife sanctuaries of Kinnaur namely Lippa-Asrang and Rupi-Babha are situated in the north-eastern part of this district. The Lippa-Asrang is in the upper catchment of *Taiti* Stream which is an important tributary of *Sutlej* river.

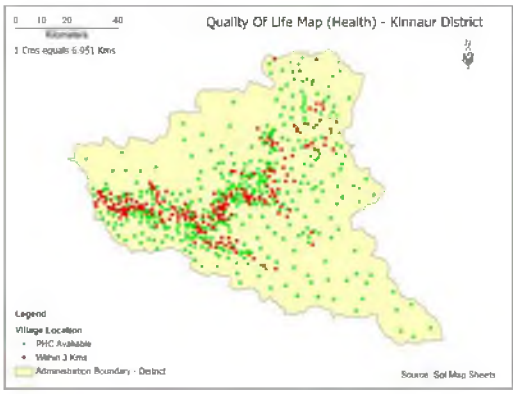
Quality of life (Health)

Availability of health facility is one of the major indicators for quality of life. If the person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector. Out of total 234 inhabited villages only 77 (32.9%) villages have medical facility. 217 villages are deprived of any primary health centre while 231 villages don't have any type of hospital. Of these hospitals facility is available to 19 villages at a distance of less than 5 kms., fifteen villages have this at 5-10 kms., while 197 villages have this facility at distance of 10+ kms.

With regard to Primary Health Centres, 37 villages have these at less than 5 kms., 44 villages have these at 5-10 kms. while 136 villages have it at 10+ kms.

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km. distance in a day and cover the scattered population.

In fact, to summarize, according to 2001 Census, on an average 85% of villages in the district do not have access to a Primary Health Center within a distance of 3 kms., 92 % of the villages do not have access to Community Health Center within a distance of 6 kms. and, 95% of the villages do not have access to a Hospital within a distance of 10 kms.



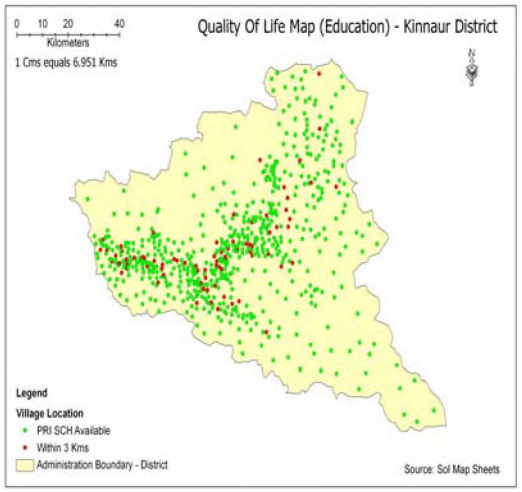
As can be observed from the map, (the valley which is the most populate (with the maximum number of villages) has deficient access to health facilities.

Quality of Life (Education)

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. Out of total 234 inhabited villages, 161 villages (68.8%) have education facility. 75 villages are deprived of primary school while 233 villages don't have degree college. With regard to primary school 33 villages avail this facility at less than 5 kms. while for 42 villages this is at 5-10 kms. Considering Degree College, 11 villages have this at less than 5 kms., 4 have this at 5-10 kms. while 218 villages avail this facility at 10+ kms.

The District Primary Education the Program had a norm of having a Primary School within a distance of 1 km. so that the child does not have to walk more than a km. to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km. in order to make the Primary School viable.

To summarize, according to Census of India 2001, on an average across the district, 22% villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 47% of the villages do not have access to a Secondary School within a distance of 6 kms., 42% of the villages do not have access to a college within a distance of 15 kms. and a staggering 88% of the villages on an average do not have access to a Vocational Institute within a distance of 25 kms.



Description of Pressure Theme Variables:

Pressure variable which are relevant in context of District Kinnaur such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have

impact on the State of natural system in Kinnaur district and its on Tehsils are described below.

Demographic Profile

Population & its Distribution

According to the 2001 Census, the total population of Kinnaur district is 78,334 persons of which 42,173 are males and 36,161 females (the Census of India, 2011 gives a provisional population figure of 84, 298 with a density of 13 per sq. km. Data at tehsil level is not available). The population of the district forms 1.29 % of the State population and ranks at 11th place among the districts. The district of Kinnaur has no urban area and as such its population refers to rural area only. It has 5 tehsil and 1 sub-tehsil having 660 villages comprising of 234 inhabited and 426 un-inhabited villages. The concentration of in-habited population is mainly along the valleys of rivers and streams as well as on undulating slope while higher altitude areas are mostly devoid of any habitation.

Population Growth

According to 2001 Census, a population of 78,334 persons has been reported against 71,270 persons in the 1991 Census. It has registered a net addition of 7,064 persons thereby indicating a growth rate of 9.9 % during 1991-2001.

Density

In light of its terrain, Kinnaur has a low density in comparison to the density of the State. The density of population in the district is 12 persons per sq. km. against the State figures of 109 persons.

Tehsil/Sub-Tehsil	Population						Percentage decadal variation 1991-2001		
	1991			2001					
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Hangrang	4,002	4,002	-	4,062	4,062	-	(+)1.50	(+)1.50	-
Poo	7,414	7,414	-	7,898	7,898	-	(+)6.53	(+)6.53	-
Morang	9,856	9,856	-	10,383	10,383	-	(+)5.35	(+)5.35	-
Kalpa	15,397	15,397	-	17,630	17,630	-	(+)14.50	(+)14.50	-
Nichar	23,861	23,861	-	26,630	26,630	-	(+)11.60	(+)11.60	-
Sangla	10,740	10,740	-	11,731	11,731	-	(+)9.23	(+)9.23	-
Kinnaur	71270	71270	-	78334	78334	-	(+)9.91	(+)9.91	-

Sex Ratio

There are 857 females for every thousand males in Kinnaur district. In the age group of 0-6, sex ratio is 979 females against per thousand males in the district as a whole.

Work Participation Rate

The work participation rate means percentage of total workers to total population. According to 2001 Census, the work participation rate for total workers (including main and marginal workers) is 61% of the total population of the district. Of the total workers the share of main workers is 51.4% and of marginal workers is 9.6%. The remaining 39% of the population belongs to the category of non-workers. Sex wise among the main workers, the ratio of males is 59.4% where as in females it is 42.3%. In the category of marginal workers the proportion of female i.e. 12.4% and is slightly higher to the males proportion of 7.1 as the females are attending to one or more economic activities in addition to their household duties to improve the family income.

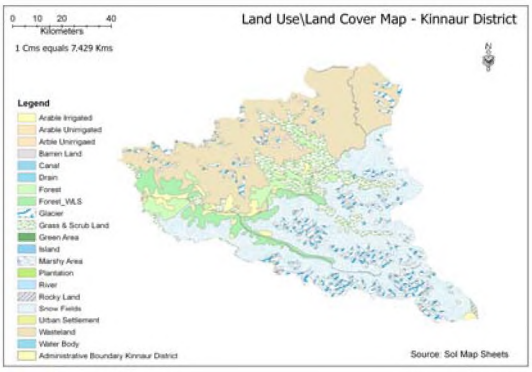
Urban Population

Kinnaur district has no urban area and as such its population refers to rural area only.

Literacy

A person who can read and write with understanding in any language is a literate for census purpose. All the children below the age of 7 years are treated as illiterates. As per 2001 Census Kinnaur district has reported 51,913 persons as literates constituting 75.2% of total population excluding 0-6 age group population. The proportion of male and female literates in the district is 84.3% and 64.4% respectively. The literacy rate of males is higher by 19.9% than of females.

Land Use



Classification of Area	Tehsil wise Land Utilization (In sq.km)						
	Nichar	Sangla	Kalpa	Morang	Poo	Hangrang	Total
Total Geographical Area	1186.21	1282.22	390.90	1628.60	1021.68	727.81	6237.42
Forest	231.12	29.09	44.20	48.61	13.07	-	366.09
Barren and unculturable land	21.10	732	267.38	845.27	474.17	216.89	2556.81
Land put to non-agriculturable uses	904.17	503.00	59.55	720.60	525.50	506.34	3219.18
Culturable waste land	5.93	3.58	2.95	2.30	1.97	0.55	17.28
Total cropped area	**29.38**	**18.03**	**19.63**	**13.68**	**8.78**	**4.57**	**94.07**

Agriculture

Kinnaur is predominantly an agricultural district. Agriculture in the hilly areas posses peculiar problems due to steep and difficult terrain, small and scattered holdings, depleting fertility of soil, by constant erosion, the crop yield are very low. The crop, season is limited to only six months due to intensive cold and snowfall. However, the economy of the district is highly agro-pastoral. Land holdings are generally small and scattered. Soils generally consist of sand, sandy-loam, clay-loam, sandy and gravel. Wheat, barley, maize, potato, vegetables and pulses are the main crops of the district. Potato is the main cash crop of district. Out of the total 94.07 sq. kms. cropped area, 12.53 sq. kms. were under double cropping pattern.

Tehsil-Wise Area Under Principal Crops*

Name of crops	Area (ha)	Production (MT)
Wheat	371	358.24
Maize	404	930.41
Rice	30	36.45
Barley	1,420	2,289.04
Pulses	1,340	790.23
Edible oilseeds	04	N.A.
Potato	244	2,110.60

Source: District Statistical Abstract, Kinnaur-2000

Irrigation

To increase the crop production, the importance of irrigation is well established. Adequate and timely supply of irrigation water to crops is the pre-requisite in the agriculture production process, particularly in areas where the rainfall is scanty and irregular. The growth in production is possible through irrigation. The scope of irrigation in the district is limited and is provided through *Kuhls* from the perennial *Khads*.

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as kuhls, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.

year	Irrigation by kuhls	Other sources of irrigation viz. Canal, Well, Lake, Tube well etc.	Tehsil wise irrigated area For the year 1999-2000	Irrigated area
1991-92	4,841	-	Nichar	184
1992-93	4,258	-	Sangla	994
1993-94	4,307	-	Kalpa	1,442
1994-95	5,622	-	Morang	1,062
1995-96	5,523	-	Poo	605
1996-97	5,523	-	Hangrang	403
1997-98	5,528	-	Total	4,690
1998-99	5,534	-		
1999-2000	4,690	-		

Livestock

Livestock is the main wealth next to agriculture of rural population. Almost every house hold in rural areas keeps a few cows, sheep and goats etc. besides some poultry birds. Animals are kept for milk, meat and providing manure to the fields. In order to improve the life standard of the people, all-round efforts are being made to improve the production of milk.

Total Number of Livestock (As per 1992 Census)

Livestock	Number
Cows	22256
Buffalo	3
Sheep	57720
Goats	28622
Others	6540
Poultry birds	5795

Horticulture

Horticulture is of great significance to the people of the State. It goes a long way in improving the economic conditions of the people. The climatic conditions prevailing in the district are very useful for the development of horticulture and apples in particular. With the introduction and availability of improved techniques, expertise in the field of horticulture and transportation facilities, the production of fruits is also increasing year by year. Kinnaur district has a distinct place in the country for its quality apples and temperate fruits like walnuts, almonds, chilgoza, raisin, apricot etc. The main commercial varieties of apple grown are Royal Delicious, Rich Red, Red Delicious and Golden Delicious which are directly marketed to Chandigarh, Delhi, Chennai, Kolkata and Mumbai markets.

Area & Production of Different Fruits (1999-2000)

Fruit	Area (Sq. Km)	Production (MT)
Apple	62.56	21818
Other Temperate fruits	0.87	121
Nuts & dry fruits	14.78	364
Citrus Fruits	_	_
Total	**78.21**	**22303**

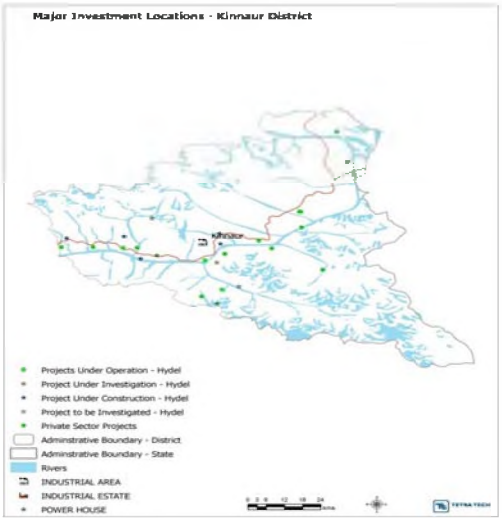
Source: District Statistical Abstract, Kinnaur-2000

Fisheries

There is a vast net work of perennial rivers, streams and khads in the district and there is a great scope for the development of fish culture. During the year 1999-2000, the production of fish was 17.5 metric tonnes. The registered fishermen and licence holders were 39 in the district.

Industries

As regard industries, Kinnaur is however undeveloped district in the State. In light of peculiar conditions prevailing in the district the chances of setting up large scale or even small scale industries are rare. However, traditional village and rural household industries like spinning, weaving, blacksmithy, silversmithy, goldsmithy, carpentry, wood and metal carving, basketry, flour milling, oil milling, fruit processing and distilling exist in almost all parts of the district. Two centres manufacturing shawls, gudmas and namdas are functioning in the district at Spillo and Nichar. There is one industrial training institute located at Reckong Peo which imparts training in various trades such as wireman, weaving, stenography and electrician.



Handicraft

Art of weaving occupies a place of pride in the crafts of the district. This household industry is certainly of the very ancient origin in the district. The district is rich in producing wool. The wool spinning and weaving is important household industry of many households in this district. Woollen caps, shawls, pattoos and tweed cloth (Patti) are woven from home-spun yarn for self use and local marketing. 'Patti' is used for making coats, long coats and caps etc.

Minerals & Mining

Rocks varying in age from Precambrian to Permo-Carboniferous are exposed in the Kinnaur district. The district can be subdivided in three main sectors on the basis of geological formations as follows:

Between the border of Kinnaur and Shimla district and Jangi: The geological formations exposed in this area have been named as Sarahan series. The Sarahan series constitute schist and gneisses with granite and Pegmatite and basis rocks

Between Jangi and Shipkila: The rocks of this sector have been designated as Jangi series. It comprises slates, carbonaceous slates, graphite phyllite, chlorite phyllite, sand stone grading into quartzite and thin bands of lime stone.

Area north and west of Shipkila: The formations exposed in this area belong to Ordovician, Silurian, Denonion and Permo carboniferuous. The Ordovician and Denonian are represented by red quartzite and grites, often under lain by conglomerates and passing upwards into shales with bands of lime stone and dolomite. No major Mining activity exists in the district

Roads & Transport

The district is neither linked with air nor with railway. Therefore, the entire passenger and goods transportation is through the road network in the district. Before the formation of State, there were no motorable or even jeepable roads in the district. The only link with the outside world was the Hindustan-

Tibet mule road. The National Highway No.22 was aligned by Public Works Department and by early 1961 was made safely jeepable up to Tapri. With the transfer of this road to Border Roads Development Board early in 1961, the road construction has been carried out by this Organization. This road runs through the heart of Kinnaur district along the banks of the *Sutlej* and *Spiti* rivers.



All the Tehsil headquarters are connected with the district headquarters by motorable roads. The district has about 997 kms. road length by end of March, 1999 and only 558 km. of motorable roads, 80 kms. jeepable roads and 359 kms. of less than jeepable roads. Reckong Peo bus depot of Himachal Pradesh Road Transport Corporation (HRTC) is operating a fleet of 46 buses daily on different routes. Some buses are also plying on inter-district and inter-State routes.

Year	Metalled	Unmetalled	Jeepable	Total
1994-95	485	346	65	896
1995-96	490	346	76	903
1996-97	500	348	70	918
1997-98	525	356	75	956
1998-99	558	359	80	997

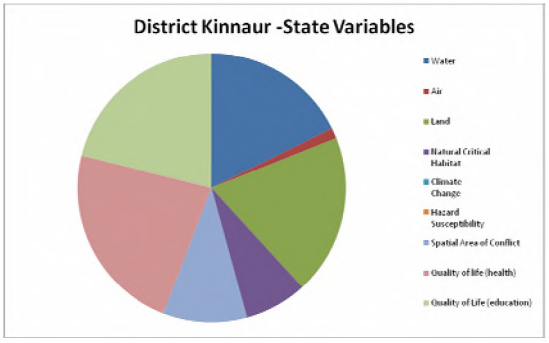
Electricity & Power

Kinnaur has rich potential for the establishment of micro Hydel projects because of the presence of large number of perennial snow-fed streams. The *Sutlej* river and its tributaries provide many suitable sites for hydro-electric projects. Two small Hydel stations setup at *Rukti* and *Pangi Nallah* to fulfill the local requirement. Some of the other hydro power projects are Bhawa Augmentation Scheme, Nathpa Jhakri Hydroelectric Project, *Baspa* Hydroelectric Project and Karcham Wangtoo Hydroelectric Projects.

Summary of State Variables at District Level

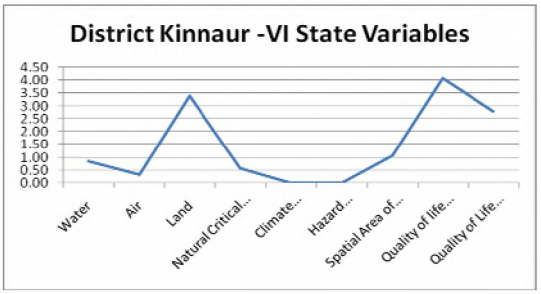
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kinnaur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Kinnaur Variable Sector	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	3219.01
Air	229.57
Land	3505.25
Natural Critical Habitat	1375.34
Climate Change	0.00
Hazard Susceptibility	0.00
Spatial Area of Conflict	1841.10
Quality of life (health)	4198.87
Quality of Life (education)	3844.88



The analysis of data indicates gaps in infrastructure and services in health and education sector. Quality of Life (health) is nearing critical stage and education is on the verge of nearing high vulnerability. Land and water resources are under pressure. Spatial Areas of Conflict is evident making the district vulnerable.

A programme for improvement in infrastructure and services in health and education sector can be undertaken on priority to reduce vulnerability.



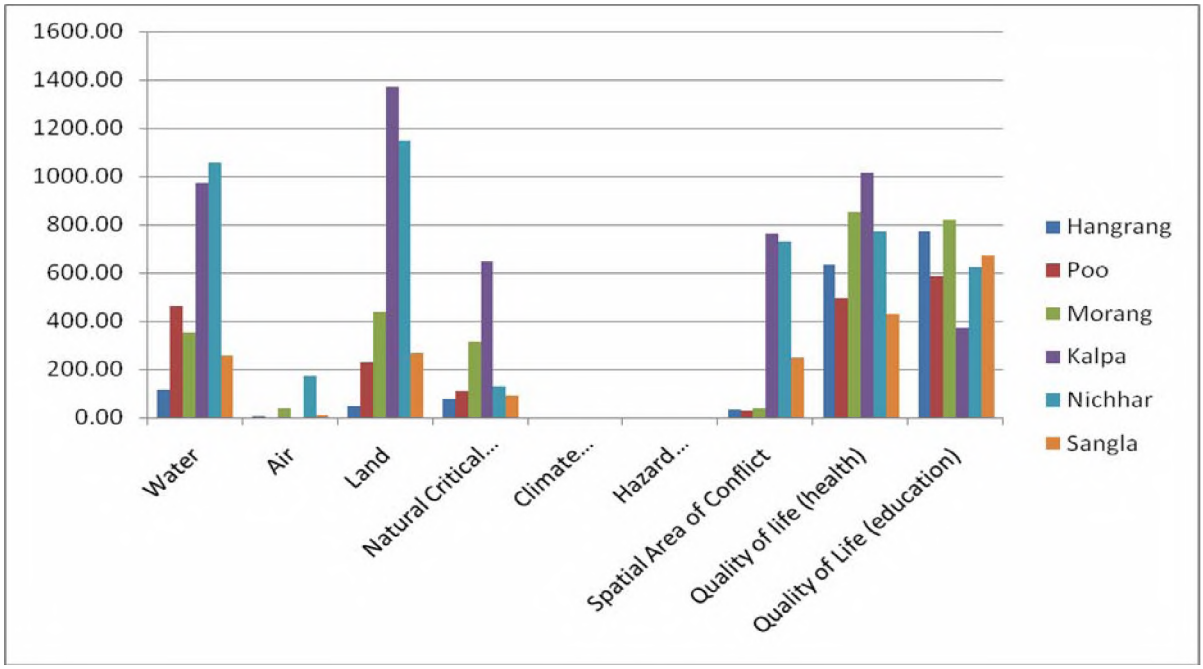
State Variables at Tehsil Level

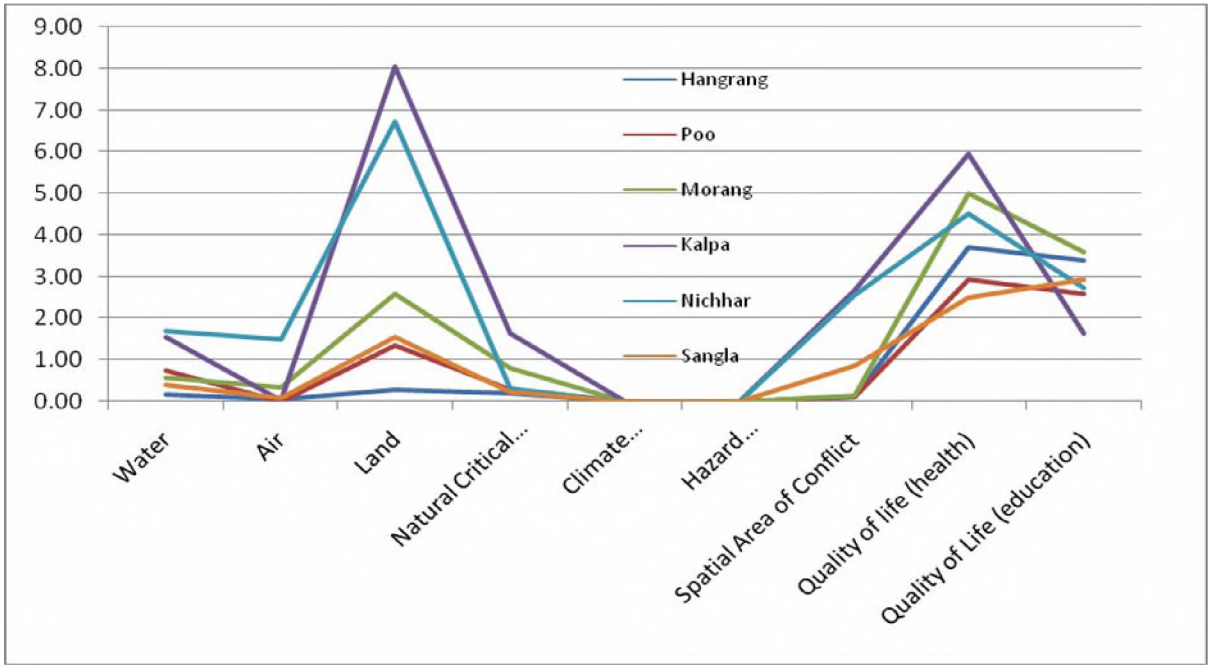
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

State Variables	Hangrang	Poo	Morang	Kalpa	Nichhar	Sangla	Vulnerability of State Sector $V_{\text{Pressure Sector}}$
Water	116.05	462.87	352.35	974.44	1057.15	256.15	3219.01
Air	5.63	1.00	39.60	2.74	170.60	10.00	229.57
Land	49.35	227.20	440.10	1374.05	1148.42	266.13	3505.25
Natural Critical Habitat	77.52	112.26	315.79	650.00	128.92	90.85	1375.34
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	0.00	0.00	0.00	0.00	0.00	0.00	0
Spatial Area of Conflict	32.66	28.75	38.09	764.40	728.10	249.10	1841.1
Quality of life (health)	631.88	498.05	853.60	1017.48	770.75	427.11	4198.87
Quality of Life (education)	771.56	587.80	816.99	375.38	624.04	669.11	3844.88

District Level Analysis Tehsilwise -State Variables





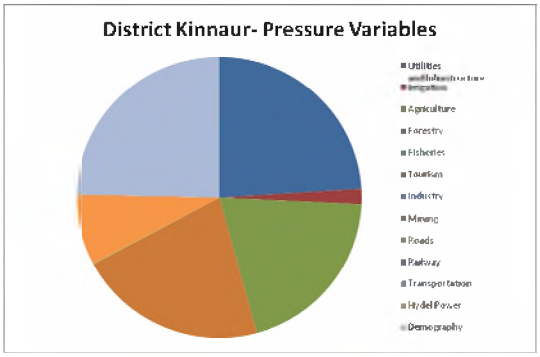
The analysis of data indicates gaps in infrastructure and services in health sector, in all the six Tehsils. Futher, gaps in infrastructure in Education sector is evident in all Tehsils except Kalpa (being the Headquarter Tehsil for the district). Land is under pressure in Kalpa and Nichhar because of activities undertaken there. Spatial Areas of Conflict is evident in Morang, Nichhar and Kalpa due to presence of many Hydel projects.

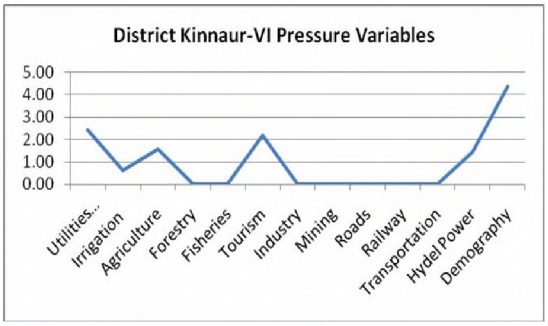
Summary of Pressure Variables at District Level

Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kinnaur. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($V_{\text{pressure Sector}}$) as a total for that particular system.

Kinnaur Variable Sector	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	4372.89
Irrigation	316.87
Agriculture	3645.37
Forestry	0.00
Fisheries	0.00
Tourism	3893.09
Industry	0.00
Mining	0.00
Roads	15.43
Railway	0.00
Transportation	0.00
Hydel Power	1481.00
Demography	4489.37

The analysis of data indicates Demographic pressure which puts pressure and increases gaps in Utilities & Infrastructure. Agriculture is a significant land use. Since the population and tourism is on the rise, projects for plugging the gaps in Utilities & Infrastructure can be developed on priority.





Pressure Variables at Tehsil Level

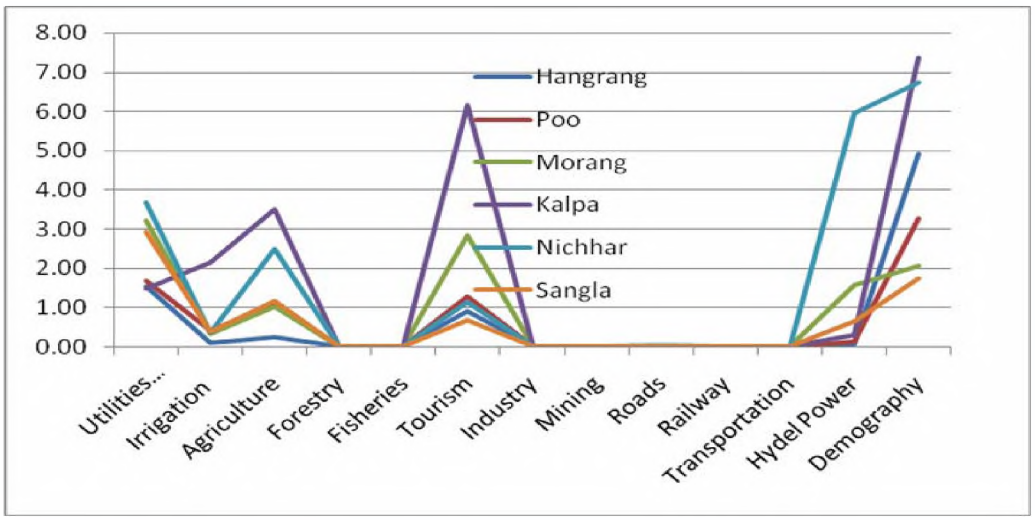
Similarly, the pressure variables computed at Tehsil level for comparison is given below.

Comparison of Pressure variables at Tehsil level:

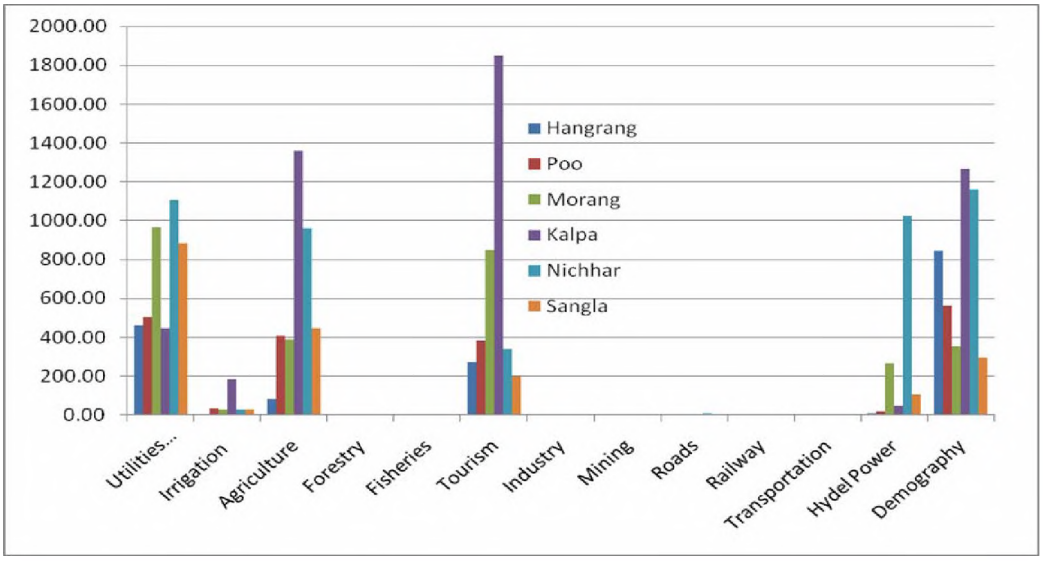
Pressure Variables	Hangrang	Poo	Morang	Kalpa	Nichhar	Sangla	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	462.71	505.97	966.01	446.45	1107.10	884.64	4372.88
Irrigation	7.36	33.80	27.97	184.60	31.00	32.14	316.87
Agriculture	83.99	409.57	388.07	1357.46	961.04	445.24	3645.37
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0
Fisheries	0.00	0.00	0.00	0.00	0.00	0.00	0
Tourism	271.90	384.10	850.02	1850.00	337.71	199.35	3893.08
Industry	0.00	0.00	0.00	0.00	0.00	0.00	0

Pressure Variables	Hangrang	Poo	Morang	Kalpa	Nichhar	Sangla	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0
Roads	1.00	1.00	1.00	1.43	10.00	1.00	15.43
Railway	0.00	0.00	0.00	0.00	0.00	0	0
Transportation	0.00	0.00	0.00	0.00	0.00	0	0
Hydel Power	11.63	18.87	268.85	51.20	1022.80	107.65	1481
Demography	846.06	564.61	354.59	1267.35	1158.32	298.43	4489.36

District Kinnaur- Tehsil wise Analysis- VI- Pressure Variables



Pressure Variables vulnerability at Tehsil level in District Kinnaur



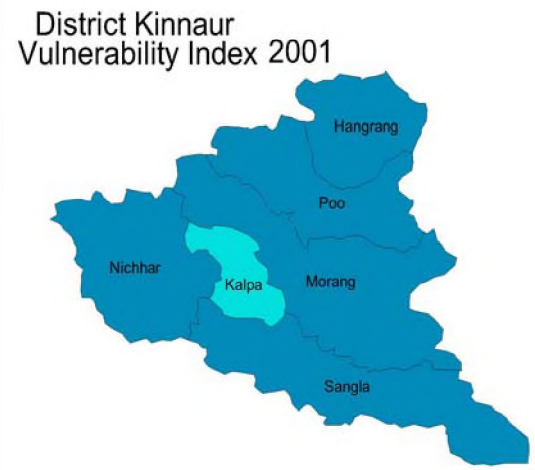
The analysis of data indicates pressure from Tourism, Demography and Agriculture in Kalpa. Nichhar faces demograhic pressures and gaps in Utilities & Infrastructure is evident. Agriculture is a signifcant land use. Sangla & Morang shows Gaps in Utilities & Infrastructure. Nichhar faces pressure from the Hydel Power sector. The remotest of the Tehsils, Hangrang is also facing demographic pressures.

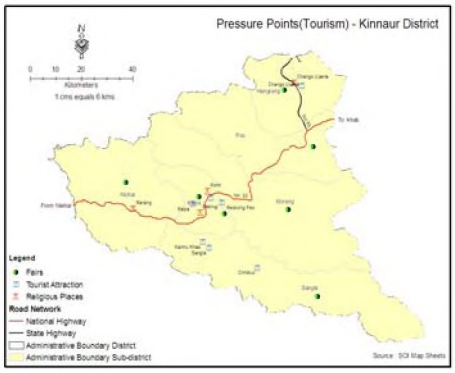
Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Kinnaur. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

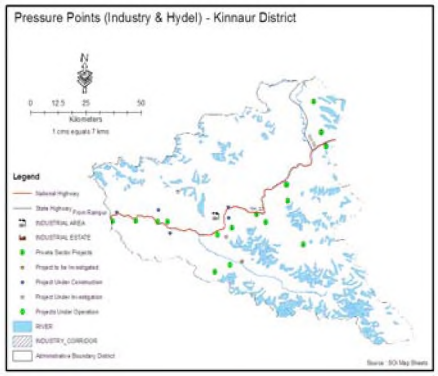
$$\frac{\sum V \text{ Pressure Sectors} : V \text{ State Sectors}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

Vulnerability Index

	Hangrang	Poo	Morang	Kalpa	Nichhar	Sangla
VI	1684.651	1917.92	2856.51	5158.49	4627.98	1968.45
denominator = 57x43			2451			
Normalized VI	0.69	0.78	1.17	2.10	1.89	0.80





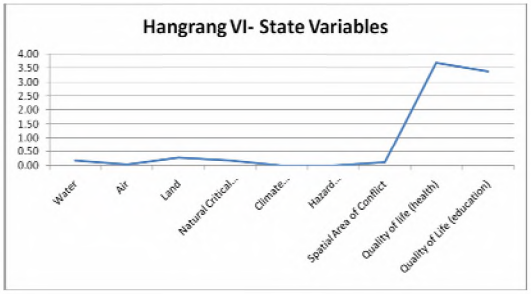


The analysis of data indicates that except for Tehsil Kalpa which also houses the district headquarters of Reckong Peo, all tehsils have very low vulnerability.. Tehsil-wise and Component –wise analysis of the Vulnerability Index follows

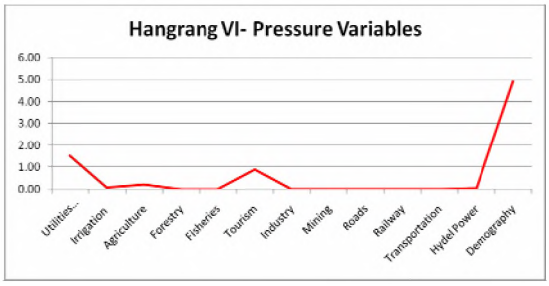
Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Tehsil Hangrang: Overall Vulnerability Index= 0.69

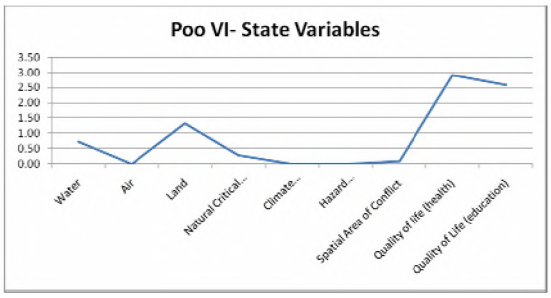


The analysis of data indicates gaps in infrastructure and services in Health sector. A programme for improving infrastructure and services in Health sector can be developed to reduce the vulnerability in this sector. No other State variable in Tehsil is of immediate concern.

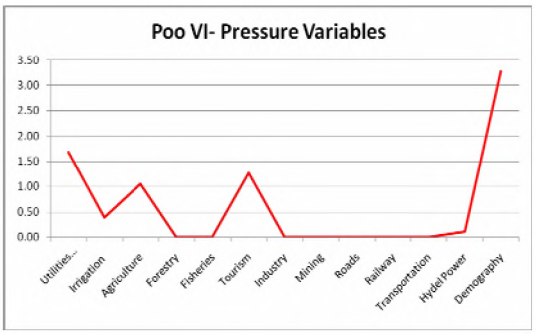


The analysis of data indicates demographic pressure. However, in so far as vulnerability is concerned, no other Pressure variable is of immediate concern.

Tehsil Poo: Overall Vulnerability Index= 0.78

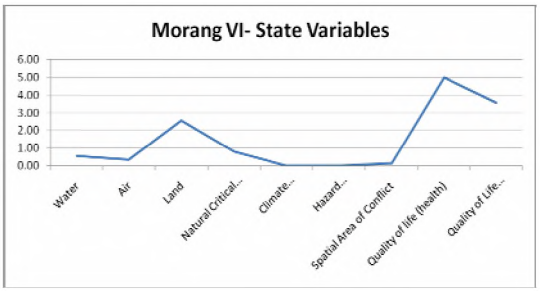


The analysis of data indicates gaps in infrastructure and services in health and education sector. The Quality of Life (Health and Education) variable though not critical, show a moderately low vulnerability. A programme for improving infrastructure and services in health & education sector can be developed to reduce the vulnerability in this sector.



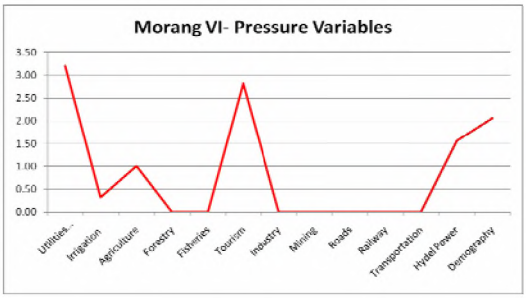
No Pressure variable is a cause of immediate concern in Tehsil.

Tehsil Morang: Overall Vulnerability Index= 1.17



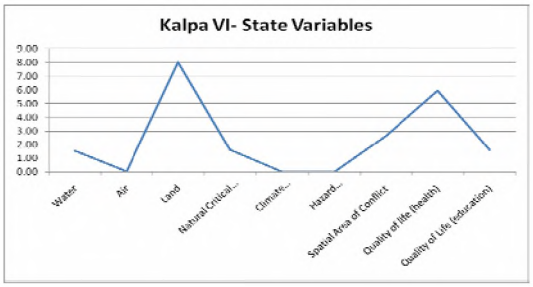
The analysis of data indicates gaps in infrastructure and services in health and education sector. Quality of Life (Health) Variable has reached the High Vulnerability segment. No other State variable in the Tehsil is of immediate concern. The Quality of Life

(Education) variables are also showing vulnerability. A programme for improving infrastructure and services in health & education sector can be developed to reduce the vulnerability in this sector.

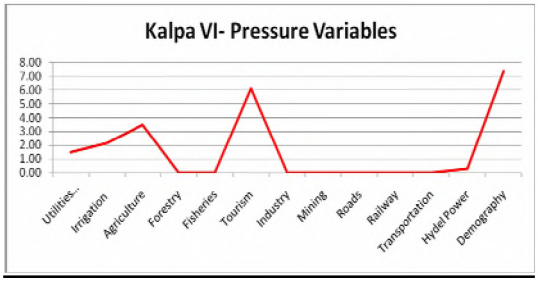


The analysis of data indicates pressure from Tourism and Utilities & Infrastructure sectors. A Plan for Tourism and projects can be prepared to reduce the gaps in Utilities & Infrastructure.

Tehsil Kalpa: Overall Vulnerability – 2.10

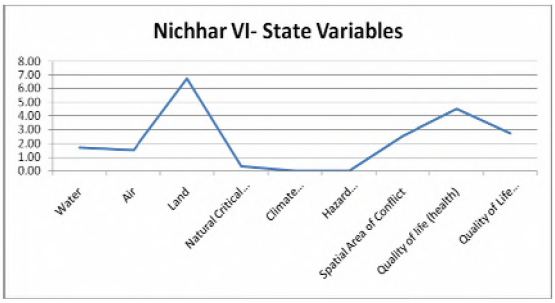


The analysis of data indicates pressure on Land which has reached the critical vulnerability segment. This may be due to the fact that the District Headquarters is housed in the Tehsil and land use changes surrounding the headquarters. Further, the analysis of data indicates gaps in infrastructure and services in health sector. The Quality of Life (Health) variables have reached the critical stage. A programme for improving infrastructure and services in health sector can be developed to reduce the vulnerability in this sector.

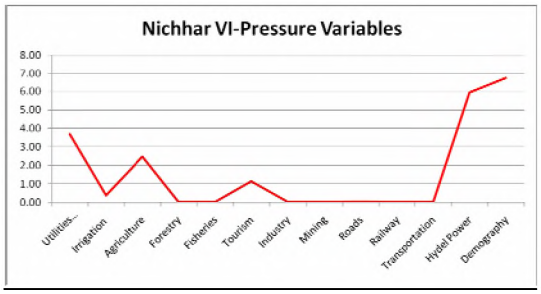


The analysis of data indicates Demographic and Tourism pressure which have reached or crossed the critical stage. The Tehsil appears to be developing as a tourist destination. A Tourism Plan can be prepared in accordance with Tourism Master Plan. A Development Plan/Land use plan can be prepared for anticipating future growth and developmental activities for reducing vulnerability.

Tehsil Nichhar: Overall Vulnerability – 1.89



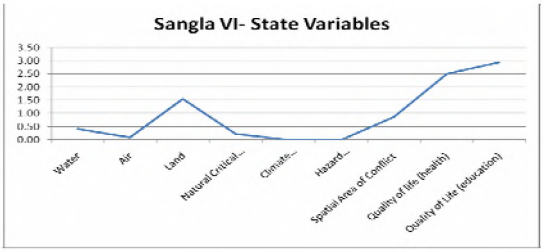
The analysis of data indicates pressure on Land which has crossed the critical vulnerability segment. This may be due to the fact that the District Headquarters is in adjoining Tehsil and land use changes surrounding the headquarters. Further, the analysis of data indicates gaps in infrastructure and services in health sector. The Quality of Life (Health) variables have reached the high stage. A programme for improving infrastructure and services in health sector can be developed to reduce the vulnerability in this sector.



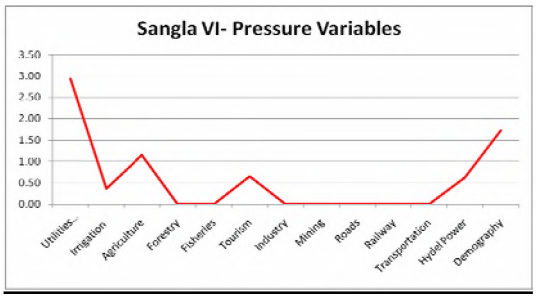
The analysis of data indicates pressure from Hydel Power Sector which has reached the critical stage. Demographic pressure creates Gaps in Utilities and Infrastructure and is a cause of priority concern. New Hydel Power

project can be considered on the basis of comprehensive and cumulative basin level environment and social impact assessment. Further, projects to plug the gaps in Utilities & Infrastructure can be taken to for reducing VI.

Tehsil Sangla: Overall Vulnerability – 0.80



The analysis of data indicates gaps in infrastructure and services in health and education sector. The Quality of Life (Health) and (Education) variables have reached the moderately low vulnerability segment. A programme for improving infrastructure and services in health and education sector can be developed to reduce the vulnerability in this sector.



The analysis of data indicates demographic pressure creating gaps in Utilities and Infrastructure which is a cause of immediate concern. Projects to plug the gaps in Utilities & Infrastructure can be developed to reduce VI.

Vulnerability Levels in Regional Context:

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

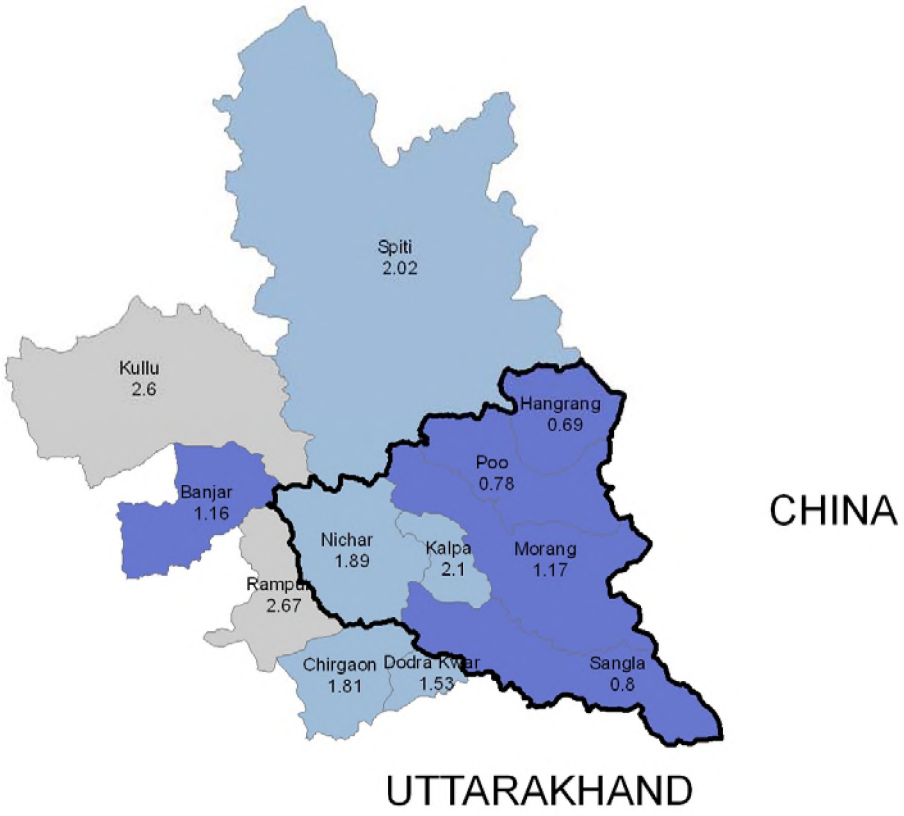
Kinnaur

S. No	Tehsil	VI	Adjoining Tehsil in Chamba District	VI	Adjoining Tehsil in other District	District	VI
1	Hangrang	0.69	Poo	0.78	Spiti	L&S	2.02
2	Poo	0.78	Hangrangi	0.69	Spiti	L&S	2.02
			Morang	1.17			
3	Morang	1.17	Poo	0.78	Spiti	L&S	2.02
			Kalpa	2.10			
			Sangla	0.80			
			Nichhar	1.89			
4	Kalpa	2.10	Morang	1.17			
			Sangla	0.80			
			Nichhar	1.89			
5	Sangla	0.80	Nichhar	1.89	Dodra Kwar	Shimla	1.53
			Kalpa	2.10	Chirgaon	Shimla	1.81
			Morang	1.17			
6	Nichhar	1.89	Morang	1.17	Chirgaon	Shimla	1.81
			Kalpa	2.10	Rampur	Shimla	2.67
			Sangla	0.80	Banjar	Kullu	1.16
					Kullu	Kullu	2.60
					Spiti	L&S	2.02

Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Kinnaur is surrounded by various Tehsils of District Lahaul and Spiti, Shimla and Kullu. The vulnerability levels of all surrounding areas are higher than that of what is prevailing in various Tehsil/ Sub tehsils (except for Nichar tehsil) of Kinnaur district. The transitional impact of vulnerability possibly will give rise to vulnerability levels when analysed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameters

(i) As is observed from the analysis of the data available, the quality of life parameters in terms of health and education need to be addressed on a priority. To reiterate our basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health center within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)-. Kalpa, Morang, Nichhar, Hangrang, Poo, and Sangla

Similarly, the quality of life parameters for education include accessibility to a Primary School within a distance of 2 kilometres, a Secondary School within a distance of 6 kilometres, a College within a distance of 10 kilometres, and a Vocational Institution within a distance of 25 kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Morang, Hangrang, Sangla, Nichhar, Poo, and Kalpa

The benchmarking of the norms has been done with a view of the terrain in the State. A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(ii) Prioritization and Rationalization of distribution of water resources for various usages is required to be undertaken.

The district has three important lakes- Nako, Sorang and Tomchoo. The district also has Hot springs at Nathpa and Joktiaring near Nichhar. As the tourism is increasing rapidly, these may come under threat in times to come. Detailed Conservation and Management Plans can be prepared for both lakes and Hot Springs for their protection and conservation.

Priority Tehsils- Nichhar, Poo.

(iii) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats i.e. Reserve forests, Wild life sanctuaries etc can be done through a series of plans culminating into projects. It has been observed that there is a gap between the forest area and the forest cover and hence a specific programme for attending this gap is required to enrich this resource wealth of the district.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(iv) The district has pasturelands which need to be demarcated and conserved.

(v) The ground water may be recharged through the creation of small check dams on the non perennial khuds, which could also improve the irrigation scenario.

Pressure Parameters

(i) Tourism as a parameter is the highest scorer in the district pressure parameters. However, tourism is one of the mainstays of economy in the State and thus has to develop further. The growth in the sector is welcome, as it boosts the economy, but the rate at which it is growing demands a definite and specific plan for the district in terms of growth of tourism.

Priority Tehsils: Kalpa, Morang, Poo, Hangrang

(ii) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

Priority Tehsils: Nichhar, Morang, Sangla

(iii) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization plan is required to be prepared through scientific studies.

(iv) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

S.No	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Water		*	*		Lake Conservation Plans, Conservation plans for Hot Springs Ground Water recharge programme
2	Natural Critical Habitat		*	*		Plans for Buffer zones Programme to remove the gap Programme for maintenance of moisture content and ground water recharging
3	Quality of life (Health)			*		Programme to improve access
4	Quality of life (Education)			*		Programme to improve access
Pressure						
1	Tourism		*			Tourism Plan at State, District, and Destination Level
2	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
3	Hydel Power	*	*			Policy regarding Catchment Area Treatment, Ecological Flow etc Water Utilization Plan

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Hangrang	Poo	Morang	Kalpa	Nichhar	Sangla
VI	1684.651	1917.92	2856.51	5158.49	4627.98	1968.45
denominator = 57x43	**2451**					
Normalized VI	**0.69**	**0.78**	**1.17**	**2.10**	**1.89**	**0.80**

Population Projections

	Pop 2001	Projected Pop 2011	Projected Pop 2021	Projected Pop 2031	Projected Pop 2041
Hangrang	6939	8727	10649	12636	14662
Poo	7898	8841	9902	11075	12353
Morang	10383	11314	12374	13557	14856
Kalpa	17630	20638	24177	28201	32662
Nichar	26630	31172	36378	42200	48588
Sangla	11731	13117	14742	16590	18642

Calculation of per capita share of VI

	Pop 2001	VI 2001	per capita share
Hangrang	6939	0.69	9.90
Poo	7898	0.78	9.90
Morang	10383	1.17	1.12
Kalpa	17630	2.10	1.19
Nichar	26630	1.89	7.09
Sangla	11731	0.80	6.84

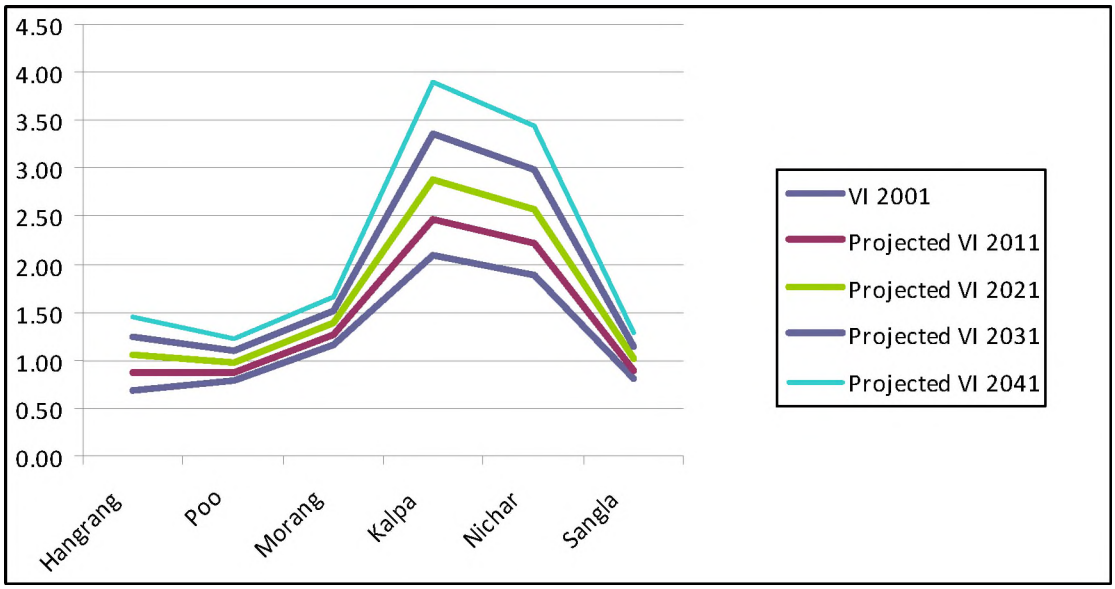
Calculation of Projected VI

	Pop 2001	VI 2001	per capita share	Projected Pop 2011	Proj. VI 2011	Projected Pop 2021	Proj VI 2021	Projected Pop 2031	Proj VI 2031	Projected Pop 2041	Proj VI 2041
Hangrang	6939	0.69	9.905E-05	8727	0.86	10649	1.05	12636	1.25	14662	1.45
Poo	7898	0.78	9.908E-05	8841	0.88	9902	0.98	11075	1.10	12353	1.22
Morang	10383	1.17	1.122E-04	11314	1.27	12374	1.39	13557	1.52	14856	1.67
Kalpa	17630	2.10	1.194E-04	20638	2.46	24177	2.89	28201	3.37	32662	3.90
Nichar	26630	1.89	7.091E-05	31172	2.21	36378	2.58	42200	2.99	48588	3.45
Sangla	11731	0.80	6.846E-05	13117	0.90	14742	1.01	16590	1.14	18642	1.28

Projected Vulnerability Index

	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Hangrang	0.69	0.86	1.05	1.25	1.45
Poo	0.78	0.88	0.98	1.10	1.22
Morang	1.17	1.27	1.39	1.52	1.67
Kalpa	2.10	2.46	2.89	3.37	3.90
Nichar	1.89	2.21	2.58	2.99	3.45
Sangla	0.80	0.90	1.01	1.14	1.28

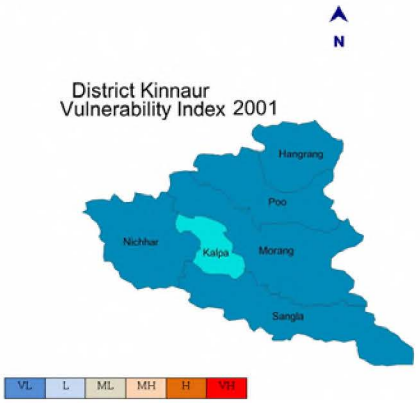
Vulnerability Index Scenarios – District Kinnaur at Tehsil Level



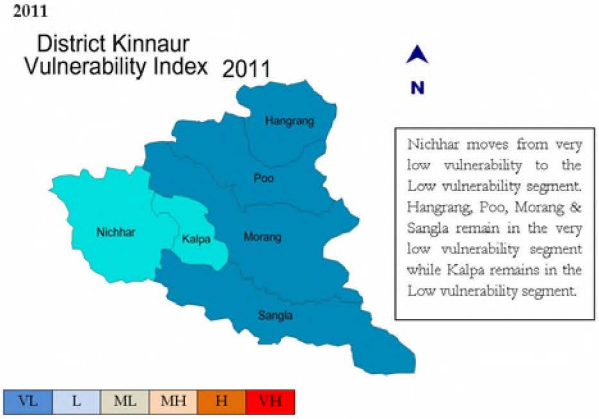
Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

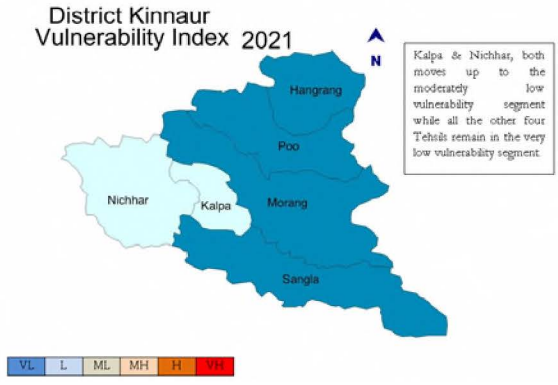
2001



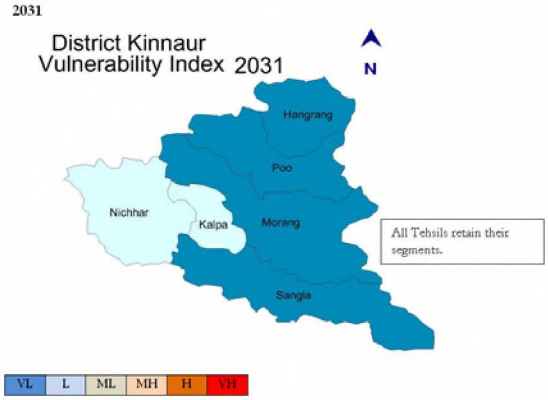
2011



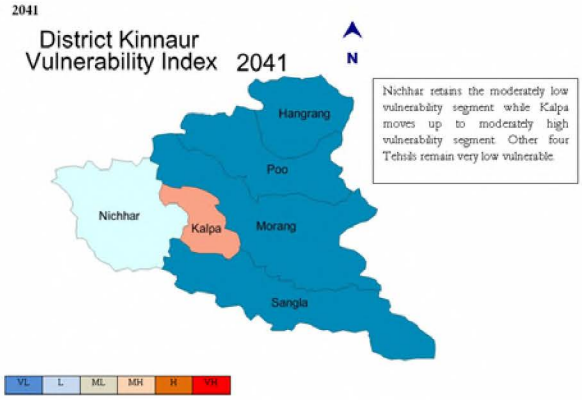
2021



2031



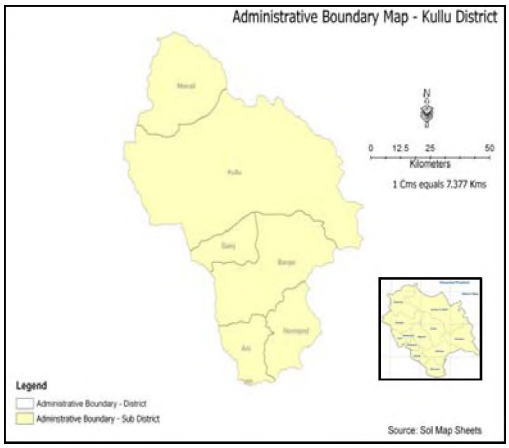
2041



KULLU

General Background

Kullu district is located in the eastern part of central Himachal Pradesh. The district lies between 31°20'25" to 32°25'0" north latitude and 76°56' 30" to 77°52' 20" east longitude. It is bounded on the north and east by Lahaul & Spiti district, on the south east by Kinnaur district, on the south by Shimla district, on the south-west and west by Mandi district and on the north-west by Kangra district. The headquarters of the district is situated at an altitude of 1,200 metres above the mean sea level on the confluence of Sarvary rivulet and Beas River. The total area of the district is 5,503 sq. kms. District ranks 5th in order of area and constitutes 9.88 % of the total area of the state. District is divided into 6 administrative units as Tehsil/Sub-Tehsil area in descending order as follows:



Kullu is the largest sub unit at about 208 sq.km, while Manali is the smallest at just about 36 sq.km.

Tehsil/Sub-Tehsil	Area (sq.km)
Kullu	207.92
Ani	78.50
Nermand	78.44
Banjar	62.67
Manali	35.51
Sainj	37.89

It is very interesting to observe that the areas stated above are the areas for the revenue villages and do not include the forests, glacial, grasslands areas which account for 5002 sq. kms. area out of a total of 5503 sq.kms.

Physiography

The Kullu district forms a transitional zone between the lesser and the Greater Himalayas and presents a typical rugged mountainous terrain with moderate to high relief. The altitude varies between 1,089 metres to over 6,632 metres from the mean sea level. The high reaches are bestowed with magnificent snow peaks and glaciers. The important glaciers in this district are *Kalihen, Beas Kund, Saraomaga, Trichu, Parvati, Dibbi* and *Mantalai*. These vary in length from 3 to 16 kms. and from 500 to 800 metres in width.

On the basis of physiography, climate, soil cover, geology and natural vegetation, the district has been divided into 5 sub-micro regions as follows:

Kullu Valley



The valley mainly spreads on the both banks of *Beas* River and also on the lower parts of its major tributaries like *Parvati* and *Tirthan* rivers. It covers maximum parts of Manali, Kullu Sainj and a small part of Banjar Tehsil. This region is surrounded by Kullu forests from almost all corners. Mandi district forms its south-western limit. This valley is mainly formed by *Beas* River and is narrow in the north and becomes wider in Kullu and in the

central and southern parts of Manali Tehsil whereas the parts of this valley falling in Sainj sub-Tehsil and Banjar Tehsil are undulating. This region in the district is comparatively plain and fertile and the elevation varies from 1,089 metres and 2,980 metres above the mean sea level. Slope rises gradually as one move away from the river banks and these slopes are densely covered with apple orchards. Most of the area of this region falls below 2,000 metres. The *Beas* rises in the Pir *Panjal range* near Rohtang pass and it enters the region near Rohla from the north. This river flows through central part of the region and flows towards southern direction up-to Aut. The *Tirthan* River, after meeting with the *Koki* and *Sainj* khads join the *Beas* River from south and then the combined course flows towards west. Major tributary of the *Beas* river in this region is the *Parvati* river which also receives the water of *Malana Nalla* and *Tos Nalla* and joins *Beas* on its left Bank near Bhuntar town. Other minor tributaries are *Manalsu*, *Solang*, *Phojal*, *Debar*, *Sanjoin*, *Siriv Nalla* and *Sarwari Khad* on the right side and *Chaki*, *Pakhnoj*, *Duhangan*, *Aliaini* and *Hurla Nalla* on the left side. The climate of this valley is warm during summers and cool during winters. Upper areas of this valley receives snow fall during the month of December and January. Snow clad peaks look very beautiful. The geology of this region is mainly composed of middle proterozoic formations. The northern fringe of this region contains Granites (unclassified), while south-eastern part has Sholi – Deoban and Largi groups and Rampur- Banjar formations. Soil of this region are mainly covered with orthents – ochrepts (58) while in the northern extreme, it contains Udalfs (20) type of soil. Higher slopes of this region are covered with mixed vegetation mainly of Deodars.

Forests

This region is formed by the area surrounding Kullu valley which spreads over parts of Manali, Kullu and Banjar Tehsil and Sainj Sub-Tehsil. The topography of the region is rugged and undulating with an altitude varying from 2,800 metres to 4,953 metres above the mean sea level. It contains many Dhars and rivulets/streams originating from the higher reaches of the region ultimately merge with the *Beas* River from both sides.



The climate of this region is cool and dry. During winter the high reaches receive snowfall. Geology of this region is mainly composed of Jutogh group/Vaikrita group and central gneiss and granites (unclassified) while in central and southern parts, geological formations of Nagthat, Mulh and Manikaran quartzites are also observed. Soils of this region are mainly covered with orthents-ochrepts (58) type while Udalfs (20) and glaciers and Snow cap (103) types of soils occur in the northern and



eastern parts of this region. Except few patches in the western part adjoining Kangra district, the whole area of this region is densely covered by forests. Thickness of the forests is more on the higher altitude while it decreases with the lower altitude. Most part of these forests extends between the elevations of 2,800 metres to 4,000 metres.

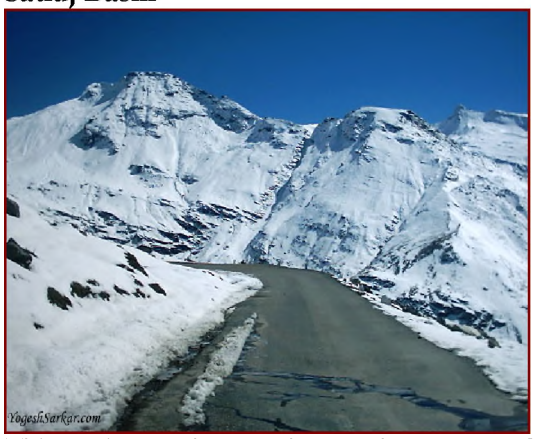
The forests contain species like Chir, Kail, Silver Fir, Walnut, Horse chestnut, Oak and Deodar.

Greater Himalaya



This region comprises the crest of Greater Himalaya which passes through north and eastern Kullu district. It covers eastern parts of Kullu and Manali tehsils, north-eastern tip of Sainj Sub-Tehsil and northern, eastern and south-eastern parts of Banjar Tehsil. This region is surrounded by Lahaul & Spiti district from north to east, by Shimla district and Sutlej basin from south and by Kullu forests from west. Its south-eastern boundary is formed by Kinnaur district. This region is very rugged and mountainous and also has many Dhars. Some of the important Dhars are *Ali Ratni Dhar* (5,269 metres), *Ghodil Dhar* (4,220 metres), *Sirkhand Dhar* (5,159 metres) and *Dharing Dhar* (4,183 metres). Elevation in this region varies between 4,012 metres and 6,632 metres above the mean sea level. *Pin Parvati* Pass (5,319 metres) is an important physical feature in this region and is situated on the boundary line between Kullu and Lahaul & Spiti districts in the east. The region contains many glaciers viz. *Dudhon* glacier, *Parvati* glacier, *Tichu* glacier, *Sara Umga* glacier and *Dibi ka* glacier on the north and north-eastern parts. *Parvati* River which originates from the *Parvati* glacier is the major tributary of the *Beas* river in this region. Another tributary *Tirthan* river also takes birth in the region from *Sirkhand Dhar*. The climate of this region is severe and dry. The main geological structure of this region is Granites (unclassified), Haimanta group and Jutogh group and central gneiss. The region is covered by udalfs (20), orthents-ochrepts (58) and glaciers and snow cap (103) types of soils. The region has no vegetation cover.

Satluj Basin



This region embraces the southern part of Kullu district including the entire Ani and Nermand tehsils. It is bounded by Kullu forests and Kullu Greater Himalaya in the north, Mandi district in the west while Shimla district encloses it from south to east. The region is hilly and also has two important Dhars. *Jalori Dhar* and *Sirkhand Dhar* which run along the northern boundary of Ani and Nermand from west to north-east direction. Altitude of this region varies between 1,059 metres and 5,148 metres above the mean sea level. Slope rises in this region from the bed of Sutlej River and its tributaries. Maximum height of 5,148 metres is attained at the boundary line between Nermand and Banjar tehsils in the extreme north of the region. The climate is hot in summers and cool in winters. Maximum rainfall is received during monsoon. Higher reaches receive snowfall during winter. Geologically western parts of this region are mainly formed by Jutogh group/vaikrita group and central Gneiss formations while in eastern part, the geological structure is formed by Nagthat, Muth and Manikaran formations. Udalfs-ochrepts (24) type of soils is found in the western part of this region while Orthents-Ochrepts (58) type of soils cover the south and eastern parts. In this region, upper areas are covered with densely mixed jungles mainly chir, kail, oak and deodar.

Pir Panjal

This region is situated in the extreme northern and north western parts of the district and occupying only a small part of Manali Tehsil. It makes its boundary with Kangra district in the west, Lahaul & Spiti district in the north and east and Kullu forests in the south while Kullu Greater Himalaya touches it from the south-east direction. The region is characterized with high snow covered mountains, glaciers and passes. The altitude of this region varies between 3,685 metres and 5,932 metres above the mean sea level. Maximum height of 5,932 metres in this region is attained by *Hanuman Tibba* which is situated on the boundary line between Kullu and Kangra districts in the west. *Rohtang* pass (3,978 metres) is situated in the northern part, is one of the major physical feature of this region besides other passes viz., *Thanod*, *Taintu Ka Jot* (4,996 metres) and *Hamta Jot* (4,268 metres). This region contains many Dhars. Some of these are *Beas Kunder Dhar*, *Shiti Dhar*, *Kara Dhar*, *Rohan Dhar* and *Satbehui Dhar*. Western part of this region is comparatively higher in elevation than eastern part. *Beas* River which is the main river of Kullu district originates in the *Pir Panjal* range from *Beas Rishi* spring near *Rohtang* pass and flows towards south. The geological structure of this region is mainly formed by granites (unclassified) formations and it has Udalfs (20) type of soil cover which is high base status of humid regions. The region is without vegetation cover. This region covers very small unmeasured area of the district and is un-inhabited due to its tough and rugged terrain and climatic conditions. The only motorable road is border road which connects this region as well as district with Lahaul & Spiti district. Rohtang pass in this region is a place of tourist interest.

Culture and Social Brief

Fairs & Festivals

The beauty of Kullu valley is enhanced by its people who are fond of song, dance and celebrations. Kullu is well known for its Dussehra. Besides Dussehra festival, a number of fairs are held in this district which is mainly religious in nature. Some of the important fairs and festivals are held and observed in Kullu district are: *Kullu Dussehra*, *Sainj Fair*, *Shamshi Virshu*, *Mela Bhuntar*, *Luhri Lavi*, *Ani Fair*, *Dalash Fair*, *Ganter Fair*, *Ghatasani Fair*, *Dhoongri Fair*, *Bhadoli Fair* and *Budhi Diwali*.

Places of Religious, Historical, Archaeological importance and Tourist Interest



Kullu district offers many attractions to the tourists. It has rich art and cultural heritage, lush green deep meadows, dazzling rivers, white capped snowy peaks and high mountains. The district has Beas and its sub-valleys which are full of natural charm and grandeur. Some of the places of interest are:

Kullu: Kullu, the headquarters of the district, is situated at an altitude of 1,200 metres on the confluence of *Sarvary* rivulet and *Beas* River. There is not much snowfall during the winters but snow clad peaks look very beautiful. Kullu town has made its name on the international tourist map for its famous Dussehra festival. The town of Kullu can accommodate large number of visitors with all facilities of boarding and lodging required by them.

Bijli Mahadev: This temple is situated at a distance of 11 kms. from Kullu, standing majestically atop a hill-lock (2,435 metres.) where a 20 metres tall staff is supposed to attract special blessings from the sky in the shape of lightening and it is said that with the flash of lightening Shivlinga shattered into pieces.

Bajaura: A place of special interest between Aut and Kullu is Bajaura. It is famous for its temple Bisheshar Mahadev, 15 kms. away from Kullu on the Kullu-Mandi main road. The temple is famous for its stone carvings and sculptural decorations.

Nagar : Nagar, on the left bank of the Beas and about 300 metres above the river, is delightfully situated on a wooded slope and commands extensive views, especially of the north and west of the valley. It is 27 kms. from Kullu and 5 kms. from Patli Kuhl. There is a bridge across the Beas connecting Patli Kuhl and Nagar.

Manali: Situated near the end of valley, Manali is one of the most attractive tourist spot not only of Himachal Pradesh but of International fame also. It is situated at a distance of 45 kms. from Kullu.



Hadimba : In addition to its scenic beauty and grandeur, Manali has many attractions but the chief attraction of interest, historically and archaeologically, is undoubtedly the Dhungri temple dedicated to Goddess Hadimba (or Hirma Devi), the wife of Bhima of Mahabharata fame, which is situated within a walkable distance from the Manali town.

Pass: It is about 3,978 metres above sea level. It is the most convenient route from Manali and throughout the whole distance provides a charming variety of scenery. The length of the pass is about one km. and has served as the route for many centuries in Central Asia. The road from Manali to Keylong passes over this pass which is 51 kms. long and the crest of the Rohtang Pass affords a wide spread panorama of mountain scenery.



Malana: Nestled between Jari and Khiksa thatch lays the village Malana. People have their own pattern of parliament i.e. Upper House (Jaostang) and Lower House (Kanishtang or Core).

Jagatsukh: Jagatsukh lies on the left bank of the Beas and the road from Nagar to Manali runs through the village. It is about twelve kilometres from Nagar and six kilometres from Manali. The temple of Gayatri Devi is also located near this temple.

Vashist: A little village located on the left bank of the Beas, but well above the river and about 3 kilometres beyond Manali and is renowned for its hot sulphur springs named as Bashisht or Vashist. There is a regular walled bathing pool with stone floors.



Arjun Guffa: A cave, which is about five kilometres from Manali and known as Arjun Gufa, is situated a little up from the left bank road near the village Prini.

Nehru Kund: A spring of clear cold water named after the late Prime Minister, Pt. Jawahar Lal Nehru, is about 6 kms. from Manali on Manali-Keylong road.

Solang Valley: It is a splendid valley between Manali and Kothi and offers the views of glaciers and snow caped mountains and peaks. The nearest glacier from Manali is in this valley. It is about thirteen kilometres from Manali and is accessible either by jeep or by bus up to Palchan village from where a jeepable road branches off to the left. Good skiing slopes are also available here which are famous for summer skiing.



Manikaran: Manikaran is famous for its hot springs. Manikaran is situated at an altitude of 1,829 metres and 40 kms. from Kullu has the finest hot water springs. The water of the springs is said to be radioactive. It is supposed to be beneficial to sufferers from rheumatism and similar ailments.



Assessment of District Vulnerability

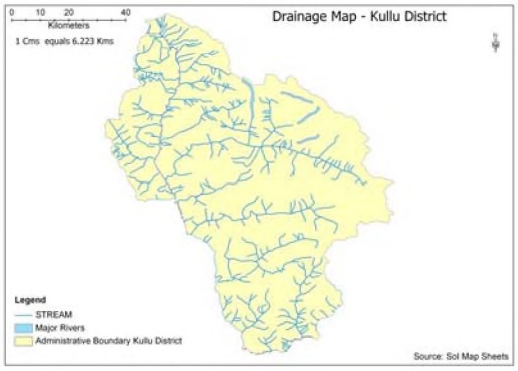
As explained above the '*Pressure*' and '*State*' variables together when analysed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Kullu district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

Beas is the principal river of the district. The *Sutlej* touches the fringes of the district boundary in the Nermand and Ani tehsils and the entire drainage of the district is received by these two rivers. The river *Beas* originates from the *Beas Kund*, a small spring of *Pir Panjal* Ranges at *Rohtang* Pass at a height of 3,900 metres approximately and flows southwards for about 120 kms. till it reaches Larjee. In this area tributaries are on the east bank spread out in the shape of a fan based on the length of the river between Bhuin and Larjee. On the right of West bank of the main affluent are the *Solang*, *Manalsu*, *Sujoin Fozal nullahs* and the *Sarvary* at Kullu.



The *Parvati* also receives the water of the *Malana nullah* at Jari and other tributaries of the *Parvati* are also on its right bank. The *Parvati* after flowing in the north-westerly direction then flows in a south-westerly course before merging with *Beas*. Between its basin and that of the *Sainj nullah* lie the Hurlagad which rises from a glaciated area. It joins the Beas opposite Bajaura. The *Sainj* originates from *Supa Kuni* a high peak located on the boundary of Spiti and after running through the Sainj valley, it merges with river *Beas* at Larjee. The *Tirthan* stream joins the Sainj a little above the junction of the latter with the *Beas*. The flow of river *Beas* and its tributaries are at its lowest during the winter months of December, January and February and highest during June, July and August. In July and August, these rivers and their tributaries are in flood and overflow their banks. The Sutlej River which forms the southern boundary of the district and separating it from Shimla district rises from Mansarover and touches the district in Nermand Tehsil opposite to Rampur Tehsil of Shimla district. Its main tributaries from the Kullu district are *Kurpan* and *Ani* which originate from *Bashleo* and *Jalori* Peaks. These rivers and their tributaries are the life line of the district and these are useful for generation of electric power and raising fishery activities.

Climate

The climate of the district is cool and dry. There are three broad seasons viz. cold season from October to February, hot season from March to June and rainy season from July to September. Wind characteristics depend upon season, as it is hot during the months of May and June and coldest in the months of December and January.

Precipitation/ Rainfall

Snowfall generally occurs in December and January at higher hills and most of the regions are cut off from the district headquarters since the mountain passes are closed. The district receives moderate rainfall and bulk of it is received during the months of July, August, December and January. August is the wettest month throughout the district. There are three rainfall recording stations in the district. These stations are Kullu, Banjar and Tinder. During the monsoon period, the land becomes fresh and green and the small water channels in the hills begin to swell.

Particulars	Maximum	Minimum
Rainfall	222.72 mm	6.52 mm
Temperature	38.8° C	5.2° C

Forest

Forests occupy a prominent place in the economy of the district. Extensive tracts of forests exist throughout the districts which are richly wooded. Forests constitute a major proportion of the total land. The forests of Kullu district are rich in various kinds of

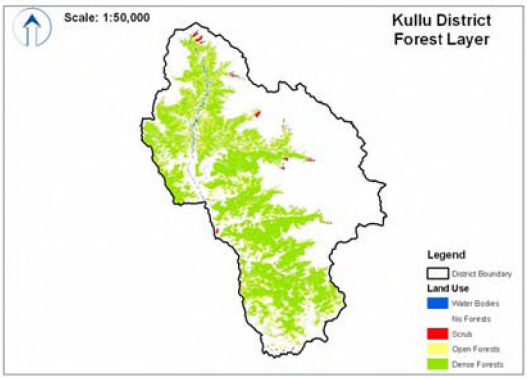
medicinal herbs like Karu, Dhoop, Muswala and Kakar Singi. Mushrooms are also available in plenty and extracted in large quantity. Deodar attains considerably dimensions in the upper Beas and Parvati valleys. All the higher ranges have dense forests, while in the valleys as one descends lower, the growth of forests is less. The Kullu forests considerably resemble those in the adjacent parts of Kangra and Mandi with the exception that in quality these are better. Cheel Pine is found best in quartizite rock and it is available in the Parvati and Tirthan valleys. Wild olive and mulberry are found on lower levels. Extensive forests of common Himalayan oak are found largely in the Hurla valley above 2,400 metres elevation. Spruce and silver fir forests also exist.



The oak, spruce and silver fir trees attain a height of about 61 metres. Hazal, Hornbeam, Yew and Bird Cherry are also found. Birch, Moru, Ban and Rhododendron are found in greater quantity along with willows, Ash, Wild, Apple and Juniper. Tree growth is replaced by Alpine pastures ascending to the limit of vegetation and snow line. These grazing grounds are used for grazing sheep and goats during the summer and also by the ponies where the slope is not too steep. There are many shrubs and plants which provide food, medicines and dyes. Wild strawberry, raspberry and barberry are also found.

Forest Cover in sq. km. in Kullu District

Geographical Area	Forest area	Forest cover		
		Dense forests	Open forests	Total
5,503	5,002	1,631	343	1,974

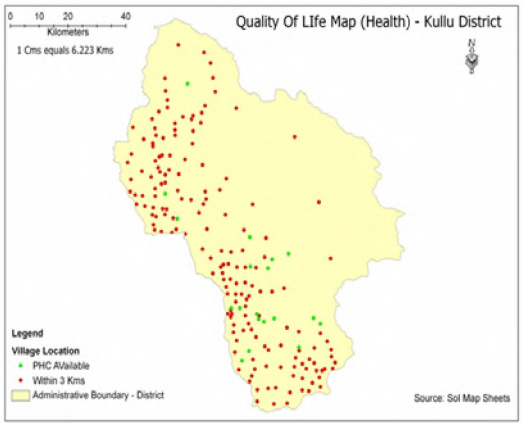


The percentage of forest cover comes to 35.9 % of the total geographical area of the district while the proportion of both dense and open forests to total forest area is 39.0 %. This gap is on account of glaciers, grasslands and barren areas which have been classified under Forest area.

Quality of Life (Health)

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector.

Out of total 172 inhabited villages, 160 villages doesn't have primary health centre. Of these 38 have these at less than 5 kms., 28 villages have these at 5-10 kms. while inhabitants of 94 villages have to travel distance of more than 10 kms.



In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population.

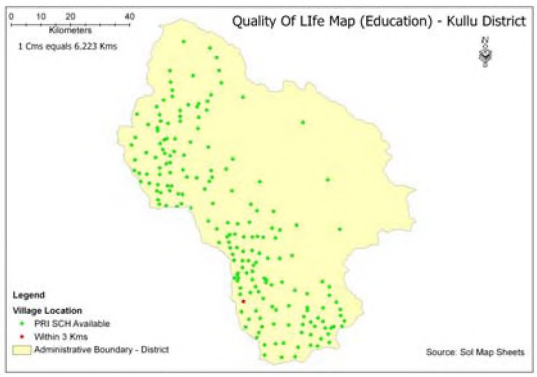
In fact, to summarize, according to 2001 census, 22.09 % villages doesn't have access primary health centre within 3 kms., 22.61% villages doesn't have access to community health centre within 6 kms. and 42.91% villages don't have hospital facility within 10 kms.

Quality of Life (Education)

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. In case of primary school, inhabitants of only one village have to travel distance of 5-10 kms. With regard to middle school, 50 villages don't have middle school. Of these, inhabitants of 30 villages have to travel less than 5 kms., those of 16 villages travel between 5-10 kms. while those of 4 villages have to travel a distance of more than 10 kms. All the villages are deprived of degree colleges. Of the total 172 villages, 12 have this at less than 5 kms., 13 villages have this at 5-10 kms. while those of 147 villages have it at more than 10+ kms.

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

To summarize, according to Census of India 2001, on an average across the district, 9.23 % villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 7.3 % villages doesn't have secondary school within a distance of 6 kms., 18.16 % villages doesn't have colleges within a distance of 15 kms. and 42.66 % of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.



On an overall scale, Kullu is better networked for education than many districts in the State. With a little effort it could reduce the gaps.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Kullu such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Kullu district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Kullu district is 381,571 comprising 198,016 males and 183,555 females (the Census of India, 2011 gives a provisional population figure of 437474 with a density of 79 per sq.km. Data at tehsil level is not available). This population of the district forms 6.28% of the State population and ranks at 9th place among the districts. Out of the total population of the district 92.1 % lives in rural areas while 7.9 % lives in urban areas. Rural population of the district is distributed among 6 tehsils, sub-tehsils and urban population is spread over 4

towns. The total urban population in the district is 30,093 persons comprising 16,885 males and 13,208 females. The total rural population in this district comes to 351,478 persons and is composed of 181,131 males and 170,347 females as per 2001 Census. This rural population is distributed in 172 villages. All the villages of the district are inhabited and the majority of villages are of large size consisting of several hamlets. The concentrations of villages are mainly along the rivers and streams.

Population Growth

According to the 1991 Census the total population of the district was 302,432. There has been net addition of 79,139 persons during 1991-2001. The decadal growth rate of the district comes to 26.2 %. The growth rate for the rural and urban areas of the district is 24.9 and 43.2 % respectively. The growth rate of rural population is slow in the district due to interior location of the district and lack of industrial development.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001

Sr. No.	Tehsil/ Sub-tehsil	Population 1991			Population 2001			Percentage decadal variation 1991-2001			% urban population	
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Manali	29,696	27,263	2,433	44,212	37,947	6,265	48.9	39.2	157.5	8.2	14.2
2	Kullu	141,462	123,921	17,541	179,646	157,080	22,566	27.0	27.6	29.0	12.4	12.6
3	Sainj	15,592	15,592	-	20,682	20,682	-	33.0	33.0	0.0	0.0	0.0
4	Banjar	31,962	30,925	1,037	38,638	37,376	1,262	21.0	21.0	22.0	3.2	3.3
5	Ani	43,167	43,167	-	50,476	50,476	-	17.0	17.0	0.0	0.0	0.0
6	Nermand	40,553	40,553	-	47,917	47,917	-	18.2	18.2	0.0	0.0	0.0
District Total :		**302,432**	**281,421**	**21,011**	**381,771**	**351,478**	**30,093**	**26.2**	**24.9**	**43.2**	**7.0**	**7.9**

Density

The density of population in Kullu district is 69 persons per sq. km. against the state average of 109 persons. At Tehsil/sub-Tehsil level, the density of population varies between 1,245 persons in Manali Tehsil and 546 persons in Sainj sub-Tehsil. In rural areas it comes to 64 persons per sq. km. while in urban areas it comes to 2,163 persons. In urban areas, the density of population varies between 2,600 persons in Manali Nagar Panchayat and 566 persons in Banjar Nagar Panchayat.

Sex Ratio

There are 927 females for every thousand males in Kullu district. The sex ratio figures for rural and urban areas of the district are 940 and 782 respectively. The proportion of females in rural areas is higher than that of urban areas. Sex-ratio in age-group 0-6 comes to 960 females per 1000 males in the district as a whole. In rural areas, this proportion is 967 females while in urban areas the sex ratio of child population works out to 855 females per 1000 males.

Work Participation Rate

The work participation rate is defined as percentage of total workers to total population. According to 2001 Census, the total workers including main and marginal workers constitute 56.7% of total population of the district. Of the total workers the share of the main workers is 43.7% and marginal workers is 13.1%. The remaining 43.3% of population belongs to the category of non-workers. As per 2001 Census among the main workers male participation rate in the district is 50.6% and corresponding proportion of females is 36.3%. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or other economic activities in addition to their household duties, to improve the family income. Majority of the workers are engaged in agricultural activities. Of the total 216,513 workers in the district 76.0% of these total workers are categorized as cultivators, 2.6% agricultural laborers, 1.3% in household industries and 20.1% in other.

Urban Population

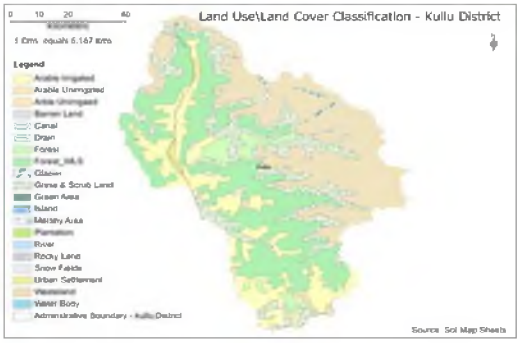
The statement below gives the position and number of urban units according to size class of population as per 2001 Census:

Size class of Town	Name an Civic Status of Town	Urban Population		
		Population	Male	Female
VI	Banjar NP	1,262	699	563
VI	Bhuntar NP	4,260	2,331	1,929
IV	Kullu MCl	18,306	9,861	8,445
V	Manali NP	6,265	3,994	2,271

Literacy

A person who can read and write in any language is taken as literate in Census. All children of age below 7 years are treated as illiterate. As per 2001 Census Kullu district has reported 239,649 persons as literates constituting 72.9% of the total population excluding the population of 0-6 years. The proportion of male and female in the district is 84.0 and 60.9% respectively. The literacy rate of males is much higher than that of females. The total literacy rates of rural and urban area are 71.6 and 88.0% respectively. The proportion of male and female literates in rural areas is 83.2 and 59.1 % respectively. In urban areas this proportion is 91.8 and 83.1% respectively. Females are better educated in urban areas than their counterparts in rural areas.

Land Use



Land use Classification of Area	Land utilization (sq. kms.)
Total Geographical Area	5503
Forest cover	1974
Glacial, Barren & grassland	3028
Land put to non agricultural use	59
Fallow land	68
Agricultural area	374

The district is comprised of many fertile valleys as well as high elevation areas. The cultivation is possible in small terraces of holdings in the high hills and the stream/khad basins, in most parts of the district. In the valleys, the cultivation is spread over a vast area. The cultivation of crops is confined mostly to flat valleys areas while orchards cover the upper slopes of the valleys and river basins. Except the valley area and stream/khad basins most of the land is either under shrub forests or grassy land with Chil trees up to the height of 1,500 metres from the mean sea level and Kail, Deodar, Spruce, Poplar on the high altitudes. It is only in the valleys that the land is mostly flat and fertile and the cultivation of cereals is done.

Agriculture



The economy of the district depends on Agriculture, and more than 80 % of the workers are engaged in Agricultural activities. The elevation of Kullu district ranges from 914 metres to 4,084 metres above sea level with varied agro-climatic conditions. The texture of soil ranges from sandy loam to clay loam and the colour of the soil also vary from brown to dark brown.

Generally, the sandy soil is acidic in nature and the terrain except the valley is all hilly. Depth of the soil varies from 50 to 150 cms. Despite this all the agro climatic conditions provide a range of potentialities for growing cash crops like off season vegetables, seed potatoes, pulses and temperate fruits apart from the cereals, millets and oil seeds. Among the cereals, wheat, maize, paddy and barley are extensively grown. The holdings are small and cultivation is done by traditional techniques of farming leading to low production. The mechanization of agricultural operation is not possible due to small size and terraced fields. Out of the total 610.24 sq.km cropped area, 245.00 sq.kms. were under double cropping. Potato is the main cash crop of Kullu district.

Tehsil-Wise Area Under Principal Crops*

Name of Tehsil	Area under Principal Crops (Sq.Km)
Kullu	18,573
Manali	2,562
Sainj	3,424
Banjar	5,667
Ani	6,804
Nermand	8,492

***** *Principal crops: maize, rice, wheat and grams, ginger and tomatoes.*

Irrigation

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

To increase the crop production the importance of irrigation is well established. Multiple cropping and to accelerate the growth in production depends upon irrigation. The source of irrigation is Kuhls, lifts and tanks where rain water is stored. The total net cultivated area in the district is 355.24 sq.kms. and out of this area only 22.67 sq.kms. is under irrigation.

The major source of irrigation in the district is Kuhls and lift irrigation whereby water is lifted from the streams/rivers by electric motor. The other sources of irrigation are not in use due to the hilly terrain. More than half of the total irrigated area falls in Kullu and Manali Tehsils which constitutes the main Kullu valley.

Tehsil-Wise Position of Irrigated Area (Sq.Km)

Agriculture Year	Source wise irrigated Area (Ha.)					
	Canal	Tank	Well	Tube well	Others including Kuhls & lift irrigation	Total
1	2	3	4	5	6	7
1995-96	-	-	-	-	2,596	2,596
1996-97	-	-	-	-	N.A.	N.A.
1997-98	-	-	-	-	2,665	2,665
1998-99	-	-	-	-	2,267	2,267
Tehsil wise irrigated Area for the year 1998-99						
Kullu	-	-	-	-	1,063	1,063
Manali		-	-	-	446	446
Sainj	-	-	-	-	42	42
Banjar	-	-	-	-	2	2
Ani	-	-	-	-	148	148
Nermand	-	-	-	-	566	566
Total	-	-	-	-	2,267	2,267

Livestock

Livestock is an important source of income. Every household keeps a few cows, buffaloes, sheep, goats etc. Sheep and goats are also found in quite good number in the district. These animals are very useful for milk, meat, wool and manure purposes.

Livestock and Poultry (According to 1992 livestock Census)

Particulars of Livestock and Poultry	Rural	Urban	Total
Cattle	158,010	883	158,893
Buffaloes	771	1	772
Sheep	10,581	88	10,669
Goats	6,579	36	56,615
Horses and Ponies	871	81	952
Others	17	83	400
Poultry	19,384	2,245	21,629

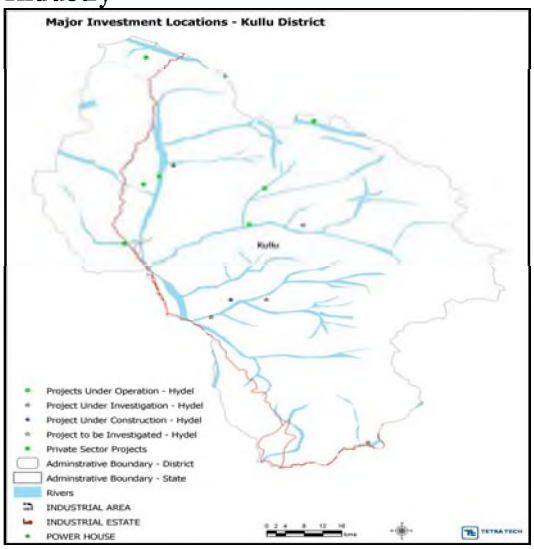
Horticulture

Horticulture occupies an important place in the economy of the district. Agro-climatic conditions prevailing in the district offer a great scope for the production of temperate and sub-tropical fruits especially apple, peach, apricot, chestnut, almonds, cherries, goose berries and olive. In order to meet the increasing demand for improved fruit plants, a number of progeny-cum-demonstration orchards besides some private nurseries have been set up at various places. Regional Horticulture Research Station of Dr. Y. S. Parmar University of Horticulture and Forestry at Bajaura has done a commendable job to achieve the target in the horticulture field.

Fisheries

Most of the habitation in Kullu district is found in the interior valleys having rivers, streams and nullahs which provide ample scope for development of pisciculture in the district. The main source of these rivers/streams and nallahs are perennial snow covered peaks of inner Himalayas. The crystal clear water of these rivers containing lot of minerals is most favourable for the growth of fisheries. The most favored fish is trout.

Industry



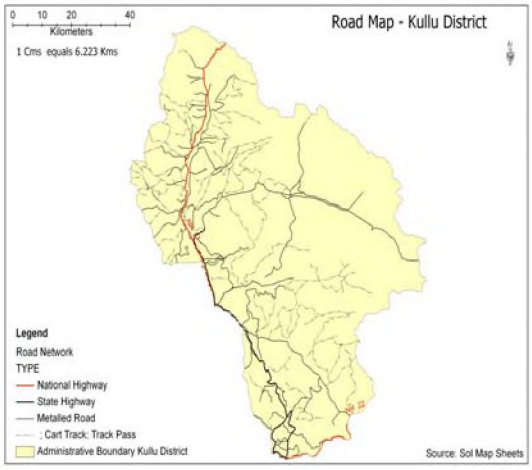
The district has bright potential for establishing industrial units for processing of fruit products as Kullu district is one major producer of apple and other fresh fruits in the state. M/s. D.S. Foods Ltd., Raison is medium scale industrial unit of the district. However, the district is known for some of its beautiful traditional handicrafts in weaving multi colored caps and shawls of which are well known in the country.

Another allied craft is the weaving of Pattoos and tweed cloth (Patti). Basketry is another handicraft of the district which plays a vital role in fruit economy of the district. Baskets are made of a high altitude species of bamboo called 'Nargal' Baskets and Kilta are useful for collection of fruits in the orchards packing and day to day working also.

Minerals & Mining

The district does not possess minerals of commercial significance and reserves of few minerals are found in the parts of district but their mining is not economically viable. White and bluish coloured crystals of beryl are found in Saraouga valley and north-east of Dando Dee Thack in the Parvati valley.

Beryl is the source of beryllium and its transparent green variety emerald is a precious gem stone. Kyanite, a silicate of aluminum is used for refractory bricks. The mineral occurs at a number of places in Parvati valley. It is found in the form of blue blades and associated with central gneiss formations. Occurrence of copper ore is reported from Chashikni, Jhari, Maol, Saon and Satgahr but deposit of copper ore are not in large quantity. Limestone occurs in the Larji formation in southern parts of Kullu valley and also in the Garsha saiji valleys. Limestone found in this district is yet to be exploited for commercial use.



Roads & Transport

The district headquarters is situated on National Highway No. 21. It is also served by state highway No. 11 and 14 and other metalled (417 km.) and unmetalled (496 km.) roads. Total road length in the district is 1,235 kms. Motorable road length was only 913 kms. in the district. Kullu is well connected with the different places of the state and other places outside the state. In addition to these motorable roads, the district has 29 kms. jeepable and 291 kms. less than Jeepable roads. Kullu is serviced by the airport at Bhuntar.

Length of Roads in Kms. Including National Highways

Type of Road	Length as on 3/ 1999	Length as on 3/ 2009
Un-metalled	496	747
Metalled	417	765
Total	913	1512
Density of Roads (per 100 Sq. km.)		27.48

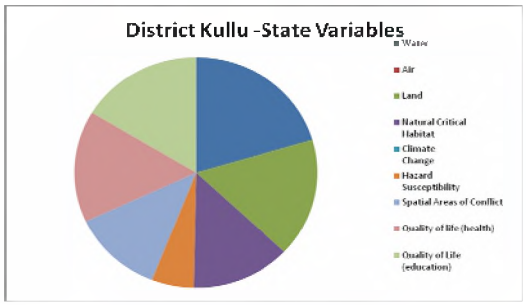
Electricity and Power

All the villages and urban areas of the district stood electrified long back. The state has a vast Hydel power generation potential. Hydel projects going on in the district are Larji Hydel project (126 MW); Parvati Hydroelectric Project (2051MW) & Malana Hydroelectric Project (86 MW).

Summary of State Variables at District Level

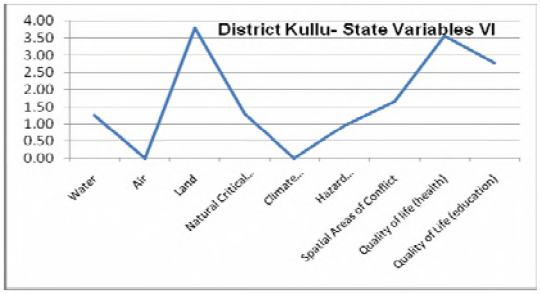
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kullu. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Kullu	
Variable Sector	Vulnerability of State Sector $V_{State\ Sector}$
Water	4763.09
Air	0.00
Land	3888.41
Natural Critical Habitat	3090.99
Climate Change	0.00
Hazard Susceptibility	1310.72
Spatial Areas of Conflict	2832.90
Quality of life (health)	3648.06
Quality of Life (education)	3810.65



It has been observed from the analysis that Water resources show a remarkable presence in the District.

The analysis of data indicates that there are gaps in Health and Education infrastructure and services. Natural Critical Habitats in the district are vulnerable. Tourism related activities have put pressure on the Land. Due to such pressures, the spatial areas of conflict are also conspicuous. In the assessment of vulnerability, Land and Quality of Life variables are bordering on the moderately low vulnerability segment and indicating to move to moderately high vulnerability segment.

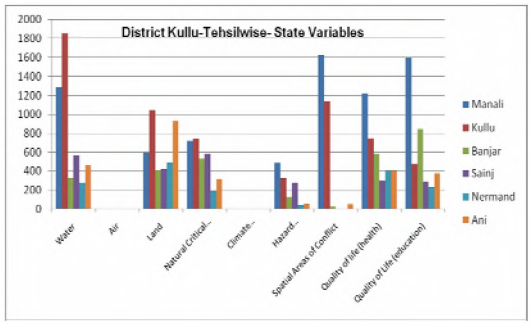


State Variables at Tehsil Level

Similarly the state variables quantified at Tehsil level are given below:

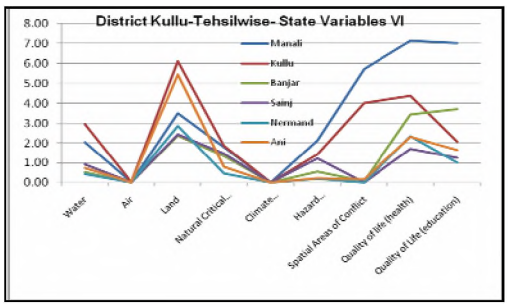
Comparison of State variables at Tehsil level:

State Variables	Manali	Kullu	Banjar	Sainj	Nermand	Ani	Vulnerability of State Sector $V_{State\ Sector}$
Water	1286.719	1849.26	327.93	568.15	272.07	458.96	4763.089
Air	0.00	0.00	0.00	0.00	0.00	0.00	0
Land	600.67	1046.73	405.90	416.55	487.58	930.98	3888.41
Natural Critical Habitat	720.67	742.58	534.70	589.61	190.70	312.73	3090.99
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	483	329.61	127.66	277.00	41.88	51.57	1310.72
Spatial Areas of Conflict	1625.5	1140.51	21.86	0.00	0.00	45.03	2832.9
Quality of life (health)	1223.1	747.06	588.44	294.40	399.03	396.03	3648.06
Quality of Life (education)	1600.2	472.03	844.43	288.92	229.77	375.30	3810.65



It is observed from the analysis that water resources are a major variable in Manali and Kullu Tehsils. However, it is not a dominant factor in the remaining four Tehsils. Manali and Kullu shows the Spatial Areas of Conflict, which is understandable, these being tourism centered Tehsils. All the six Tehsils are substantially susceptible to hazards. All tehsils display Natural critical habitats thereby reflecting the homogeneity

of the resource across the District. Manali can address the Quality of Life Variables on priority, followed by Kullu. Other four Tehsils need to address the Quality of life variable gaps by providing health and education infrastructure and services.



As can be seen from the graph, the VI for land has crossed criticality in Kullu and Ani Tehsils, while it is in the moderately low segment in Manali and Nermand. It is in the low vulnerability segment in Banjar and Sainj. The criticality of Spatial Areas of Conflict is reflected in Manali, while it is high in Kullu. Services and Infrastructure relating to Education and Health sector in Manali needs improvements as quality of life variables have crossed the critical stage of vulnerability. Kullu and Banjar also need priority attention in these sectors.

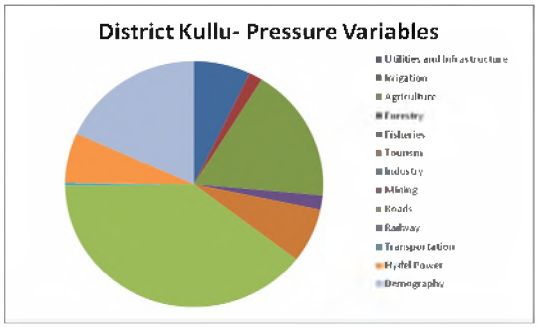
Summary of Pressure Variables at District Level

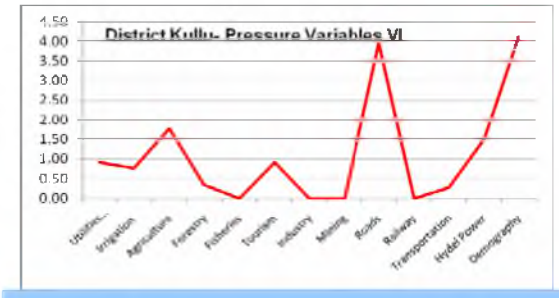
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kullu. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($V_{\text{pressure Sector}}$) as a total for that particular system.

Variable Sector	Kullu Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	1658.81
Irrigation	394.69
Agriculture	4123.38
Forestry	433.18
Fisheries	0.00
Tourism	1660.31
Industry	0.00
Mining	0.00
Roads	9198.91
Railway	0.00
Transportation	69.74
Hydel Power	1550.20
Demography	4253.56

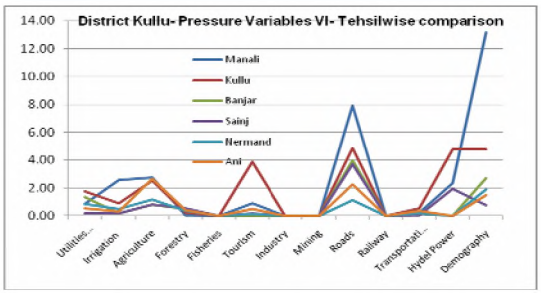
As can be observed from analysis, a lot of work has been done in the road sector. High Tourist volume and Demography are putting stress on the District. Agriculture in the district is vulnerable because of the terrain of the district.
Hydel Power and Tourism make their presence felt in the District. Gaps in Utilities and Infrastructure are also creating pressure.

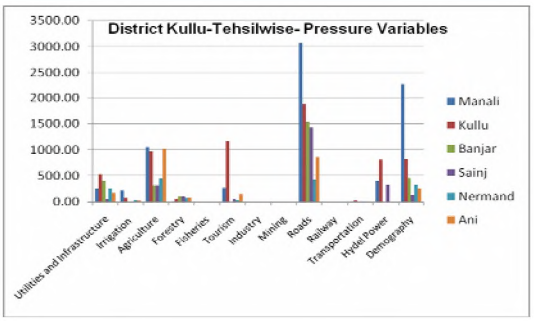
As stated earlier, Demography has a high vulnerability in the district, along with roads sector, where the work has already been completed.





Pressure Variables	Manali	Kullu	Banjar	Sainj	Nermand	Ani	Vulnerability of State Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	253.99	531.35	400.49	52.67	255.74	164.57	1658.81
Irrigation	220.00	76.75	15.05	16.68	41.25	24.96	394.69
Agriculture	1059.39	968.60	313.35	316.96	445.21	1019.87	4123.38
Forestry	11.00	48.18	106.70	110.00	73.70	83.60	433.18
Fisheries	0.00	0.00	0.00	0.00	0.00	0.00	0
Tourism	263.67	1162.20	0.00	45.87	41.75	146.82	1660.31
Industry	0.00	0.00	0.00	0.00	0.00	0.00	0
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0
Roads	3061.50	1880.10	1537.66	1427.40	429.71	862.54	9198.91
Railway	0.00	0.00	0.00	0.00	0.00	0.00	0
Transportation	9.31	23.50	11.10	2.18	7.75	15.90	69.74
Hydel Power	399.00	817.30	0.00	333.90	0.00	0.00	1550.2
Demography	2260.00	819.78	466.58	128.97	325.92	252.31	4253.56





As can be observed from analysis, Demography is extremely critical in Manali. With very little land available for urbanization, development of more tourism in Manali as well as Kullu could be taken up as per the Tourism development/ master plan. Further, good practices and recommendations outlined in Sectoral Guidelines of Tourism, Art and Culture can be followed.

Manali displays high pressures in Demography, Roads and Agriculture. Kullu displays high pressures in Roads, and Tourism, which is predominantly due to various tourist destinations and festivals like the Kullu Dussehra and to some extent in agriculture. Roads seem to be a dominant pressure sector in Banjar and Sainj. Ani displays a strong pressure in Agriculture sector. The Demographic pressures on Manali and to some extent on Kullu can be attributed to the employment opportunities available in these two major urban centres and other opportunities which are based on the tourism and National Highway.

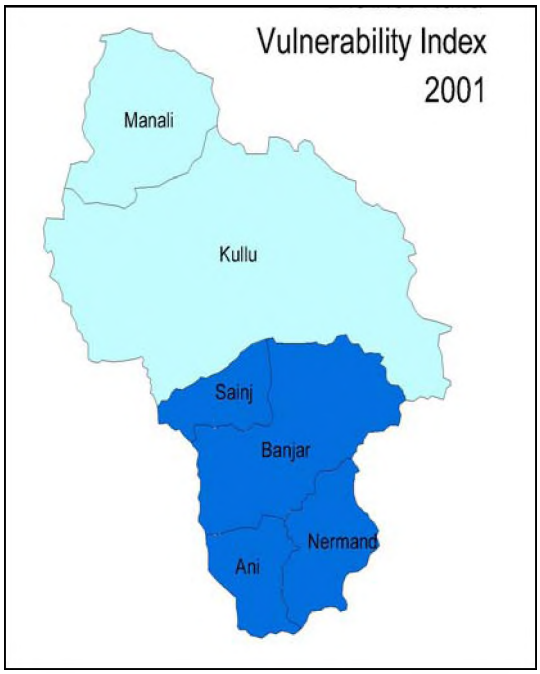
Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Kullu. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

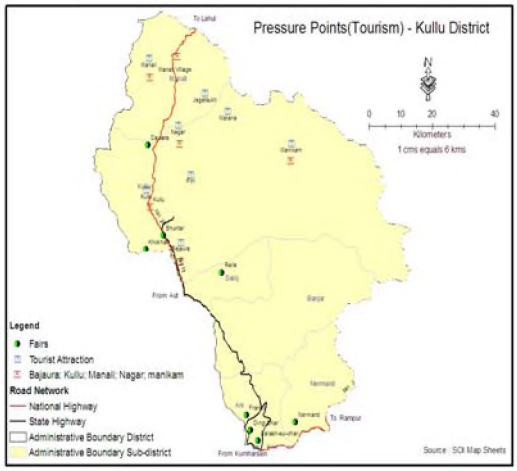
$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

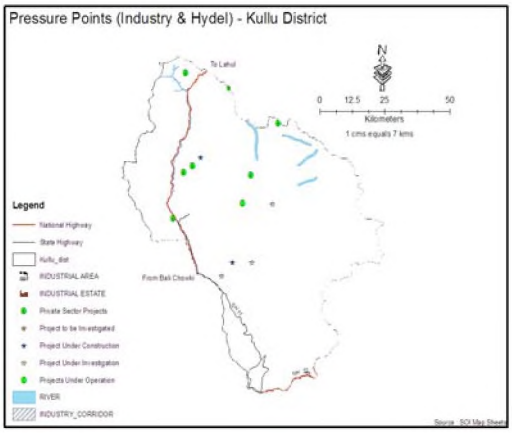
Vulnerability Index

	Manali	Kullu	Banjar	Sainj	Nermand	Ani
VI	7539.86	6367.04	2850.92	2434.63	1621.03	2570.5
Denominator = 57x43			**2451**			
Normalized VI	**3.08**	**2.60**	**1.16**	**0.99**	**0.66**	**1.05**

As can be observed from the Vulnerability Index map above, the Tehsils which have a good connectivity in terms of roads and have major tourism activities, Manali and Kullu have a higher VI, which is understandable, though this also, at the present gets in the Marginally low vulnerability segment. The remaining four Tehsils i.e. Sainj, Banjar, Ani and Narmand have a very low vulnerability. Manali and Kullu, through which the NH passes, are experiencing the pressures of National connectivity as well as the impact of tourism.



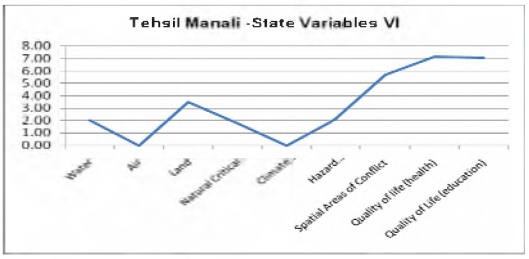




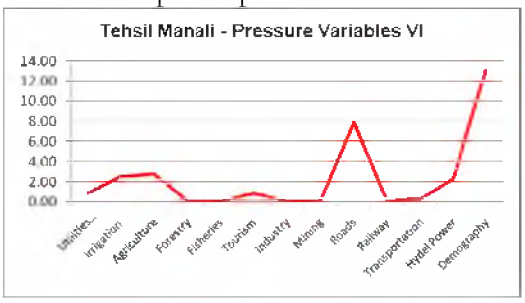
Description of Sectoral Vulnerability at Tehsil Level:

State & Pressure variables, have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Manali - Overall Vulnerability Index = 3.08



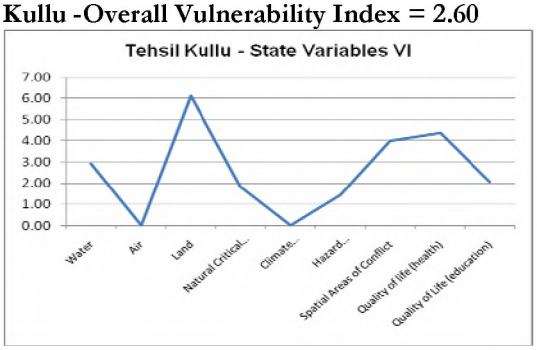
The Spatial Areas of Conflict due to excessive Demographic and tourism related activities have crossed the critical stage. The gaps in Quality of Life (Health and Education) are conspicuous because of inadequate services and infrastructure in health and education sectors and therefore have crossed the critical stage. Land as a State Resource is at present under the moderately low vulnerability segment and thus preventive measures can be taken in the future development plan.



It is observed from the analysis that Demography has crossed the critical segment. Apart from that, no other Pressure variable is cause of immediate concern.

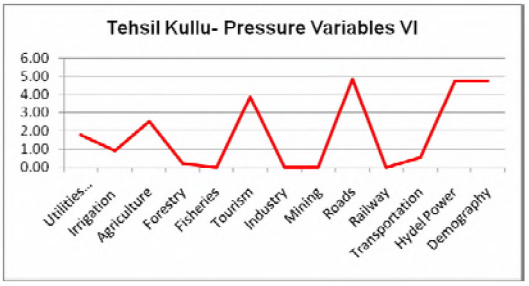
A programme for the addressing the Quality of Life (both, Health and Education) variables by improving the services and infrastructure in health and education sectors is recommended. Tourism related activities can be s per the development plan/tourism master plan. A Conservation Plan for Manali Town is recommended.

Kullu -Overall Vulnerability Index = 2.60



It is observed from the analysis that Land is the most vulnerable State variable and has crossed the criticality mark. Consequently, Spatial Areas of Conflict are also in the high vulnerability segment.

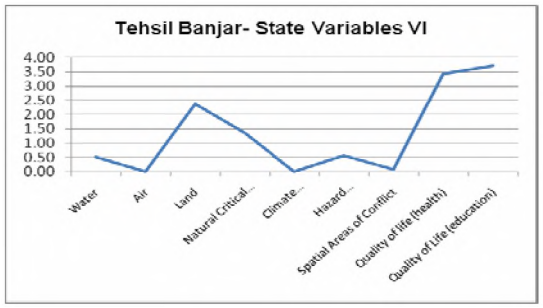
Quality of Life (Health) variables has also reached high vulnerability segment. A programme to reduce the gaps in the Quality of Life (Health) variables especially with reference to the Community Health Centres can help in reducing the vulnerability in the sector.



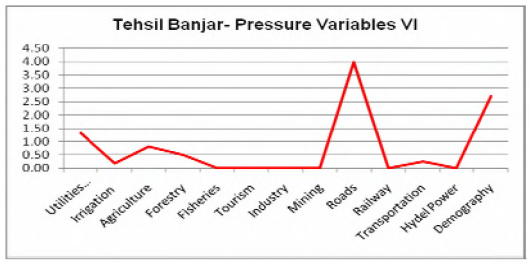
The high VI for Roads indicates that a lot of work has been done in this sector. Tourism is also under high vulnerability segment and thus has to be addressed as per the tourism development/master plan and concerned sectoral guidelines. Hydel Power and Demography are also in the Very high Vulnerability segment. Any further development in the Hydel sector should be based on basin level cumulative and comprehensive environment and social impact assessment.

Quality of Life (Health) need to be improved by providing health infrastructure and services to reduce the Vulnerability. Any addition in the Hydel Power sector should be based on basin level cumulative and comprehensive environment and social impact assessment. The Region as a whole should be addressed through a Regional Plan to balance the demographic growth.

Banjar- Overall Vulnerability Index = 1.16



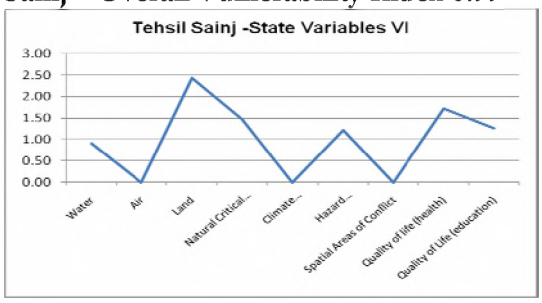
Except for the Quality of Life (Health and education) variables which are in the moderately high vulnerability segments, all the other State variables are in the low or very low vulnerability segments.



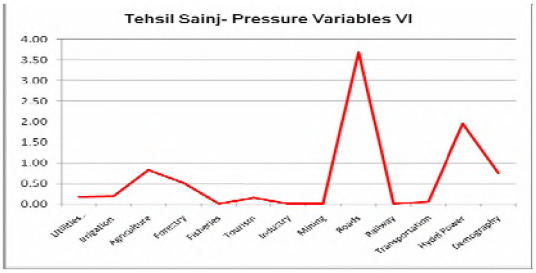
Roads development which has already taken place displays a high vulnerability. Future expansion of existing roads and new roads (including maintenance works) should be as per development needs and the concerned sectoral guidelines. Apart from that, the Demography has crossed over from low to moderately low vulnerability segment.

A programme for the improvement in the Quality of Life (Education) by providing infrastructure for secondary schools, colleges and vocational institutes is recommended. A programme for providing health infrastructure and services for reducing the gaps in the Quality of life (Health) is also recommended.

Sainj – Overall Vulnerability Index 0.99

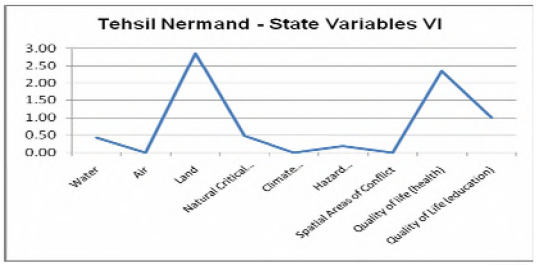


All the variables are in the low or very low vulnerability segments and thus are not a cause of immediate concern.

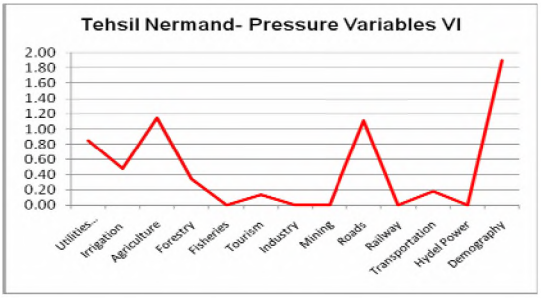


Except for the Road sector, where development has already taken place, no other variable is cause of immediate concern. Future expansion of existing roads and new roads (including maintenance works) can be as per development needs and the concerned sectoral guidelines.

Nermand – Overall Vulnerability Index = 0.66

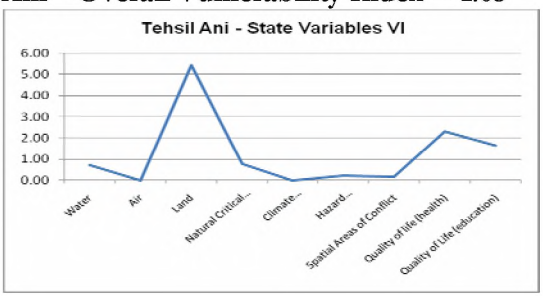


All the variables of State are in the low or very low vulnerability segment and thus are no cause for immediate concern.

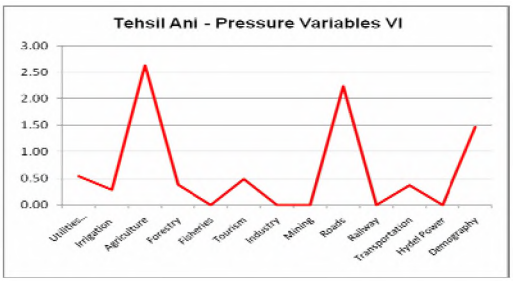


All the variables of Pressure too are in the low or very low vulnerability segment and thus are no cause for immediate concern.

Ani – Overall Vulnerability Index = 1.05



Land in Ani Tehsil appears to be the critically vulnerable. Pressure on land can be factored into future development planning. All other variables of State are in the low or very low vulnerability segment and thus are no cause for immediate concern.



All the variables of State are in the low or very low vulnerability segment and thus are no cause for immediate concern.

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

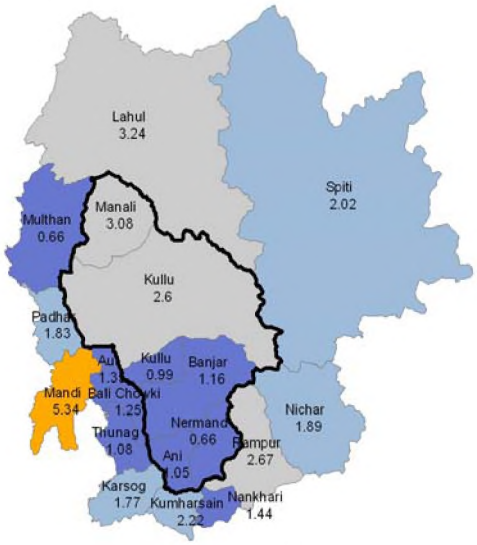
Kullu

S.No.	Tehsil	VI	Adjoining Tehsil in Kullu District	VI	Adjoining Tehsil in Other District	District	VI
1	Manali	3.08	Kullu	2.60	Lahaul	Lahaul & Spiti	3.24
					Multhan	Kangra	0.66
2	Kullu	2.60	Manali	3.08	Lahaul	Lahaul & Spiti	3.24
			Banjar	1.16	Spiti	Lahaul & Spiti	2.02
			Sainj	0.99	Nichar	Kinnaur	1.89
					Padhar	Mandi	1.83
					Mandi		5.34
					Aut	Mandi	1.35
					Multhan	Kangra	0.66
3	Sainj	0.99	Banjar	1.16	Aut	Mandi	1.35
			Kullu	2.60	Balichowki	Mandi	1.25
4	Banjar	1.16	Kullu	2.60	Nichar	Kinnaur	1.89
			Nermand	0.66	Rampur	Shimla	2.67
			Ani	1.05	Balichowki	Mandi	1.25
			Sainj	0.99			
5	Ani	1.05	Banjar	1.16	Thunag	Mandi	1.08
			Nermand	0.66	Karsog	Mandi	1.77
					Kumharsain	Shimla	2.22
6	Nermand	0.66	Banjar	1.16	Rampur	Shimla	2.67
			Ani	1.05	Nankhari	Shimla	1.44

Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Kullu is surrounded by various Tehsils of District Lahul & Spiti, Kangra, Kinnaur, Mandi and Shimla. The vulnerability levels of all surrounding areas are higher than that of what is prevailing in various Tehsil/ Sub tehsils of District Kullu. The transitional impact of vulnerability possibly will give rise to higher vulnerability levels in Kullu and Manali when analysed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programmes and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the programme as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken.

Detailed conservation and management plans for the water resources in the entire district are required at the moment as a preventive exercise. This type of intervention will help in sustainable management of water resources so that in case later any major water demanding Industrial corridor is established there would not be any detrimental impact on the water resources and the resource conserved sustainably.

(ii) As is observed from the analysis, the quality of life in terms of health and education required to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

<u>Priority Tehsils(in descending order)-. Manali, Kullu, Banjar, Nermand, Ani, Sainj</u>

Though the scenario as far as quality of life (education) is fairly better, yet the gaps which exist, are required to be addressed,

according to the norms stating accessibility to a Primary School within a distance of 2 kilometers, a Secondary School within a distance of 6 kilometers, a College within a distance of 10 kilometers, and a Vocational Institution within a distance of 25 kilometers. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Manali, Banjar, Kullu, Nermand, Ani and Sainj.

The benchmarking of the norms has been done with a view of the profile, terrain of the State.

A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(iii) It has been observed that there is a gap between the forest area and the forest cover and hence a specific programme for attending this gap is required to enrich this resource wealth of the district.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the eco system of that area to maintain moisture content in critical areas besides recharging of the ground water.

(iv) The district has a number of Spatial Areas of Conflict, especially, places of tourist interest and mass congregation, which are located in sensitive areas such as Rohtang pass, Marhi, Solang valley, Vashishtha, Hadimba, Kothi, Manikaran, and Dussehra grounds Kullu, along with the sites of Hydel Power projects, which are a cause of concern. Detailed qualitative and quantitative studies can be conducted for preparation of an action plan for such places on priority to reduce the vulnerability owing to Spatial Areas of Conflict.

Pressure Parameters

(i) From the data available, it emerges that a lot of work has been done in the road sector, which is a good sign for developmental scenarios, yet, it also raises an alarm as development of roads open up hitherto inaccessible areas. The improved access endangers the State components like Forests, green cover, wildlife and biodiversity of the area. It is recommended that the state may intervene with policy instruments to protect these areas from such interference.

(ii) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has decreased in some Tehsils while increasing in a couple of other tehsils. Moreover, the yield has increased thus exerting the pressure. The 12.6% reduction in agricultural land in Manali, may probably have development of Tourism at Manali, whereby tracts of land may have been diverted to create resorts and hotels and supporting infrastructure. Rationalization of land requirement for non agricultural use can be considered in line with existing development plans, land use plan, State Agriculture Plan and District Agriculture Plan.

(iii) Tourism as a parameter is the third highest scorer in the district pressure parameters. However, tourism is one of the mainstays of economy in the State and thus has to develop further. The growth in the sector is welcome, as it boosts the economy, but the rate at which it is growing demands a definite

and specific plan for the district in terms of growth of tourism.

The district, especially Manali and Kullu are major tourist destinations, but they also have a fragile environment and thus a carrying capacity study can be done. For example, a town like Manali, whose municipal area is just 3 square kilometres, would have a limited carrying capacity. If areas are not available within these limits, land under agricultural use would be diverted. It is learnt that new resorts and tourists facilities are proposed at Nagar, Kothi, Solang valley, Marhi and Rohtang. A thorough examination of these proposals is needed. For a sustainable coexistence of Tourism and Environment, a broad State Level Plan and Detailed District Level Plans for Tourism can be prepared along with Destination Plans as per the Tourism Master Plan.

(iv) Utilities and Infrastructure form the fourth highest pressure in the district. The Pressure exists because there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(v) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization plan is required to be prepared through scientific studies.

(vi) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyse and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Water		*	*		Water Utilization Plan
2	Quality of life (Health)			*		Programme to improve access
3	Quality of life (Education)			*		Programme to improve access to Vocational Institutes
4	Natural Critical Habitat		*			Plans for Buffer zones
5	Spatial Areas of Conflicts		*		*	
Pressure						
1	Roads	*				Policy to take care of State variables
2	Agriculture	*				Policy regarding Diversion of land for non-agricultural use
3	Tourism		*			Tourism Plan at State, District,

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
						and Destination Level
4	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
5	Hydel Power		*			Detailed EIA and EMP

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Manali	Kullu	Banjar	Sainj	Nermand	Ani
VI	7539.86	6367.04	2850.92	2434.63	1621.03	2570.5
denominator = 57x43			**2451**			
Normalized VI	**3.08**	**2.60**	**1.16**	**0.99**	**0.66**	**1.05**

Population Projections

Tehsil	2001	2011	2021	2031	2041
Manali	44212	57491	73442	91569	111530
Kullu	157260	191101	232628	280880	334988
Banjar	37376	44651	53434	63561	74874
Sainj	20682	24353	29176	34969	41570
Nermand	50476	61163	73579	87571	102991
Ani	47917	56320	66453	78141	91207

Calculation of per capita share of VI

Tehsil	Population	VI 2001	per capita share
Manali	44212	3.08	6.97
Kullu	157260	2.6	1.65
Banjar	37376	1.16	3.10
Sainj	20682	0.99	4.79
Nermand	50476	0.66	1.31
Ani	47917	1.05	2.19

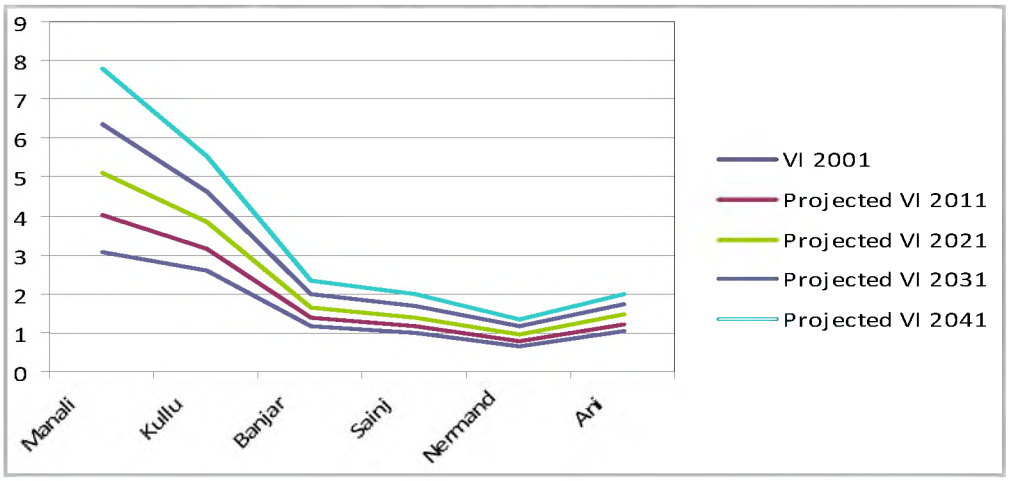
Calculation of Projected VI

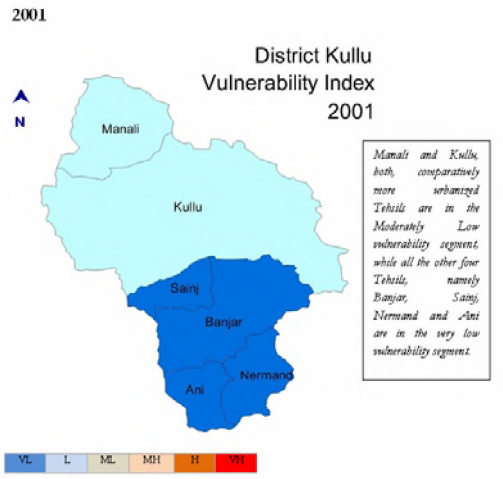
Tehsil	Pop 2001	VI 2001	per capita share	Proj.Pop 2011	Proj. VI 2011	Proj Pop 2021	Proj VI 2021	Proj Pop 2031	Proj VI 2031	Proj Pop 2041	Proj VI 2041
Manali	44212	3.08	6.97	57491	4.01	73442	5.12	91569	6.38	111530	7.77
Kullu	157260	2.6	1.65	191101	3.16	232628	3.85	280880	4.64	334988	5.54
Banjar	37376	1.16	3.10	44651	1.39	53434	1.66	63561	1.97	74874	2.32
Sainj	20682	0.99	4.79	24353	1.17	29176	1.40	34969	1.67	41570	1.99
Nermand	50476	0.66	1.31	61163	8.00	73579	9.62	87571	1.15	102991	1.35
Ani	47917	1.05	2.19	56320	1.23	66453	1.46	78141	1.71	91207	2.00

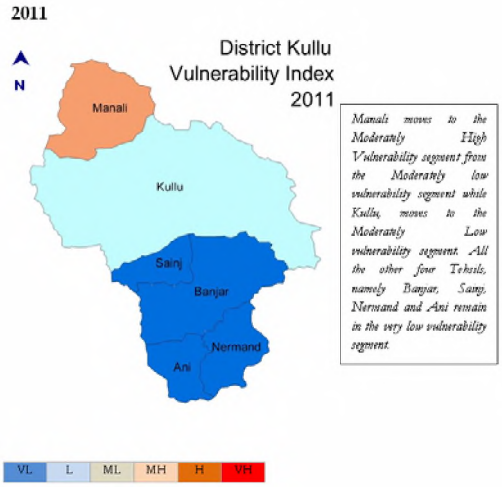
Projected Vulnerability Index

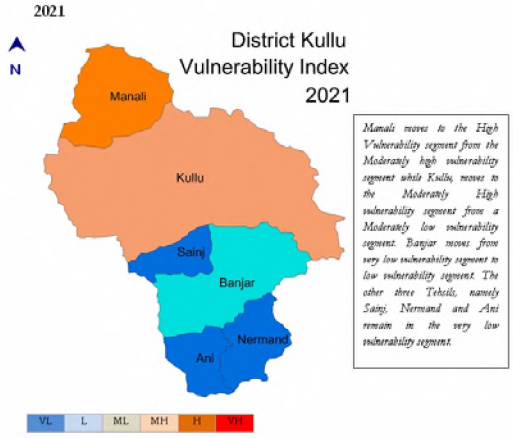
Tehsil	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Manali	3.08	4.01	5.12	6.38	7.77
Kullu	2.6	3.16	3.85	4.64	5.54
Banjar	1.16	1.39	1.66	1.97	2.32
Sainj	0.99	1.17	1.4	1.67	1.99
Nermand	0.66	0.8	0.96	1.15	1.35
Ani	1.05	1.23	1.46	1.71	2

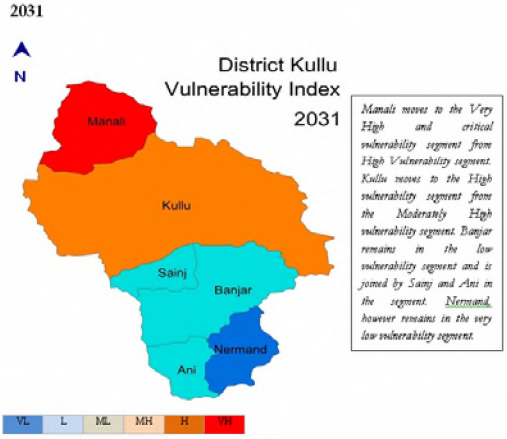
Vulnerability Index Scenarios – District Kullu at Tehsil Level



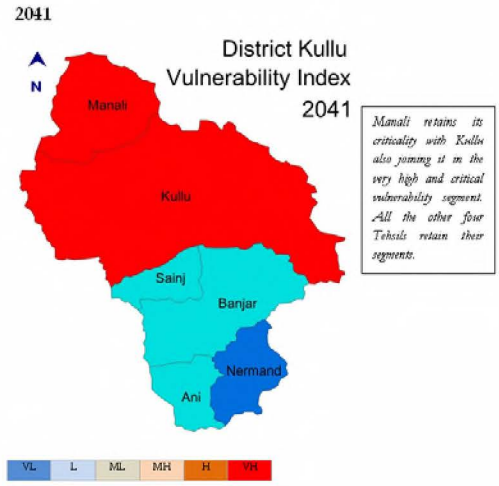








2041

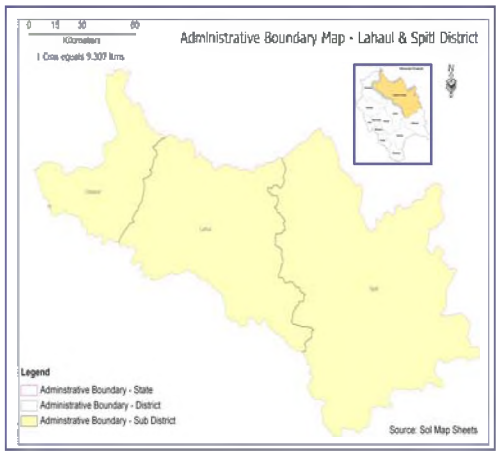

District Kullu
Vulnerability Index
2041
N
Manali
Kullu
Sainj
Banjar
Nermand
Ani
VL
L
ML
MH
H
VH
Manali retains its criticality with Kullu also joining it in the very high and critical vulnerability segment. All the other four Tehsils retain their segments.

LAHAUL & SPITI

General Background

Lahaul & Spiti is located between latitudes of 31°44'57" & 32°59'57" in North and between 76°46'29" and 78°41'34" east longitudes. It is situated in northern & north eastern part of Himachal Pradesh. It touches Tibet on eastern border, Ladakh on northern side; Chamba, Kangra & Kullu on western & southern side while on south eastern side is Kinnaur. The general elevation in the district is above 2,700 metres with the greater part of the district having elevations ranging from about 4,000 metres. to 6,000 metres and some of the peaks are above 6,400 metres. Lahaul and Spiti is the largest district in the State.

Lahaul & Spiti district is spread on an area of 13,835 sq. kms., which constitutes 24.85% of total geographical area of the State. Administratively, district is divided into 2 Tehsil & one Sub-Tehsil. Spiti is the largest entity with area of 7100.5 sq. kms. followed by Lahaul with area of 3759.4 sq. kms., while the smallest unit is Udaipur at 1976.1 sq. kms.



Physiography

The district of Lahaul & Spiti forms a northern part of Trans Himalayan Zone of Himachal Pradesh and is situated in the northern and north eastern part of the state. It is characterized with high mountains, snow covered peaks and deep valleys. Two valleys of Lahaul & Spiti form the district but both these valleys are different to each other in physical character. Spiti valley which is formed by *Spiti* river in the southern and south eastern part of the district is broad and has tough terrain while Lahaul valley which is formed by *Chandra Bhaga* river is narrow. The whole water of the district is drained by these two rivers and their tributaries. The special feature of this district is the existence of glaciers and the high snowy mountain ranges. Geology of this district is fossil rich rocks. These rocks are Lurian age chiefly schists states and balaim conglomerates principal rock is conglomerates in Spiti area sand Gruvite and slate in Lahaul area. Soil erosion is the biggest problem of the district as tree cover is missing due to scanty rainfall and high altitude. This district lies in the alpine Himalayan mountain system which is a major earthquake prone belt of the earth. Due to high elevation and tough climatic conditions, this district does not possess forests.

On the basis of geology, climate, soils, forest covers and physical features, this district has been divided into five sub regions.

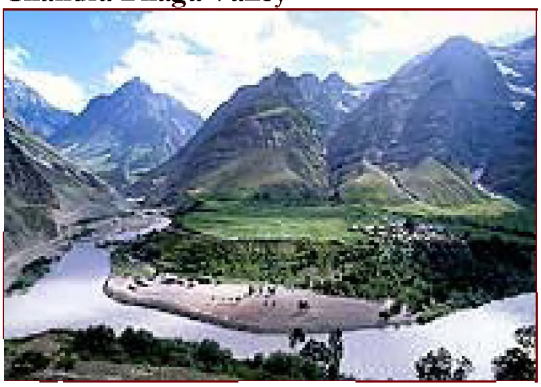
Pir Panjal



It forms a narrow tract along the western and south eastern parts of this district. This region is mountainous where elevation rises steeply from the river bed. This region consist of many dhars and perennial streams/rivulets originating in this region

and join *Chandra Bhaga*. *Rohtang* Pass is the most important physical feature of this region. Geology of this region mainly comprises of granites (unclassified structure) and Jutogh group. Soils are of Udalfs category.

Chandra Bhaga Valley



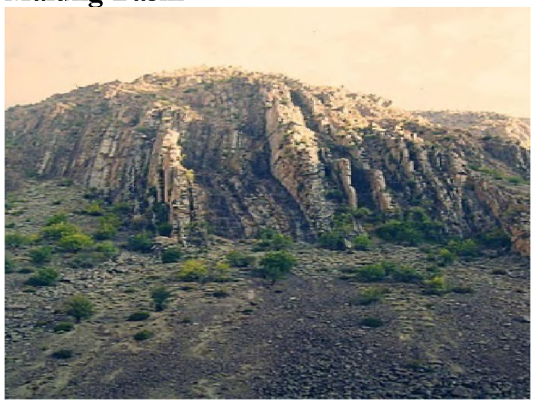
This narrow valley formed by *Chandra* and *Bhaga* River and major tributaries like *Miyar* and *Thirot* Nallah is surrounded by Greater Himalayan glaciated range from north-west, north and east directions, from south-west and south it is enclosed by *Pir Panjal* and from west Chamba district surrounds it. Geological structure of this valley is mainly formed by Jutogh group/Central Gneiss formations, Granites (unclassified) and Haimanta group. The deposits of Gypsum and limestone are found in the valley but due to various reasons, these deposits remained untapped. Scattered patches of vegetation like Junipers, Blue Pines, Birch, Willows, Poplar and Walnut are seen in the areas adjoining the river banks.

Greater Himalaya Glaciated Range



This region include north eastern and north western of Udaipur sub-Tehsil, eastern half and north western part of Lahaul Tehsil and central, eastern and south western parts of Spiti Tehsil. This is a vast region and is constituted of 40% of the total area of the district. This region has very high peaks covered with massive snow and glaciers, *Chander Tal* and *Suraj Tal* glaciers are located in the centre of this region which give origin to *Chandra* and *Bhaga* rivers and valleys which separates from *Spiti* Basin. Its tributaries like *Miyur Nallah*, *Thirot Nallah*, *Jankari Nallah* and *Spiti* river and *Lingti Nallah* also originate from this range. This region also separates *Malung* Basin from *Spiti* Basin. *Chandra Bhaga* valley is connected with *Spiti* Basin through *Kunzam* Pass. *Baralacha* pass connects *Bhaga* valley with *Malung* Basin. The remaining Greater Himalaya Glaciated range is inaccessible and these glaciers are *Bara* and *Chhota Shingri*, *Gungstang*, *Kesash* and *Miyar* glaciers. This region is formed by Granites (unclassified), Haimanta group and Triassic formations. Soils of this range are categorised as Udalfs, Udolis and Glaciers and snow capped soils and is devoid of any population and vegetation.

Malung Basin



It forms an extreme northern part of the district which includes north-western part of Spiti Tehsil and north-eastern fringe of Lahaul Tehsil. It is enclosed by Jammu & Kashmir from north to east while Greater Himalayan glaciated range surrounds it from south to west. Geological structure of this region is mainly formed by Triassic and Jurassic formations and soils of this range are categorized as Udolfs. The elevation of

this region ranges between 4,700-6,157 metres. Climatic conditions are very severe and terrain is very tough which makes the region inaccessible. This basin does not possess any population and vegetation.

Spiti Basin



It is comprised of south-eastern part of the district which includes southern and eastern parts of the Spiti Tehsil and covers all inhabited villages of Spiti Tehsil. The villages in this region are mainly concentrated on the banks of rivers like *Pin, Lingti and Spiti*. This region is surrounded by Kinnaur district from south and east directions while Greater Himalaya glaciated range encircle it from the remaining sides. Physiographically, this region is more rugged and mountainous. Slopes rise steeply on the both sides of *Spiti* and *Pin* rivers and cultivable land is confined to the lower slopes. Upper slopes are devoid of any vegetation. *Spiti* river originates from the heights of *Kunzum* La and receive water from numerous rivers and rivulets. The *Pin* River which has its source near *Bhabha* Pass also joins the *Spiti* river. Geology of this basin is formed by mostly Triassic, Jurassic and permo carboniferous formations and soils are categorized as Udolfs, Orthents-Ochrepts and Udalfs types.

Culture and Social Brief

Fairs & Festivals

People of Lahaul & Spiti celebrate several fair and festivals at different occasions. Some of these are: *Ladarcha* fair, *Pauri* Fair, Tribal Fair *Keylong, Tsheshu* Fairs, Festival of light, *Fagli*, and *Gothsi*.

Places of religious, historical or archaeological importance and tourist interest in the district

The nature has endowed Lahaul & Spiti with interesting, charming, fascinating and attractive landscapes. Its valleys, mountains, glaciers, rivers, forts, gompas and ancient buildings of the once ruling dynasty are of particular interest. The district is famous for its old monasteries, not only for their religious backgrounds but for archaeological and historical importance and as well centres for tourist attraction and places for pilgrimage. The gompas are rich treasurers of cultural heritage and centre of study in Buddhism. They have ornate paintings of saints, demons and evil looking beasts. The important monasteries in Lahaul region are *Kardang, Sheshur, Gemur, Bokar, Guru Ghantal* whereas in Spiti area *Tabo* and *Kye* monasteries are famous. *Trilok Nath and Marikula* are the famous temples of Udaipur sub-Tehsil.

A brief description of the monasteries and temples is as follows:

Kardang Monastery: It is situated on the left bank of Bhaga River opposite Keylong and was built in the late medieval times. The image of Togdan Sakyo Sri, the teacher of Lama Norbu and grand teacher of Lama Hishe Rangdol has been enshrined. It is a treasurer house of good Buddhist manuscripts and decorated with beautiful fresco paintings depicting the life of Buddha and Buddhist deities.

Trilok Nath temple: It is situated on the left bank of *Chandra Bhaga* river at a distance of 12 kms. from Udaipur and 45 kms. from Keylong. It is one of the rare temples which is worshipped equally by Hindu, Buddhist, and Baudh. The devotees from distant places come to pay their homage to the deity of this unique temple. A large number of people including Sadhus and other religious personalities attend it for getting the blessing of Lord Triloknath.

Margul or Marikula: It is unique for its exquisite wooden carvings. The beautiful statue has been placed on a rectangular pedestal with several steps and inscriptions in different languages.

Shashur Monastery: It was established in the 17th century and lies on the hill beyond Keylong and is famous for thankas, idols and Tibetan paintings. The shrine has a chamber of horrors and also has the images of Buddha and other deities. The presiding deity is a colossal image of the Buddha.

Guru Ghantal Monastery: It is situated on the right bank of *Chandra Bhaga* and perhaps the oldest monastery in Lahaul area dating back to 10th century with wooden structure of pyramidal roofs which exhibit interesting wood carving. The monastery now enshrines a black stone image of goddess Kali called Varjeshwari Devi (Dorji Lama) and wooden image of Buddha which according to local tradition was installed by a Lama Ringchen Zangop from Kinnaur some eight hundred years ago.

Kye Monastery: It is the oldest and biggest monastery in Spiti valley which is located at a height of 4,116 metres above the mean sea level. This monastery has a few religious Buddhist works of Kangyur and Tangyur and has a rich collection of scrolls, idols and masks. It is famous for its murals and highly valued books. It is also seat for religious training to newly introduced Lamas.

Tabo Monastery: It is an ancient monastery located at the left bank of *Spiti* river at an elevation of 11,200 ft. above the mean sea level.

Passes: A worth noting passes in this region of religious and tourist interest are the *Baralacha* pass situated at 4,891 metres above the mean sea level and is nearly 8 kms. long and consists of a high neck of land connecting the central mountains with the main Himalayas and roads from Zanskar, Ladakh, Spiti and Lahaul meet on the top of it. It is the source of three rivers namely *Bhaga* on the north-west, *Yunum* on the north and *Chandra* on the South-east. *Kunzum* Pass provides the main avenue of approach from Lahaul to Spiti and source of *Spiti* river. Its height is 4,554 metres from the mean sea level. *Rohtang* Pass, the main gate between Lahaul & Spiti and Kullu is situated at the height of 13,050 ft. above the mean sea level. To the left of this pass is the lake of *Sirkund* or *Dashir*, a number of people visit the small glacial lake from Kullu, Lahaul & Spiti and other parts of the States. The river *Beas* rises near the crest of *Rohtang* and *Beas Kund*.

The Marikula Devi temple in Udaipur and Tabo monastery in Spiti has been undertaken by the Archaeological Survey of India. All the ancient monasteries, forts, old buildings of ruler dynasty and villages of historical backgrounds have the significance of archaeological importance.

Gonduala: It is situated at a distance of 16 kms. from Keylong at a height of 10,300' above sea level. An annual fair is held in the month of July. The village monastery is of historical significance and large number of visitors witnesses the fair at this place.

Shashin: This village is situated on the right bank of river *Chandra* at a distance of 30 kms. from Keylong. A shrine dedicated to this deity lies in the village.

Sissu: It is situated at a distance of 32 kms. from Keylong between Keylong-Koksar road at the height of 10,300 ft. Snow trout is found in *Wamphere* waters. The Department of fisheries has tried to breed carps fish in the pond.

Keylong: Keylong is district headquarters and situated at the height of 10,500 ft. above the mean sea level on the left of *Bhaga* river.

Kibber: It is locally known as Khyipur and one of the highest villages in the world situated at a height of 13,400 ft. and distinguished for its houses built of stone instead of mud which is predominant material in Spiti valley.

Dhandar: Situated at an elevation of 12,300 ft., this village at one time was the capital of Spiti. On the top of the hill is a large structure known as Dhandar Fort which is a monument of ancient architecture.

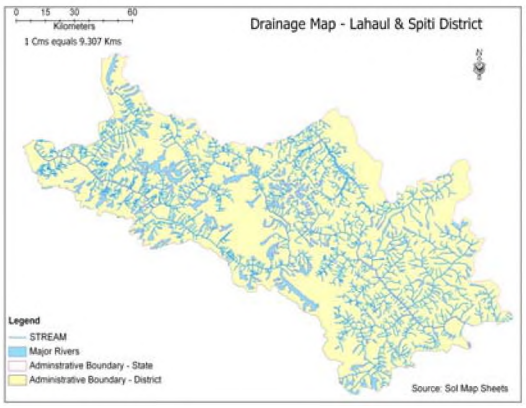
Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analysed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analysed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Lahaul & Spiti district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System



The *Chandra* & *Bhaga* Rivers are the main drainage lines of Lahaul. After their confluence at Tandi, they are known by name *Chandrabhaga* or *Chenab* river. In Spiti sub division major river is *Spiti*.

Chandra River

The river originates from huge snow bed on south eastern side of *Baralacha* pass. After flowing about southwestern course of 48 kms. river sweeps round to west and flows for about 64 km. west & north west and reaches Tandi where it meets *Bhaga* river. Throughout its course, river is fed by many glaciers.

Bhaga River

The river takes its origin from snow bed on south-western foot of *Baralacha* pass and flows in northwest and later curves round to south west. The total length of river is about 65 km. The banks of stream are steep & rocky.

Chandrabhaga/Chenab River

It is formed by *Chandra* & *Bhaga* rivers. The river is in spate during summers but may occasionally freeze during winters. Flash floods occur with regularity in early afternoon in summers.

Spiti River

The river is formed at base of *Kunzum* Range. On its western side lies a vast salt water lake. The river follows a long winding course interlocked here & there by spurs that project from foot of plateaus on both side.

Pin River

It is an important right bank tributary of *Spiti* river. It is about 50 kms. long. The depth of river depends upon season. The water of river is highly heavily charged with silt.

Tsarab River

In the north, the *Tsarab* runs north-westwards for about 50 kms. before joining the *Lingti* river and entering Zangskar in Ladakh. The *Tsarab* is, because of its peculiar location, not used for any purpose by the Spitians. Its watershed does not contain any human habitation; it ultimately joins the *Indus* in Ladakh.

Lakes



Suraj Tal, Chandr Tal, Neel Kanth, Mane lakes are situated at the heights of 11,400 ft. to 15,000 ft. above the mean sea level. *Suraj Tal* is a pretty lake situated on the *Baralacha* pass at a distance of 65 kms. from Keylong. It is situated at a height of 15,500 ft. above the mean sea level and river *Bhaga* originates from here. *Chander tal* is an Ox Bow lake spread over in six furlongs in length and three furlongs in breadth and has an outlet into the *Chandra* river. It is blue in colour and situated at the height of 14,200 ft. above the mean sea level amidst the huge grassy bowels covered with Himalayan flowers during the summer and provides a resting place for migratory Siberian ducks. *Neel Kanth* Lake is situated at an elevation of 14,000 ft. and is approachable from village Nainghar. It is a glacial lake formed at the base of Neel Kanth peak and considered as sacred abode of Lord Shiva and people go there for pilgrimage during July to September and offer trishuls and scarves in honour of lord Shiva. *Mane* lake is a glacial lake situated at a distance of 16 kms. from Kaza at the height of 15,000 ft. on broad flat mass of land punctuated with murrains.

Climate

The climate of the district is generally dry throughout the year as the district lies between the eastern or main Himalayan on the north and the mid Himalaya on the south. The winter season from about the middle of November to March is followed by the spring which last up to the end of May. The next four months are summer season. Spiti region of the district is comparatively more difficult than Lahaul and Udaipur in terms of terrain, climate and habitation. The climate of Lahaul and Udaipur area is however more colder and the air is crisp and clean especially in the valley of *Chandra Bhaga*. From June to middle of September, the day temperature rises considerably and it is fairly warm but the nights are quite cold and pleasant. Snow starts falling from October onwards and December to March which is the severely cold months and it snows regularly. In the valley of *Chandra Bhaga*, the climate is temperate in summer and semi arctic in winter. The warmest months are July and August. The air is generally very dry over the district during summer and transition seasons.

Precipitation/ Rainfall

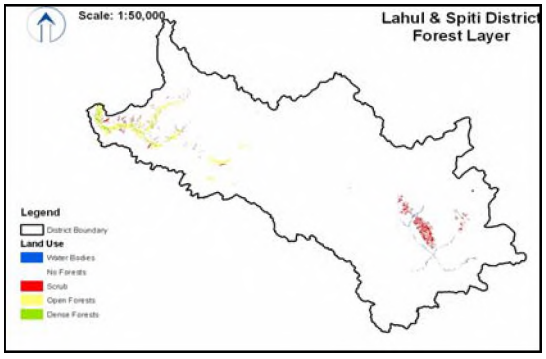
The monsoon hardly penetrates into the district as its enormous mid Himalayan mountain ranges almost diverts the monsoon clouds and thus rains are scanty. Spiti region of the district is also typical mountainous desert and rains occur in the form of misty drizzles. The district receives lower precipitation in comparison to other districts of the State. The winter is the only season when precipitation is normally received in the form of snow. It is also dry in winter except during spells of rain or snow fall. The skies become heavily clouded or overcast when the district is affected by western disturbances during December to May and there is some moderate cloudiness during summer. The winds are generally light in valleys and lower elevations while it is stronger at the higher elevations. Its

direction at the surface depends very much on the nature of the terrain and it flows generally from northerly to north easterly in the summer and westerly to north westerly in the remaining seasons.

Particulars	Maximum	Minimum
Rainfall	162.51 mm	9.29 mm
Temperature	12.21^0 C	-5.49^{0}C

Forests

As the district is situated in the inner Himalayas and its deep valleys are dry, rugged and barren there is no scope for afforestation of economically useful forests. The greatest problem is conservation of soil .There is a poor forest in the district in comparison with the vast area, there are only a few and scanty forests of Kail, deodar and birch owing to difficult climatic conditions and high elevation. The principal tree species in the forest areas are Kail, deodar, pencil cedar, birch, willow, juniper, bird cherry and poplar are met with in various places in the form of small cluster of trees. Kail, the most valuable tree of Lahaul is found at intervals along the left bank of river *Chandra* between Koksar to Sissu, up to Tandi along the *Chandrabhaga* down to Chamba border and little beyond Nainghar in *Thirot nallah*. In the *Bhaga*, it occurs on its left bank in *Kardang* and *Cheling* on northern slope. Except in Mooling where there are some big trees, Kail is generally of small size and mostly occurs either in banks of canopied trees or scattered amongst the cliffs where the soil is sufficient for them to grow.



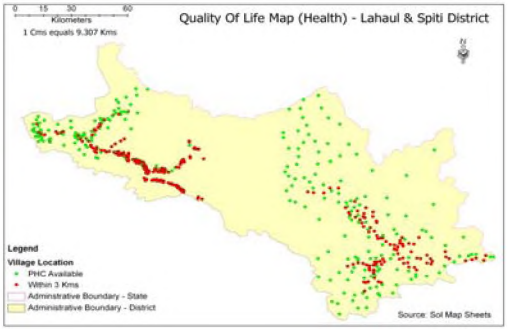
Deodar, the most common tree of Lahaul division is chiefly found in Kothis of Gumrang and Kolong near Jaspa and in the Pattan valley in Kothi jalma on the right bank of river *Chandrabhaga*. The scattered trees on the small patches are found in the right bank of *Bhaga*. There are few trees of spruce near Guru Ghantal monastery, in the *Jhalma Nallah* and *Thirot Nallah* mixed with Kail. Willow is largely cultivated near villages where irrigation is available. The poplar and willow trees are popular for afforestation in Lahaul & Spiti valleys. The forest area cover in the district is only 150 sq. kms. out of total geographical area of the district which constitutes only 1.1% of the total area according to the Forest report of 1999. Besides this, scrub forests also cover 45 sq. kms. area.

Quality of Life (Health)

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to access health facilities it demonstrates lack of quality of life in critical sector.

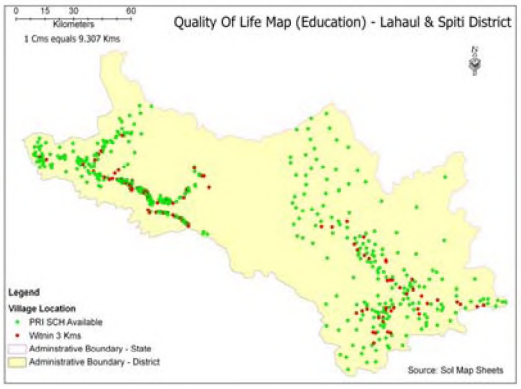
In fact, to summarize, according to 2001 Census, 69% villages doesn't have access Primary Health Centre within 3 kms. 85.85% villages don't have access to Community Health Centre within 6 kms. and 85.24% villages don't have hospital facility within 10 kms.



Quality of Life (Education)

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

Out of 287 inhabited villages in district, 98 villages don't have primary school. 91 villages have primary school facility is available within a distance of less than 5 kms. while inhabitants of 6 villages have to cover distance between 5-10 kms. Only for one village primary school facility is available at distance of 10+ kms. There are 230 villages in district which have no middle school facility. Of which 144 villages have this facility at distance less than 5 kms., for 68 villages it is available at distance of 5-10 kms. and for remaining 18 villages middle school is available at distance of 10+ kms. As far as facility of Degree College is concerned 286 villages doesn't have Degree College. For 2 villages, facility is available within 5 kms, for 6 villages facility is available within 5-10 kms. and for major chunk of 278 village's degree college facility is available in 10+ kms. distance range.



To summarize, according to Census of India 2001, on an average across the district, 35.73 % villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 57.75% villages doesn't have secondary school within a distance of 6 kms., 83.64% villages doesn't have colleges within a distance of 15 kms. and 92.74% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Lahaul & Spiti such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Lahaul & Spiti district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

Lahaul & Spiti is the smallest district as far as the population is concerned, having 33,224 persons population as per 2001 Census. This population constitutes of 18,441 males and 14,783 females (the Census of India, 2011 gives a provisional population figure of 31,528 with a density of 2 per sq. km. Data at tehsil level is not available). The population of the district is merely 0.55% of the total population of the State. Lahaul & Spiti district has total 521 villages, out of which 234 villages are uninhabited. This entire population of the district is distributed in 287 inhabited villages and majority of these villages are small sized having population of less than 200 persons. These villages are mostly scattered in valley of *Chandra-Bhaga* river and its tributaries in Lahaul Tehsil, Udaipur sub-Tehsil and valleys of Spiti, Pin and Lignite rivers in Spiti Tehsil. The habitation is not possible in higher altitude areas as these remain under snow cover for the most part of the year and remain cut off from the rest of the world. The district has no urban area and the rural population is distributed in three Tehsil/sub-Tehsil. Lahaul Tehsil has a population of 13,099 persons comprising 7,455 males and 5,644 females while Udaipur sub-Tehsil

contains 9,446 persons consisting 5,112 males and 4,334 males. Spiti Tehsil is inhabited by 10,679 persons with 5,874 males and 4,805 females.

Population Growth

Population of the district was 31,294 persons in 1991 which has grown to 33, 224 in 2001 Census showing net increase of 1,930 persons during 1991-2001. In terms of percentage, it has increased by 6.17%. At Tehsil/sub-Tehsil level, the highest growth of 11.24% has been recorded in Spiti Tehsil and is followed by Udaipur (8.91). The lowest growth is recorded in Lahaul (0.53 %) Tehsil.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSIL BY RESIDENCE, 1991-2001

Tehsil/ Sub-tehsil	Population						Percentage decadal variation 1991-2001			Percentage urban population	
	1991			2001							
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
Udaipur (S.T)	8,673	8,673	-	9,446	9,446	-	+8.9	+8.9	-	-	-
Lahaul (T)	13,030	13,030	-	13,099	13,099	-	+0.5	+0.5	-	-	-
Spiti (T)	9,591	9,591	-	10,679	10,679	-	+11.3	+11.3	-	-	-
District Total :	**31,294**	**31,294**	**-**	**33,224**	**33,224**	**-**	**+6.2**	**+6.2**	**-**	**-**	**-**

Density

This district is very thinly populated and its distribution is very uneven. The density of population in this district is only 2 persons per sq.km. against the state average of 109 persons per sq.km. The physical and climatic conditions are very hostile for human habitation in this district resulting in low concentration and slow growth of population.

Sex Ratio

According to 2001 Census sex ratio in the district works out 802 females per 1,000 males against the State, average of 968 females. At Tehsil level, it varies between 848 females in Udaipur sub-Tehsil and 818 in Spiti Tehsil while Lahaul Tehsil has lowest sex ratio of 757 females.

Work Participation Rate

The work participation rate is defined as percentage of total workers to total population. According to 2001 Census 21,088 persons have been categorized as total workers including main and marginal workers constituting 63.5 %of the total population. The share of main and marginal workers comes 57.8 and 5.7 percent respectively. At Tehsil level, the highest percentage of total workers has been recorded in Lahaul (70.2) and is followed by Udaipur (63.5) sub-Tehsil. Spiti Tehsil has lowest proportion of 55.3 %.

As regards the male work participation rate, the proportion of total male workers comes to 68.3 % of the total male population while female participation rate works out 57.4 % in the district. Male marginal workers constitute only 4.4 % and the proportion of female marginal workers in 7.2 %. At Tehsil level percentage of male workers is higher than females in all Tehsil/sub-Tehsil.

Urban Population

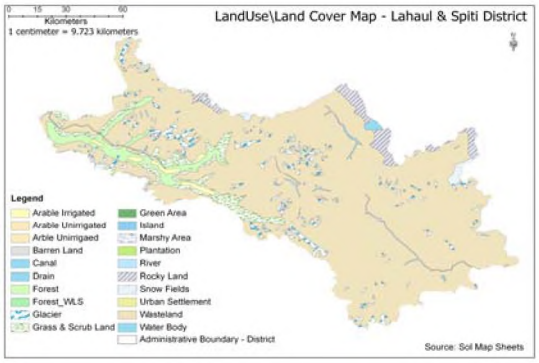
Lahaul and Spiti district has no urban area and as such its population refers to rural area only.

Literacy

A person who can read and write with understanding is considered literate in Census. All children below 7 years are termed as illiterate. As per 2001 Census district has 21,609 literates comprising 13,726 males and 7,883 females. The

proportion of literates is 73.1% of the total population excluding the population of 0-6 years. As regard the sex wise literacy rate in the district, this rate among the males is 82.8 % while among the females it comes to 60.7 %. During the decade of 1991-2001, the district has made tremendous progress in the field of education and the proportion of literates has increased from 56.8 % in 1991 to 73.1 % in 2001 Census. The proportion of female literates has increased very sharply from 38.0 % in 1991 to 60.7 % in 2001 while percentage male literates increased from 71.8 to 82.8 % during the period. But gap in male and female literacy is still very wide which comes to 22.1% in 2001 Census. Among the Tehsil, Spiti Tehsil ranks at the top with 74.1% literates which is followed by Lahaul Tehsil having 73.7 % literates and 71.1% in Udaipur sub-Tehsil. Male literacy is again highest in Spiti (86.4 %) and lowest is found in Udaipur (80.9) while proportion of male literates in Lahaul comes 81.5 %. But in case of female literacy Lahaul ranks first with 63.2 % and is followed by Udaipur (59.5) and Spiti (58.7 %). The gap in male and female literacy varies between 27.7 % in Spiti and 18.3 % in Lahaul Tehsil.

Land Use



Land use Classification of Area	Land utilization (Sq Km)
Total Geographical Area	9110.9
Forest	1354
Barren & Uncultivable land	5515
Other uncultivated land excluding fallow land	2208
Fallow land	4
Total cropped area	**32**

As the map aptly demonstrates most of the agricultural land, grasslands and forest occur and co-exist in the valleys only. The upper reaches are either covered by glaciers or are barren wastelands.

Agriculture

Agriculture in Lahaul & Spiti district is the predominant occupation. The traditional crops on the uneconomic holdings used to be barley and buck wheat and pulses like peas, oil seeds etc. These are the cash crops even today. However, with the opening of the vehicular roads etc, the people have shifted from cereal crops to commercial crops like seed potatoes, hops and kith etc. Lahaul sub-division produces seed potatoes which are known for its disease freeness and popular through out the country. In order to help the farmers with the latest technology and techniques of producing disease free seed potatoes, the Government has started seed farm at Gorma in Pattan valley to aid and advise the farmers. Before the coming of seed potatoes, kuth used to be the principal commercial crop in the valley for which research station was set up at Keylong in 1960 for doing research on scientific lines. There are another two experimental farms in Lara and Kyulling in Spiti sub-division for seed multiplication. The cash crops like seed potatoes, peas and herbs are mainly exported to Delhi, Amritsar and the states of Gujarat, Tamil Nadu, and West Bengal etc. Kuth being basically a medicinal plant is also exported to countries like France, Germany, England and Japan where the extract of its roots is used as an ingredient for producing quality perfumes. Hops are also exported and it is mainly used for manufacturing of beer. The valley located on the lower elevation of the region produce vegetables like cabbage, cauliflower and tomatoes which are marketed at Keylong, Kullu and Delhi. The people of the area shifted themselves from traditional occupation to that of growing of cash crops.

Tehsil/Sub-Tehsil wise area (sq.km.) under main crops

Name of crop	Tehsil wise Area Lahaul (T)	Udaipur (S.T)	Spiti (T)	Total area
Cereals				
1 Wheat	0.19	0.56	0.66	1.41
2 Maize	-	0.38	-	0.38
3 Barley	0.33	0.53	5.06	5.92
4 Kuth	0.10	1.50	-	1.60
'B' All Pulses	6.34	3.35	4.68	14.37
'C' Other Crops				
1 Potato	5.95	1.88	0.35	8.18
2 Peas	6.29	3.24	4.62	14.15
3 Edible oil seeds	-	0.01	0.17	0.18

Irrigation

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

The rain in the district is very scanty and occasional. The people therefore are constrained to depend upon perennial irrigation facilities which are derived from springs, nallahs and rivers through the local kuhls. Most of the cultivated area in the district is irrigated while in Lahaul it is almost 100%, in Spiti it is about 85 %.

Tehsil-Wise Irrigated Area Under Principal Crops*

District/Tehsil/ Sub-Tehsil	Source wise irrigated area (in sq.km.) Canal	Well	Other Sources (Kuhl/ spring Govt.& Private)	Total
Lahaul (T)	-	-	13.61	13.61
Udaipur (S.T)	-	-	7.63	7.63
Spiti (T)	-	-	11.4	11.4
Lahaul & Spiti District	-	-	32.64	32.64

Livestock

The people of Lahaul region are primarily dependent on agro-commercial activity while the Spitians are predominantly agro-pastoral with livestock population outnumbering the human population. The nature of the terrain of the district is very rugged and mountainous and the communication system is still not regular through out the year. These factors have necessitated the rearing of animals for transportation of goods, ploughing of fields, obtaining raw wool/hair for warm cloth weaving and mating and for milk and mutton purposes. According to livestock Census of 1992, there were 63,440 livestock in the district as compared to 69,564 in 1988. This shows a decrease of 6,124 livestock during the five years. The main livestock comprises sheep, goats, cows and pack animals. The number of sheep was 38,776, goats 11,180, cows 8,117, horses and ponies 1,140, mules 288, donkeys 1,926, yaks 1,997 and pigs 16. Apart from it, there are 4,361 poultry birds in the district. The declining trend of livestock is perhaps due to diversification of occupational structure in the district and attention of people is being attracted towards off-season vegetables which fetch good returns in the market.

Horticulture

The people of the district have also adopted apple cultivation on selected area particularly in the Pattan valley. The fruit crops introduced in the district are apple, pear, plums, almond, apricot, cherry, walnuts and hops.

Except apple and hops, all the fruit crops are not marketed due to limited cultivation and inadequate transportation facility. Unmarketable and surplus fruits are marketed to HPMC. There is one Govt. Fruit nursery farm established at Thirot in which apple, apricot and plum plants are prepared for sale every year.

Industries

Lahaul & Spiti district does not have any industry worth the name. This is partly because of, for setting up of industry, there is no raw material available locally, secondly, no local expertise exists and thirdly no local market exists for the produce. Logically there had been no industry in the district nor will be in the foreseeable future too. Only few household industries like carpet making, carding of wool

and weaving of woolen and pashmina shawls and other clothes are present. There are 17 registered industries (almost all of them being house hold) functioning in the district.



Bee Keeping & Sericulture

Due to typical geographical position and varied agroclimatic condition prevailing in the district and non availability of bee flora, the activities of bee keeping & sericulture are quite negligible. However, some of the pockets in lower areas, the farmers produce honey for their domestic use. The Horticulture Department has made tremendous achievement in development of hops production by establishing five hops processing centres.

Minerals & Mining

Large number of occurrences of minerals like copper, gypsum, sulphur, limestone and antimony are available in the district. Except antimony in Bara Shigri, no detailed work has been done for assessing the economic potential of these deposits. Most of the deposits being on the altitude of 12,000 ft. and above, the season for experiment and investigation is very limited and no headway has been made. The importance of these deposits lies in their strategic use and is being the only deposits of its kind in the country.

Roads &Transport



The Lahaul & Spiti Tehsil are connected by the National Highway 21 and 22 respectively whereas another road being constructed by the Border Roads Organization which is branch of National Highway 21, turns at Tandi towards west and leads to Pangi via Udaipur Tehsil.

Roads play vital role in the political, social and economic development of an area which exposes the area to outside world. The other important roads which join the three valleys of the district are Samdoh-Kaza, Kaza-Keylong through Kunzum pass and Keylong-Udaipur. Kaza remains open for vehicular traffic for nine months whereas Keylong is accessible for only five to six months in a year. The district is being served by 914 kms. of motorable roads length out of which 280 kms. are metalled and 634 kms. are Kutcha roads. Of the total 1,051 kms. motorable road length in the district, 260 kms. are double lanes, 681 kms. are single lane. 18 kms. are Jeepable and remaining 92 kms. are less than Jeepable road. The Government is now also planning to keep this track open for whole of the year by constructing a tunnel between Solang and Sissu which will reduce the distance between Manali and Keylong by 60 kilometres on the

one hand and keep the vehicular traffic open for whole of the year.

Length of Roads and Motorable Roads

Year	Pucca roads	Kutcha roads	Total length	Double lane	Single lane	Jeepable roads	Less than Jeepable roads	Total length
1999-2000	280	634	914	260	681	18	92	1,051

The transport facility for connecting the district with the outside world is available for five months in Keylong region and for nine months in Spiti region of the district. Within these two regions, local buses ply in the fair weather during the winter season.

Electricity & Power

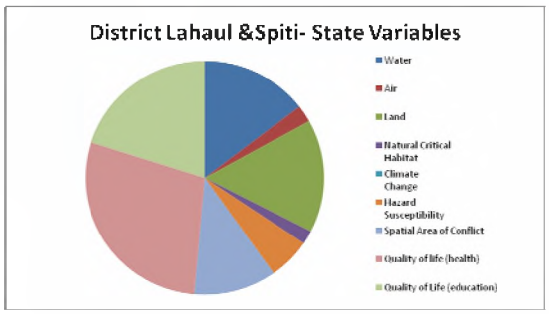
All inhabited revenue villages numbering 272 in the district were electrified before 1998 achieving the 100% electrification. Two microhydel generating power stations were catering to the needs of people till 1980. Both these projects were located in the Lahaul valley. The first project was commissioned in 1963 at Billing having three generators. Two of 50 KW capacities each and one of 100 KW capacities and located at Shansha. Another project at Sissu with 100 KW capacities was commissioned in 1976 which also serves the needs of Lahaul valley. Due to this, all the villages of this valley have been electrified. A diesel generating power station was installed at Kaza which could cover Kaza area only. Now the valley has been provided with Rongtong Hydro Electric Power Project which was commissioned in 1986 and is located on Rongtong Nallah, a tributary of Spiti River. It has capacity of 2,000 KW which can easily meet all the needs of Spiti valley. Another project on Thirot Nallah in Udaipur Tehsil, which is a tributary of the Chandra Bhaga River with a capacity of 4.5 MW, was commissioned in mid nineties which meet the needs of Udaipur area of the district. In this way, all the valleys of the district has been equipped with power projects to meet the respective requirements. Where the hydro electric power is not possible to be generated or is very costly, the non conventional sources like solar panel system have been tried so that the target of 100 % electrification could be achieved. In addition to these projects, a sub station at Karga with an installed capacity of 1 MVA has also been commissioned in 1990. The 33 KV transmission line between Manali to Karga is perhaps the highest transmission line in the world which passes through the Rohtang pass at an altitude of 3,915 metres. One 166.25 KVA generator has also been installed to cater the needs at the time of break down.

Summary of State Variables at District Level

Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Lahaul and Spiti. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($V_{\text{State Sector}}$) as a total for that particular system.

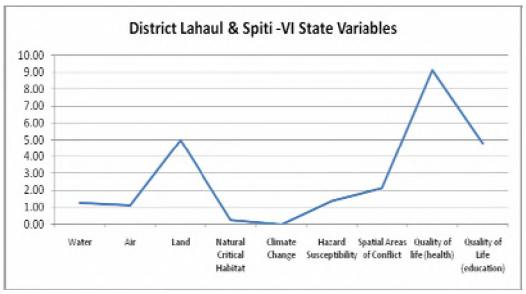
Lahaul & Spiti	
Variable Sector	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	2386.78
Air	386.38
Land	2567.20

Lahaul & Spiti	
Variable Sector	Vulnerability of State Sector $V_{State\ Sector}$
Natural Critical Habitat	304.00
Climate Change	0.00
Hazard Susceptibility	943.01
Spatial Area of Conflict	1837.92
Quality of life (health)	4675.37
Quality of Life (education)	3288.96



The analysis of data indicates gaps in infrastructure and services in health and education sector. Further, analysis indicates pressure on Land and water resources. Spatial Areas of Conflict are also evident.

Gaps in infrastructure and services in health have crossed the critical stage, while gaps in education infrastructure & pressure on land are on the verge of crossing it. A programme for improving infrastructure and services in health and education sector can be considered on priority to reduce vulnerability.

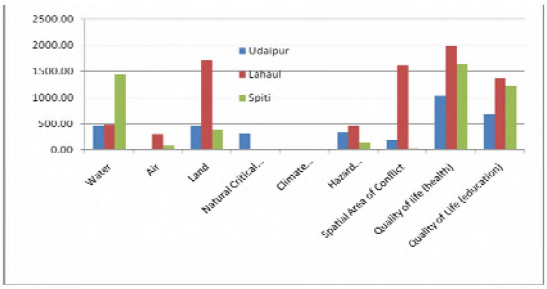


State Variables at Tehsil Level

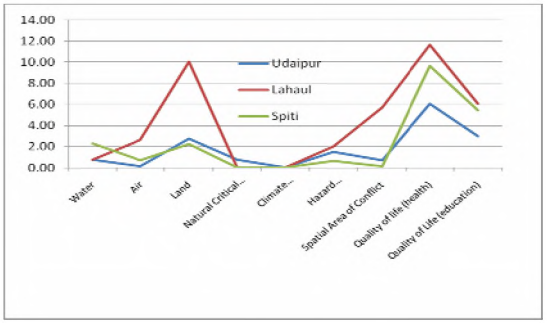
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

State Variables	Udaipur	Lahaul	Spiti
Water	457.38	482.7	1446.7
Air	10.2	300	76.18
Land	465.48	1717.4	384.32
Natural Critical Habitat	304.0	0.00	0.00
Climate Change	0.00	0.00	0.00
Hazard Susceptibility	338.97	461.50	142.54
Spatial Area of Conflict	192.87	1620	25.05
Quality of life (health)	1035.29	1992.64	1647.43
Quality of Life (education)	681.32	1377.88	1229.76



State Variables vulnerability at Tehsil level in District Lahaul & Spiti



The analysis of data indicates gaps in infrastructure and services in health sector all the three Tehsils. Gaps in infrastructure in Education sector is evident in Lahaul and Spiti. Since Udaipur has very little population, it does not have major gaps infrastructure in Education sector. However, it has the second highest score. Spatial Areas of conflict is evident in Lahaul due to the presence of many Hydel projects. Land is under pressure in Lahaul due to administrative presence at the District Headquarters and land use changes.

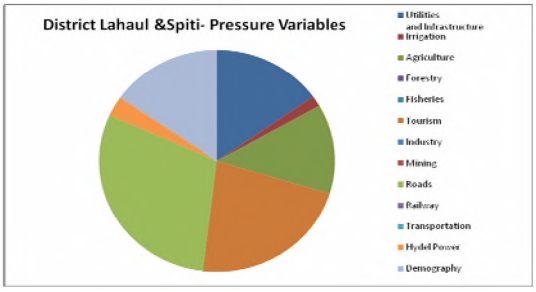
Summary of Pressure Variables at District Level

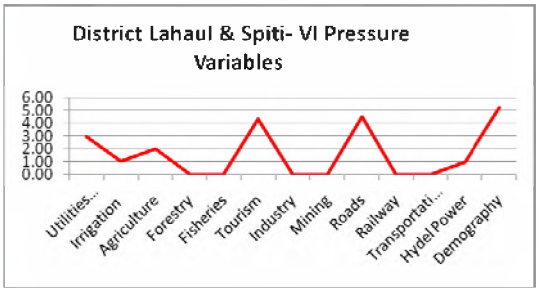
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Lahaul & Spiti. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Lahaul & Spiti Variable Sector	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities & Infrastructure	2655.80
Irrigation	266.40
Agriculture	2277.21
Forestry	0.00
Fisheries	0.00
Tourism	3873.10
Industry	0.00
Mining	0.00
Roads	5224.34
Railway	0.00
Transportation	0.00
Hydel Power	508.70
Demography	2684.06

The analysis of data indicates development of Road network which has opened up new areas. Tourism and Demographic growth has created pressure on Utilities & Infrastructure. This also accounts for the pressure on Land.

Further, analysis indicates that Demographic pressure is reaching a critical level and Tourism pressure is also reaching a high level of vulnerability. Hydel sector pressure is evident, which can be addressed by a water utilization plan.





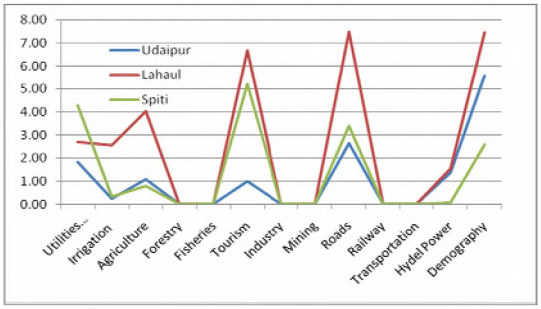
Pressure Variables at Tehsil Level

Similarly, the pressure variables computed at Tehsil level for comparison is given below.

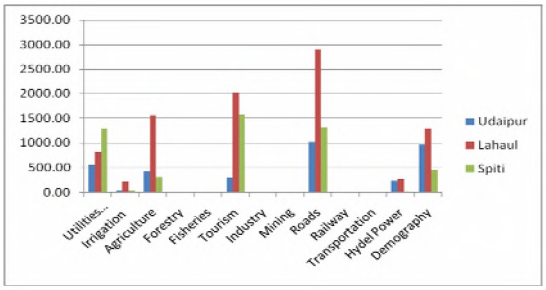
Comparison of Pressure variables at Tehsil level:

Pressure Variables	Udaipur	Lahaul	Spiti	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities and Infrastructure	551.63	814.50	1289.66	2655.79
Irrigation	19.65	220	26.75	266.4
Agriculture	416.92	1557.4	302.90	2277.22
Forestry	0.00	0.00	0.00	0
Fisheries	0.00	0.00	0.00	0
Tourism	296.2	2010.50	1566.4	3873.1

Industry	0.00	0.00	0.00	0
Mining	0.00	0.00	0.00	0
Roads	1011.11	2901.2	1312.03	5224.34
Railway	0.00	0.00	0.00	0
Transportation	0.00	0.00	0.00	0
Hydel Power	231.70	265.0	12.00	508.7
Demography	958.30	1283.52	442.24	2684.06



Pressure Variables vulnerability at Tehsil level in District Lahaul & Spiti



The analysis of data indicates development of Road sector across the District opening up newer areas. Pressure of Tourism in the Lahaul & Spiti Tehsils is on the increasing in these two Tehsils. Agriculture and Demographic pressure is evident in the Lahaul Tehsil. Further, analysis indicates that land is being diverted for Agriculture use which is substantiated by higher rating of Land resource. Gaps in Utilities and Infrastructure sector is evident in Spti which need to be plugged.

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Lahaul & Spiti. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

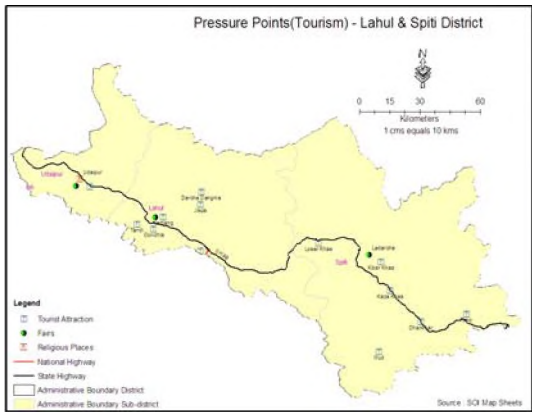
Vulnerability Index

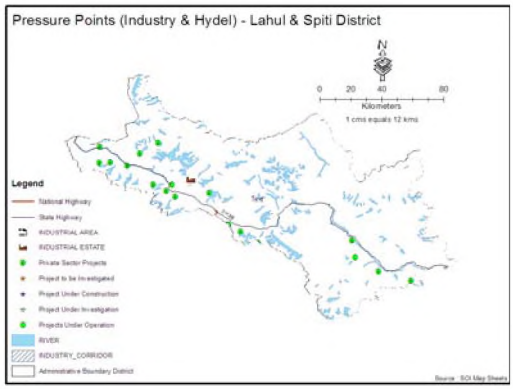
	Udaipur	Lahaul	Spiti
$\sum V_{\text{State and Pressure}}$	3485.51	7952.12	4951.58
denominator = 57x43		**2451**	
Normalized VI	**1.42**	**3.24**	**2.02**

The analysis of data indicates that Udaipur Tehsil is in the very low vulnerability segment while Spiti Tehsil is in the low vulnerability segment. Lahaul, the Tehsil housing the District Headquarters, is in the moderately low Vulnerability segment. The variation in the Vulnerability Index of these Tehsils follows.



Pressure Points

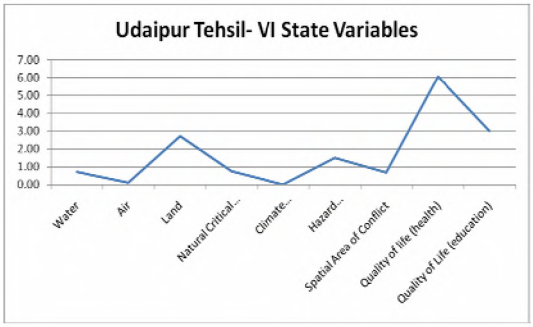




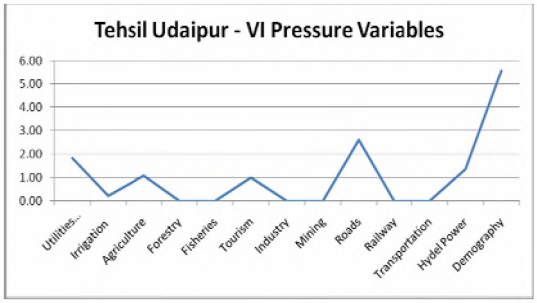
Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Tehsil Udaipur: Overall Vulnerability Index= 1.42

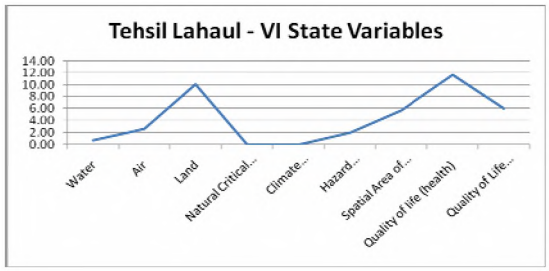


The analysis of data indicates gaps in infrastructure and services in Health sector. No other State variable in the Tehsil is of priority concern. A programme for improving infrastructure and services in Health sector can reduce the vulnerability.

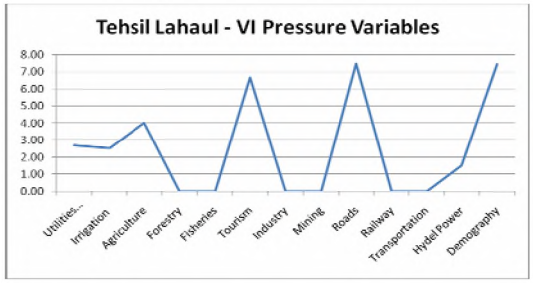


The analysis of data indicates demographic pressure. No other Pressure variable is of priority concern as regards vulnerability.

Tehsil Lahaul: Overall Vulnerability Index= 3.24



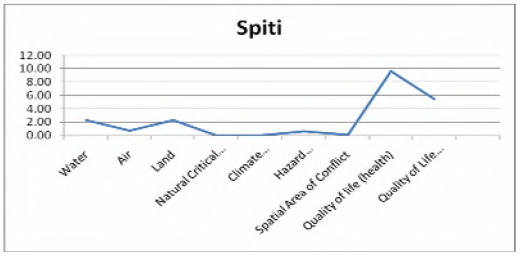
The analysis of data indicates gaps in infrastructure and services in Health sector. The gaps have reached very critical stage. Gaps in infrastructure in Education sector have also touched criticality. Programmes for improving infrastructure and services in Health & Education sectors can reduce the vulnerability. Land resources are critical vulnerable. A Development Plan/ Land use plan can be prepared to reduce vulnerability.



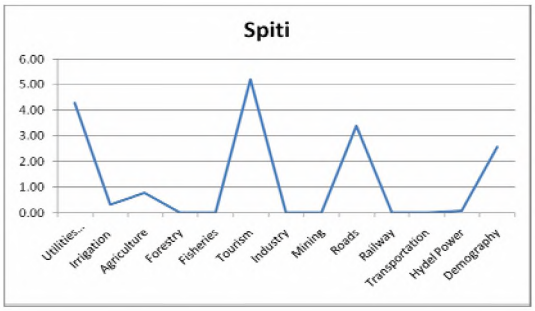
The analysis of data indicates Demographic pressure and development of Road network. Pressure from Tourism has crossed the

critical stage. A District level Tourism Plan in accordance with Tourism Master Plan can be prepared. Development Plan/Land Use Plan in accordance with State Agriculture Plan /District Agriculture Plan can reduce the vulnerability of Agriculture sector.

Tehsil Spiti: Overall Vulnerability Index= 2.02



The analysis of data indicates gaps in infrastructure and services in Health sector. The gaps have reached very critical stage. Gaps in infrastructure in Education sector have also touched criticality. No other State variable in the Tehsil is of priority concern. Programmes for improving infrastructure and services in Health & Education sectors can reduce the vulnerability.



The analysis of data indicates Tourism pressure and gaps in Utilities & Infrastructure sectors. A Detailed Plan for Tourism in line with Tourism Master Plan can be made. Further, Projects can be prepared to fill the gaps in Utilities & Infrastructure sector.

On an overall basis, programmes and projects for addressing gaps in infrastructure and services in terms of health, education, utilities and infrastructure can reduce Vulnerability and Vulnerability Index. Similarly, conflict resolutions at the Spatial Areas of Conflict can reduce vulnerability.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in considerat of the intervention prioritization.

Lahaul & Spiti

S.No.	Tehsil	VI	Adjoining Tehsil in L&S District	VI	Adjoining Tehsil in Other District	District	VI
1	Udaipur	1.42	Lahaul	3.24	Chaurah	Chamba	1.75
					Pangi	Chamba	1.46
					Bharmaur	Chamba	1.96
2	Lahaul	3.24	Spiti	2.02	Multhan	Kangra	0.66
			Udaipur	1.42	Manali	Kullu	3.08
					Kullu	Kullu	2.60
					Bharmaur	Chamba	1.96
3	Spiti	2.02	Lahaul	3.24	Nichar	Kinnaur	1.89
					Morang	Kinnaur	1.17
					Poo	Kinnaur	0.78
					Hangrang	Kinnaur	0.69
					Kullu	Kullu	2.60

Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Lahaul and Spiti is surrounded by various Tehsils of District Chamba, Kangra, Kullu and Kinnaur, the vulnerability levels of all surrounding areas are lower than that of what is prevailing in various Tehsil/ Sub tehsils of District Lahaul and Spiti except for Udaipur Tehsils. Udaipur Tehsil's neighbouring Tehsils namely Chaurah, Pangi and Bharmaur in Chamba District has higher VI values. The transitional impact of vulnerability possibly will give rise to vulnerability levels when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameters

(i) As is observed from the analysis of the data available, the quality of life parameters in terms of health and education need to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 kilometres, Community Health Centre within a distance of 6 kilometres and a Hospital within a distance of 10 kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

<u>Priority Tehsils(in descending order)-.Lahaul, Spiti, Udaipur</u>

Similarly, the quality of life parameters for education include accessibility to a Primary School within a distance of 2 kilometers, a Secondary School within a distance of 6 kilometers, a College within a distance of 10 kilometers, and a Vocational Institution within a distance of 25 kilometers.

Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Lahaul, Spiti, Udaipur

The benchmarking of the norms has been done with a view of the profile, terrain of the State.

A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(ii) Prioritization and Rationalization of distribution of water resources for various sectors can be undertaken as a number of hydel power projects are underway.

The district has a number of lakes. As the tourism is increasing rapidly, these may come under threat in future. Detailed Conservation and Management Plans for the lakes are very important so that sustainability is achieved and the resources are conserved.

(iii) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats *i.e.* Reserve forests, Wildlife sanctuaries etc can be done through a series of plans culminating into projects.

Further, the groundwater may be recharged through the creation of small check dams on the non perennial *khuds*, which could also improve the irrigation scenario.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) Tourism as a parameter is the third highest scorer in the district pressure parameters. However, tourism is one of the mainstays of economy in the State and thus has to develop further. The growth in the sector is welcome, as it boosts the economy, but the rate at which it is growing demands a definite and specific plan for the district in terms of growth of tourism. For a sustainable coexistence of Tourism and Environment, a broad State Level Plan and Detailed District Level Plans for Tourism can be prepared along with Destination Plans as per the Tourism Master Plan.

Priority Tehsils: Spiti, Lahaul and Udaipur

(iii) Utilities and Infrastructure form the second highest pressure in the district. The Pressure exists because there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

Priority Tehsils: Spiti, Lahaul and Udaipur

(iv) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization

plan is required to be prepared through scientific studies.

(v) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix:

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Water		*	*		Lake Conservation Plans, Ground Water recharge programme Water Utilization Plan
2	Natural Critical Habitat		*			Plans for Buffer zones
3	Quality of life (Health)			*		Programme to improve access
4	Quality of life (Education)			*		Programme to improve access
Pressure						
1	Roads	*				Policy to take care of State variables*
2	Tourism		*			Tourism Plan at State, District, and Destination Level
3	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
4	Hydel Power	*				Policy regarding Catchment Area Treatment, Ecological Flow etc

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

Tehsil	Udaipur	Lahaul	Spiti
VI	3485.51	7952.12	4951.58
Denominator = 57x43		2451	
Normalized VI	1.42	3.24	2.02

Population Projections

Tehsil	Pop 2001	Projected Pop 2011	Projected Pop 2021	Projected Pop 2031	Projected Pop 2041
Udaipur	9446	10,394	11,528	12,836	14,302
Lahaul	13099	12,877	12,664	12,461	12,267
Spiti	10679	11,110	11,799	12,721	13,841

Calculation of per capita share of VI

Tehsil	Pop 2001	VI 2001	Per Capita Share
Udaipur	9446	1.42	0.00015
Lahaul	13099	3.24	0.000247
Spiti	10679	2.02	0.000189

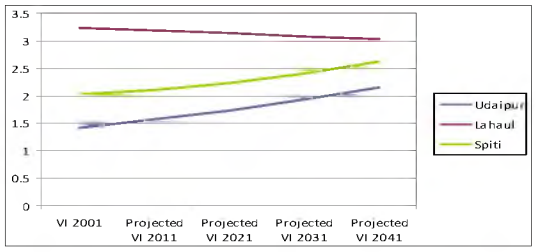
Calculation of Projected VI

Tehsil	Pop 2001	VI 2001	per capita share	Proj Pop 2011	Proj. VI 2011	Proj Pop 2021	Proj VI 2021	Proj Pop 2031	Proj VI 2031	Proj Pop 2041	Proj VI 2041
Udaipur	9446	1.42	0.00015	10,394	1.56	11,528	1.73	12,836	1.93	14,302	2.15
Lahaul	13099	3.24	0.000247	12,877	3.19	12,664	3.13	12,461	3.08	12,267	3.03
Spiti	10679	2.02	0.000189	11,110	2.10	11,799	2.23	12,721	2.41	13,841	2.62

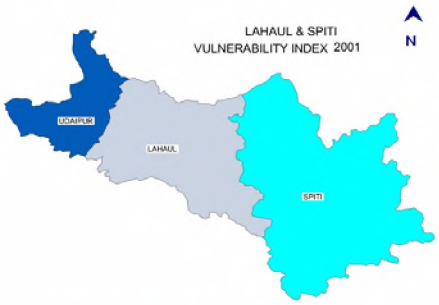
Projected Vulnerability Index

Tehsil	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Udaipur	1.42	1.56	1.73	1.93	2.15
Lahaul	3.24	3.19	3.13	3.08	3.03
Spiti	2.02	2.10	2.23	2.41	2.62

Projected VI- Mapping the future scenarios



2001

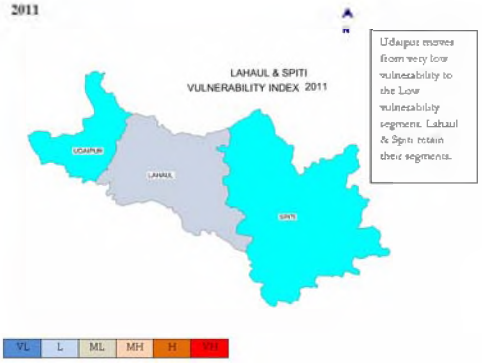


Range

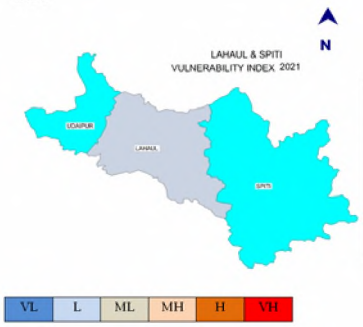
Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	



2011



2021



All three Tehsils remain in their segments of Udaipur & Spiti in low vulnerability and Lahaul in moderately low vulnerability.

2031



All three Tehsils remain in their segments of Udaipur & Spiti in low vulnerability and Lahaul in moderately low vulnerability.



2041

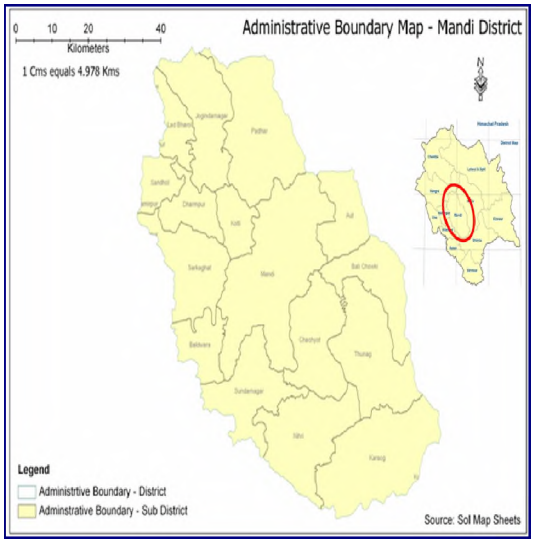


Udaipur and Lahaul retain their segments of low and moderately low vulnerability while Spiti moves to moderately low vulnerability segment from the low vulnerability segment.

MANDI

General Background

Mandi district is situated in the central portion of Central Himachal Pradesh. It lies between 31°13' 30" and 32°04' 22" north latitudes and 76°36' 08" and 71°23' 26" east longitudes and is bounded by Kangra district in the north and North West, Hamirpur and Bilaspur districts in the west, by Solan and Shimla districts in the south and by Kullu district in the east. The district has an area of 3,950 sq. kms. out of the total area of 55,673 km^2 of Himachal Pradesh according to the Surveyor General of India. It occupies seventh rank among the districts in terms of area which constitutes 7.10% area of the State.



Mandi district is divided into 16 administrative units as Tehsil / Sub-Tehsil their area in descending order is as follows:

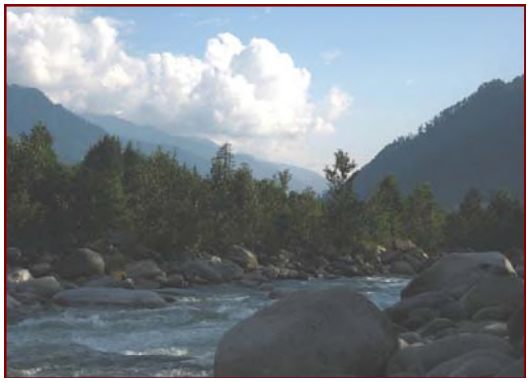
Sr. No.	Tehsil/Sub-Tehsil	Area (sq.km)
1	Mandi	583.8
2	Karsog	531.6
3	Padhar	413.8
4	Nihri	341.4
5	Thunag	324.7
6	Jogindernagar	260.1
7	Chachyot	247
8	Sundernagar	233.5
9	Sarkaghat	215.2
10	Balichowki	202.7
11	Aut	154.3
12	Dharampur	119.1
13	Lad Bharol	93.2
14	Baldwara	92.4
15	Kotli	91.0
16	Sandhol	65.4

Physiography

The configuration of the district is mountainous interspersed with many flat and undulating valleys formed by *Beas* river and its tributaries. Balh valley in Mandi Sadar and Sundernagar tehsils and Chauntra valley in Jogindernagar Tehsil are very wide and long which are granary of the district. The district is criss-crossed by many hill ranges or *dhar*, prominent of them are *Dhauladhar*, *Ghogardhar*, *Sikandar dhar* and *Vairkot dhar* which generally run in the district from north-west to south-easterly direction. The altitude of the district varies between 503 metres and 4,034 metres above the mean sea level.

On the basis of physiography, climate, soils, natural vegetation and geology the district is divided into four sub-micro regions as follows:

Dhauladhar



This region covers 245 villages of district. *Dhauladhar* extends over north and north-eastern Mandi and runs in continuation to *Dhauladhar* of Kangra district in north-west to south-east direction passing through

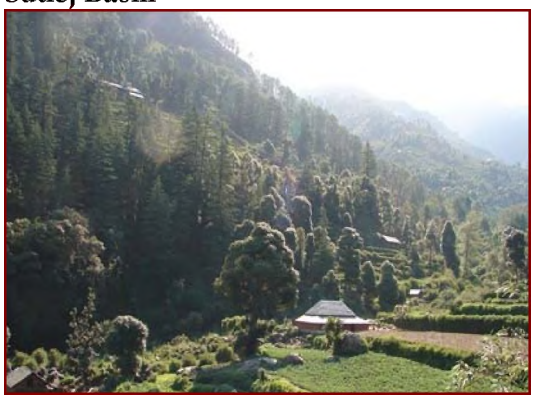
north eastern part of Jogindernagar Tehsil, maximum parts of Padhar Tehsil except south eastern corner, north-eastern margin of Mandi Tehsil and north-western portion of Aut sub-Tehsil. The region is very rugged and mountainous with many snow covered peaks of above 4,000 metres high. *Uhl* is the main river of this region with its tributaries like *Jhakwan*, *Panchwad*, *Bubbu Nal*, *Sang Nal*, *Baroh Nal* and *Batheri khad* from left side.

Beas Basin



This region covers 1478 villages of district. This is the biggest sub micro region of the district in terms of area and population. It stretches in a north-west to south-east direction in the central part of district. It covers south-western corner of Padhar Tehsil, north-western, western and southern parts of Jogindernagar Tehsil, whole of Ladbharol, Sandhol, Balichowki sub-tehsils and Chachyot Tehsil, maximum part of Dharampur, Kotli and Aut sub-tehsils and Mandi Tehsil, northern part of Sundernagar Tehsil, three villages of Nihri sub-Tehsil and almost whole of Thunag Tehsil except southern portion. It is bounded by Kullu district in the east, *Dhauladhar* in the north and north-east, Kangra and Hamirpur districts in north-west, Mandi lesser Himalaya in west and *Satluj* Basin in the south. This basin is hilly with many *dhars* like *Sikandardhar*, *Margholi dhar*, *Bhaburi dhar*, *Rajotu dhar*, *Chharyand dhar* and *Shikari Devi dhar* etc. except valleys of Balh and Chauntra. *Beas* river is the principal river of this region.

Sutlej Basin



This region covers 1000 villages of district. This extends over the southern part of the district covering Sundernagar Tehsil except northern portion, southern Thunag Tehsil, whole of Karsog Tehsil and Nihri sub-Tehsil except a small northern pocket. It is bounded by *Beas* basin and Mandi Lesser Himalaya in the north, by Bilaspur district in the west and Kullu district in the east. The terrain is rugged and hilly with many *dhars* with elevation varying between 2,160 metres to 3,124 metres. *Sutlej* river is the life line of the basin which forms southern boundary of the district and separates it from Shimla and Solan districts.

Mandi Lesser Himalaya

This region covers 615 villages of district. This spreads over the western part of Mandi district occupying whole of Baldwara sub-Tehsil and Sarkaghat Tehsil, southern part of Dharampur sub-Tehsil, south western part of Kotli sub-Tehsil, western part of Mandi Tehsil and small central track of Sundernagar Tehsil. It makes its boundary with *Beas* basin in north and east, *Sutlej* basin in south and Bilaspur and Hamirpur districts in the west. The terrain of this region is rugged and hilly with altitude ranging between 682 metres to 2,051 metres above the mean sea level. The important rivulets of the region are *Baker*, *Sir*, *Son* and *Ratti Khads*.

Culture and Social Brief

Fairs & Festivals

The people of the district celebrate various festivals almost round the year. As Hindus constitute the major population of the district, all the Hindu festivals like Dussehra, Diwali, Holi, Baishakhi and Shivratri etc are celebrated with great pomp and show. Some of the important fairs and festivals being celebrated in the district are as follows:

Shivratri fair of Mandi: Shivratri fair of Mandi is one of the most colourful State fairs of Himachal Pradesh. This fair is held in the month of Phalguna (February/March) on the Krishna Chaturdashi or the 14th day of waning moon and continues for eight to ten days.

Mamail fair: The temple of Mamleshwar at Mamail is at a distance of 2 kms. from Karsog. Vijay Dashmi fair is held there every year on the 11th day of the bright half of the lunar month in Asavina (October).

Mahunag Fair: Bakhari is a small hamlet in Mahu Panchyat circle about 13 kms. from Churag on Shimla-Karsog road where the temple of Mahunag is situated at a height of about 2,000 metres. A fair is held on a rectangular piece of land surrounded by tall pine trees, about 2 kms. away from the temple, known as *Bagra Dhar* on the 2nd and 3rd Jaistah (May) every year.

Rawalsar Fair: Rawalsar fair has a great religious importance and is celebrated on the 10th day of every new year according to the Tibetan calendar. Tibetan year starts sometimes in February/March. Rawalsar fair is also known as Tsechu fair. Buddhists from various parts of the country come to this place to celebrate the birthday of Guru Padma Sambhav. The festival of Tsechu takes place twice a year known as Chhota Tsechu and Bara Tsechu. The former takes place on Shukla Dashmi of pausa month of the Bikrami era (December/January) whereas the later on the Shukla Dashmi of the month of Phalguna (February/March).

Places of historical, archaeological and religious importance and tourist interest

Some of the important places of interest in the District are as follows:

Mandi Town



This historic town was the capital of the former princely state of Mandi and now it is the district headquarters of Mandi district. Along the banks of river *Beas*, the town is situated in a somewhat plain valley surrounded by hill ranges at an altitude of about 800 metres. It is considered as the gateway of Kullu and Manali. Mandi town has long been an important commercial centre. It is connected with Shimla, Kullu, Pathankot and Chandigarh and all the tehsils/sub-tehsils of the district by road. Mandi is known for its old stone temples depicting a range of fine carvings. Bhutnath temple is practically synonymous with Mandi. In March, the festival of Shivratri is a major event and the Bhutnath temple is its focus. The Tarna Devi temple, which is also known as Shamkali temple, is located on Tarna hill.

Rawalsar



Rawalsar is located at a distance of 24 km. in south-west from Mandi. This place is sacred for Hindus, Buddhist and Sikhs. It is located on a mountain spur at an altitude of about 1,300 metres. It has a dark jewel-like lake, green woodland and high hills. There are islands of floating reed in *Rawalsar* Lake. The Chheshu fair held in February / March and the festival of Baisakhi is important event of Rawalsar. At opposite ends of *Rawalsar* Lake there are two Tibetan monasteries. The Sikhs also have a Gurudwara at Rawalsar. There are three Hindu temples also. *Kunti* Lake located at a distance of about 5 kms. from Rawalsar on Mandi-Dharampur road.



Kamlah Fort

It is situated in Sarkaghat sub-division at a distance of about 35 kms. from Sarkaghat on the border with Hamirpur.

Sundernagar

It is located at a distance of 25 kms. from Mandi on Chandigarh-Mandi National Highway No.21. The balancing reservoir of *Beas-Sutlej* link canal is located in this town. There is a famous temple of Goddess Mahamaya a top a hill. There is also a famous temple of Mahadev located at a distance of 3 kms from the town in a village known as Mahadev.



Jogindernagar

This town is situated at a distance of 56 kms. from Mandi at an altitude of 1,220 metres on Pathankot-Kullu road. Besides this, another place Gumma is situated about 11 kms away towards Mandi from Jogindernagar which is known for its salt quarries. Balakrupi is a famous religious place and Karamgarh and Ahju Garh are places of historical importance near Chauntra. Chauntra village nestled in charming surroundings with chil pine forests and snow-clad mountains at a distance of about 9 kms from Jogindernagar, is known for the manufacturing of black and green tea.

Tattapani

Tattapani is a famous place for hot water springs. It is situated in Karsog sub-division on the right bank of *Sutlej* river, 50 kms away from Karsog on Karsog-Shimla road and 56 kms. away from the state capital Shimla. The

hot water spring of this place is being used for curing gout and rheumatic pains.

Pangana

The village is situated in Karsog sub-division at a distance of 25 kms from Karsog. The fort and palace present varied interest for the visitors from the archaeological point of view.

Janjehli

It is situated in Thunag Tehsil and this place is one of the most picturesque of the Mandi district. The high mountains and lush deodar trees with dense forests accompanied with sparkling water of *Bakhli* river add to the charming beauty of this area. Apart from trekking and resort, Shikari Devi is also a religious place and a seat of Goddess Durga.

Kamru Nag Temple

There is a beautiful lake laid amidst the hills and deodar trees. A wooden temple of Kamru Nag is built on the bank of the lake.

Barot

It is situated at a distance of 75 kms. from Mandi town at a height of about 1,900 metres above mean sea level. It is a beautiful hill resort and can be approached from Jogindernagar either by covering a distance of 18 kms. on foot or in a haulage way trolley or by road via Jhattingri. The beautiful man made lake which feeds the Shanan power house and trout fish hatchery are worth seeing.

Chauntra

It is a picturesque village about 9 kms. from Jogindernagar and sprawls over gentle and fertile hills. The surroundings are charming with snow clad mountains and chil pine forests. The village is famous for the black and green tea.

Aut

It is situated on the Mandi-Kullu road about 32 kms from Mandi town. It is a small, but, lovely place on the right bank of the *Beas*.

Parashar

It is about 32 kms. north-west of Mandi town. It has a lake with a pagoda shaped wooden temple on its edge. This lake contains floating islands. A large fair is also held here in the month of June. Wool and blankets are largely sold.



Assessment of District Vulnerability

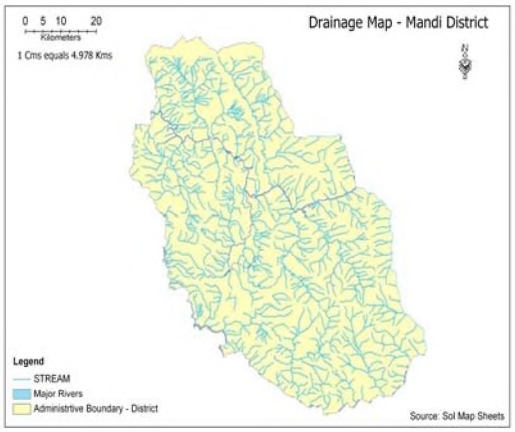
As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability vis-à-vis utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables:

The status of natural systems such as river system, climate, forests, quality of life

(education and health) relevant in context of Mandi district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System



Beas and *Sutlej* are the main rivers which pass through the district with several small rivulets / streams as their tributaries. The *Beas* enters the district from eastern side near Largi village where the *Sainj* and *Tirthan* streams join it and flows east to north-west direction. It leaves the district in the west near Sandhol and enters into Kangra district. *Uhl, Rana Khad, Luni Khad and Binno Khad* join it from north and other rivers/*khads* which join it from south are *Bakar, Masant, Jhangi, Chaned, Sakrain, Soan, Arnodi, Kasani, Junisuketi, Bakhli, Tirthan* and *Hansa.* The *Satluj* river which forms its southern boundary and separates it from Solan and Shimla districts is another major river in the district. It enters the district near Firnu village in the Chawasigarh area and flows towards southwesterly direction. It leaves the district near Dehar and enters into Bilaspur district. *Behna, Ropri, Bagri, Chanod* and *Alsed* etc. are important streams/*khads*, which fall into *Satluj* from northern side. *Rawalsar, Parashar* and *Kamrunag* are the important natural lakes in the district.

Climate

In upper areas, the climate remains cold throughout the year. The areas of Padhar, Chohar, Seraj and Sonar usually experience snowfall during winter. The winter starts from the middle of November and continues till the middle of March. In summer Balh valley and other low areas are quite hot. The *Satluj* basin experiences excessive hot months near the south-east border. Tatapani and Dehar are the hottest places in the district. Thereafter, the rises till the onset of monsoons which starts from the last week of June or first week of July and continues till the middle of September. During October and November, the nights are pleasant and days are a bit hot. The sub-temperate climatic conditions prevail in *Dhauladhar* micro sub-region, as it is a mountainous track. Higher reaches of the region receive sufficient snowfall every year during winter and remain cut off from the other parts of the district. The lower areas are comparatively hot. The climatic conditions of the higher reaches of *Beas* basin are temperate. Lower areas are comparatively hot during the summer.

Precipitation/Rainfall

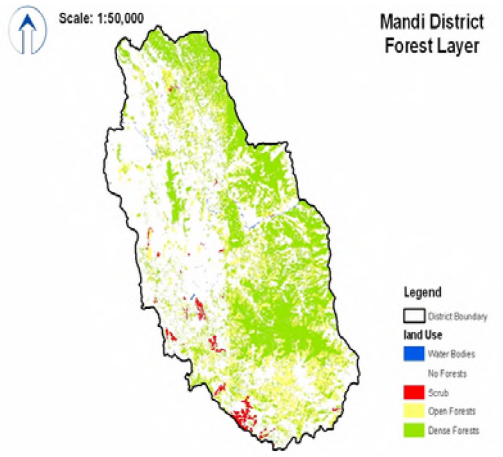
Month of July and August receive heaviest rainfall in this region. In winter these areas receive snowfall almost every year where the weather remains cool throughout the year. In winter, upper areas of Nihri, Thunag and Karsog receive snowfall every year. Rainfall is mostly received during the monsoon months. The district receives an ample and uniformly distributed rainfall. Mandi district receives an annual average rainfall of 1,445 mm. During the winter and early part of the spring, the district is affected by a series of westerly disturbances which cause snowfall, sometimes heavy at the higher elevations and rain in lower elevations. Fog occurs in the valley in winter.

Particulars	Maximum	Minimum
Rainfall	2,243.3 mm	1,118.9 mm
Temperature	40° C	0.5° C

Forest

Forests are scattered throughout the district on the higher slopes. The important forests are those lying in the *Sutlej* valley. Deodar forests are generally found at an altitude varying from 5,000 to 9,000 feet. The species is at its best in the Damoon forest at an altitude of about 7,000 feet. Chill forests are found at an altitude between 950 metres to 2,750 metres.

In the lower areas, bamboos and other bush type forests are found in the entire district. Deodar, Chill, Kail, Silver Fir etc. are important species available in the district. The other prominent trees of the region are Simbal, Tuni, Mulberry, Willow, Poplar, Oak, Walnut and Bamboo etc.



Area under Forest (sq. km)

District and Forest Division	Forest under the control of Forest Department					Not in the control of forest deptt.	Total
	Protected Forest	Demarcated Reserve Forest	Undemar-cated Reserve Forest	Unclassified Forest	Other Forest		
Mandi	-	1457.64	37.73	27,064.00	-	-	176,601.00
Jogindernagar	-	188.02.	10.39	25.60	-	-	19,867.29
Mandi	-	321.21	975.92	-	-	-	33,097.79
Suket	-	274.46	428.00	13,885.00	-	-	41,759.26
Nachan	-	342.54	427.00	3,789.00	-	-	38,470.69
Karsog	-	331.39	902.32	9,304.40	-	-	43,405.74

Quality of Life Health

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population.

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector. Of the total 2833 inhabited villages 2788 are deprived of Primary Heath Centres. Of these, 564 villages have this at less than 5 kms. 1173 villages enjoy the facility at 5-10 kms. while inhabitants of 1051 villages have to cover distance of more than 10 kms. to avail the facility.

In fact, to summarize, according to 2001 Census, 70.54% villages doesn't have access primary health centre within 3 kms. 65.53%

villages don't have access to community health centre within 6 kms. and 79.73% villages don't have hospital facility within 10 kms.

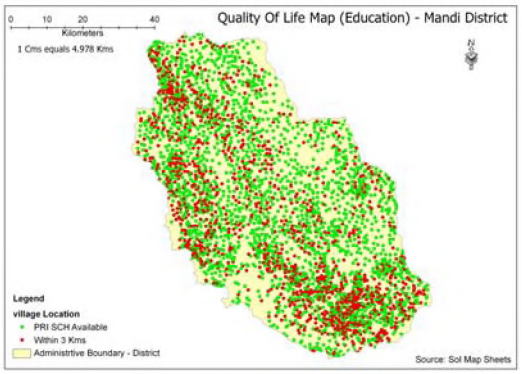


Quality of Life Education

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. A number of villages do not have educational facilities within the village at district level. They have to go out of their village to avail these facilities. Of the total 2833 inhabited villages 1212 villages are devoid of Primary school. Inhabitants of 1103 villages have this facility at less than 5 kms. while those of 109 villages have to travel a distance of 5-10 kms. In case of middle school 2335 villages are deprived of this facility. Of which 1583 have this at less than 5 kms. 712 villages avail this facility at 5-10 kms. while inhabitants of 40 villages avail this facility at 10 kms. or more. With regard to degree college 2830 villages doesn't have this facility. To avail this facility inhabitants of 106 villages have to travel distance of less than 5 kms. 711 have this at 5-10 kms while those of 2013 villages have to travel distance of 10 kms or more.

To summarize, according to Census of India 2001, on an average across the district, 17.81% villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 15.62% villages doesn't have secondary school within a distance of 6 kms. 14.96% villages don't have colleges within a distance of 15 kms. and 96.7% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.



Description of Pressure Theme Variables:

Pressure variable which are relevant in context of District Kangra such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Kangra district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Mandi district is 901,344 persons comprising 447,872 males and 453,472 females (the Census of India, 2011 gives a provisional population figure of 999518 with a density of 253 per sq. km. Data at tehsil level is not available). This population of the district forms 14.83% the State population and ranks at 2nd place

among the districts. Out of the total population of the district 93.2% lives in rural areas while 6.8% in urban areas. Rural population of the district is distributed among 16 Tehsil/sub-Tehsil and urban population is spread over in 5 towns. The total urban population in this district is 60,982 persons comprising 32,196 males and 28,786 females. The total rural population in the district comes to 840,362 persons and is comprised of 415,676 males and 424,686 females as per 2001 Census. The rural population is distributed in 2,833 inhabited villages out of total 3,338 villages in the district. Of the total villages, 505 villages are uninhabited.

Population Growth

According to the 1991 Census the total population of the district was 776,372 which rose to 901,344 in 2001 Census. There has been a net addition of 124,972 during 1991-2001. The decadal growth of the district comes to 16.1%. The growth rates for the rural and urban areas of the district are 16.1% and 16.7% respectively. The growth rate of urban population is slow in the district due to the lack of industrial development.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001

S.No	Tehsil/ Sub-Tehsil	Population						Percentage decadal variation 1991-2001			% urban population	
		1991			2001							
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Padhar	37,241	37,241	-	44,144	44,144	-	18.5	18.5	-	-	-
2	Jogindernagar	65,939	61,126	4,513	75,675	70,627	5,048	15.3	15.5	11.9	6.9	6.7
3	Ladbharol	23,165	23,165	-	25,404	25,404	-	9.7	9.7	-	-	-
4	Sandhol	17,361	17,361	-	18,443	18,443	-	6.2	6.2	-	-	-
5	Dharampur	26,493	26,493	-	30,898	30,898	-	16.2	16.2	-	-	-
6	Kotli	20,498	20,489	-	23,941	23,941	-	16.8	16.8	-	-	-
7	Sarkaghat	70,404	67,311	3,093	78,469	74,763	3,706	11.5	11.1	19.8	4.4	4.7
8	Baldwara	35,528	35,528	-	40,330	40,330	-	13.5	13.5	-	-	-
9	Sundernagar	88,191	67,794	20,397	101,437	77,451	23,986	15.0	14.2	17.6	23.1	23.6
10	Mandi	165,389	141,142	24,247	192,370	164,128	28,242	16.3	16.3	17.5	14.7	14.7
11	Aut	20,785	20,785	-	26,873	26,873	-	29.3	29.3	-	-	-
12	Balichowki	27,289	27,289	-	33,663	33,663	-	23.4	23.4	-	-	-
13	Thunag	38,220	38,220	-	44,106	44,106	-	15.4	15.4	-	-	-
14	Chachyot	42,394	42,394	-	50,435	50,435	-	19.0	19.0	-	-	-
15	Nihri	26,859	26,859	-	31,777	31,777	-	18.3	18.3	-	-	-
16	Karsog	70,916	70,916	-	83,379	83,379	-	17.6	17.6	-	-	-
	District Total :	**776,372**	**724,122**	**52,250**	**901,344**	**840,362**	**60,982**	**16.1**	**16.1**	**16.7**	**6.7**	**6.8**

Density

The density of population in Mandi district is 228 persons per sq. km against the state average of 109 persons. At the Tehsil /sub-Tehsil level, the density of population varies between 436 persons in Baldwara sub-Tehsil and 93 persons in Nihri Tehsil.

Sex Ratio

There are 1,013 females per thousand males in Mandi district. The sex ratio for rural and urban areas of the district comes to 1,022 and 894 respectively. It is observed that the proportion of females in rural areas is higher than that of urban areas. Sex ratio in the age group 0-6 comes to 918 females per 1,000 males in the district as a whole. In the rural areas, the proportion is 922 females while in urban areas the sex ratio works out to 840 females per 1,000 males.

Work Participation Rate

The work participation rate is defined as percentage of total workers to total population. According to 2001 Census, the total workers including main and marginal workers constitute 50.4% of the total population of the district. Of the total workers, the share of main workers is 29.9% and marginal workers are 20.5%. The remaining 49.6% of population belong to the category of non-workers. As per 2001 Census among the main workers male participation rate in the district is 39.4% and corresponding proportion of females is 20.4%. Male and female marginal workers account for 13.2% and 27.8% respectively. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or more economic activities in addition to their house duties, to improve the family income. It is observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than that of female main workers.

Urban Centres & Population

The statement below gives the status and number of urban units by size class as per 2001 Census:

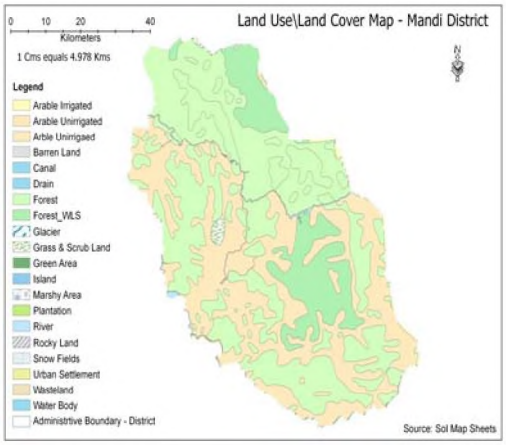
Literacy

As per 2001 Census Mandi district has reported 587,884 persons as literates constituting 75.2% of total population excluding the population of 0-6 age-group. The proportion of male and female literates being 85.9 and 64.8% respectively. The literacy rate of males is much higher than that of females.

The total literacy rates of rural and urban areas are 74.1 and 90.5% respectively. The proportion of male and female literates in rural areas is 85.3 and 63.3% respectively. In urban areas this proportion is 93.8 and 86.8% respectively. It is thus clear that females are better educated in urban areas than their counterparts in the rural areas.

Size Class of Town	Name and Civic Status of Town	Urban Population		
		Person	Male	Female
V	Jogindarnagar N.P	5,048	2,663	2,385
III	Mandi M.Cl.	26,873	14,233	12,640
VI	Rawalsar N.P	1,369	745	624
VI	Sarkaghat N.P	3,706	1,870	1,836
III	Sundarnagar M.Cl.	23,986	12,685	11,301

Land Use



The district is spread over deep valleys and high elevations except Balh and Chauntra valleys. The cultivation is possible only in small holdings in the deep valleys or the river basins in most parts of the district. The district is also having both reserve and demarcated forests in addition to the undemarcated forests which contribute of shrubs or grasslands. It is only in the Balh and Chauntra valleys that the land is flat and fertile and cultivation of cereals is extensively carried out.

Agriculture



The economy of this district is predominantly agrarian and provides direct and indirect employment to the major chunk of the population. About 80% of the population is engaged in agriculture as their occupation while great majority of remainders are more or less dependent on land for a considerable portion of their incomes. The district is however deficient in cereal production. Balh valley of Sundarnagar block and Sandhol areas along the Beas river of Dharampur block and Jogindarnagar valley are the only major areas in producing cereals in the district which cater to the demand of sizeable population of the district. The main reason for the low agricultural production is the lack of adequate irrigation facilities, uneconomically small landholdings, traditional technique of farming in hilly track, rocky and undulating terrains. Mechanized farming is by and large confined to the Balh valley. The climate and soil in higher altitude are much suitable for horticulture production. The district can be divided into three distinct regions from agricultural points like foothills, mid hills and high hills. The main cash crops of the district are potato, off season vegetables and ginger. Among the vegetables, cultivation of peas, tomato, brinjal, cauliflower, cabbage, radish, turnip, spinach, carrot, lady finger and cucumber is very popular. Potato is the only surplus agricultural produce in the district, which is exported for seed purposes. At the end of year 1997-98, a total area of 1636.69 sq.kms was sown in the district. Of these, 1486.18 sq. kms. were covered under edible grains and pulses and 9.49 sq.km under the millets and other cereals. The remaining sown areas were used for the production of potato, sugarcane, ginger, chilly and oil seeds products. There were 136,696 holdings of different sizes and types in the district during 1995-96 covering the total area of 1295.91 sq. kms.

Block - wise Crops and Cropping Systems of District Mandi (ha)

Block	Major crops								Cropping system
	Name	Area	Name	Area	Name	Area	Name	Area	
Sadar	Maize	8,602	Paddy	1368	Wheat	9228	Vegetable & peas	148	Maize-Wheat Paddy-Wheat
Balh	Maize	5,059	Paddy	3,012	Wheat	8,107	Vegetables Peas	181	-do-
Sundernagar	Maize	6,184	Paddy	1,759	Wheat	6,907	Mash	165	Maize-Wheat Paddy-Wheat
Gohar	Maize	3,529	Paddy	563	Wheat	3,812	Vegetables Peas	803	Maize-Wheat Paddy-Wheat
Seraj	Maize Paddy	2,991 69	Wheat	3,240	Barley	1,331	Potato Vegetables Peas	771 129	Maize-Peas Peas-Wheat

Block	Major crops								Cropping system
	Name	Area	Name	Area	Name	Area	Name	Area	
Karsog	Maize	6,389	Paddy	1,551	Wheat	8,684	Mash	993	Maize-Wheat Paddy-Wheat
Gopalpur	Maize	7,390	Paddy	5,274	Wheat	11,430	Barley	103	Maize-Wheat Paddy-Wheat
Dharmpur	Maize	2,361	Paddy	2,320	Wheat	4,701	Barley	123	Maize-Wheat Paddy-Wheat
Chauntra	Maize	3,159	Paddy	4,103	Wheat	6,203	Barley	465	Paddy-Wheat
Drang	Maize	3,701	Paddy	1,326	Wheat	5,514	Potato	676	Maize-Wheat Paddy-Wheat Potato-Fallow

Irrigation

*Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as **kuhls**, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

Artificial irrigation is entirely from Kuhls or small water courses taking off from the minor streams and hill torrents. There is no irrigation from Beas and very little from Suketi while the beds of their main tributaries are usually too deep in their lower courses to permit large areas being watered. At the end of year 1997-98, only 131.39 sq.km constituting 14.34% of the net cropped area of 916.12 sq.km in the district was irrigated. A meager area of 2.02 sq.km was irrigated by well and tube well while major chunk of 129.37 sq.km irrigated by other sources. A sizeable part of cultivated area does not have the assured irrigation facilities and the agriculturists have to depend on the vagaries of weather in the district. The constructions of Kuhls and undertaking lift irrigation schemes are being carried out under various plans Sprinkle irrigation was introduced in Balh valley and the system has become popular and extends to lower areas. The tube-wells are also introduced in Balh valley.

Irrigated area (source-wise) from 1997 -1998

Year	Irrigated by well (in Hect.)	Other sources (in Hect.)	Total irrigated Area (in Hect.)	Irrigated area under various crops (in Hect.)			
				Rice	Maize	Wheat	Barley
1997-98	202	12,937	13,139	9,587	1,906	11,049	205

Other crops (in hectares)									
Mustard	Potato	Ragi	Urd	Alsi	Ginger	Turnip	Soybean	Chillies	Pulses
39	90	15	66	288	26	2	111	19	113

Livestock

The livestock is the chief wealth next to agriculture and every household has a few cows or buffaloes, sheep, goats, pigs and ponies in rural areas. The main supplementary means of livelihood of sizeable population in the district is animal husbandry which is helpful to small and marginal farmers for increasing their income. According to cattle census of 1992, the total number of cattle and poultry birds in the district was 942,473 and 81,456 respectively. There were 430,331 cows, 107,676 buffaloes, 2,014 horses and ponies, 315 donkeys, 2,607 mules, 196,041 sheep, 203,270 goats and 219 pigs in the district in 1992 as per cattle census.

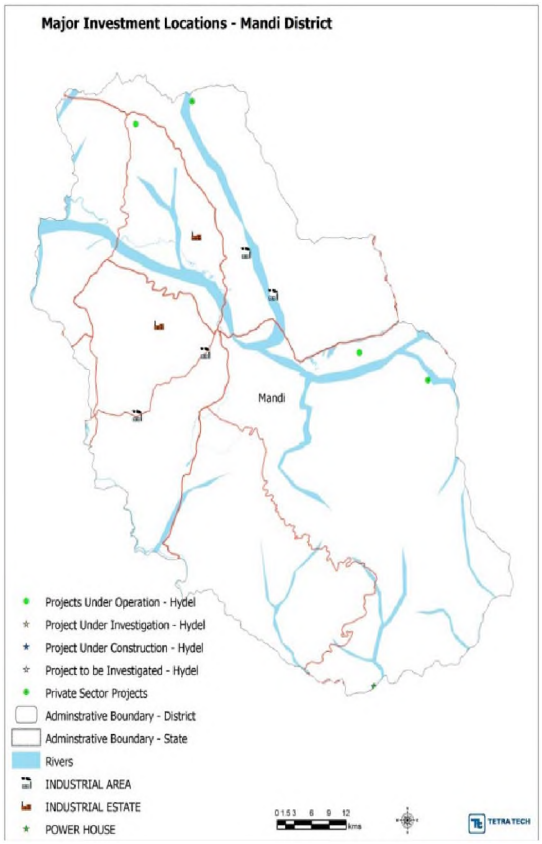
Horticulture

The agro-climatic conditions of Mandi district are quite suitable for tropical and sub-tropical fruits. Apple orchards are located predominantly in Karsog, Chachyot and Thunag. The geographical conditions are favorable for the development of horticulture. The places at higher altitudes produce apple, cherry, plums, apricot and lower areas produce mangoes, litchis, guava and citrus fruits. Walnuts are grown all over the district and of late commercial varieties of walnuts have found great favor. Citrus fruits like Kagzi Lemons, Kinnu, and Orange are being propagated in the lower areas of Sundernagar, Mandi, Sarkaghat and Joginder nagar Tehsils.

Fisheries

Mandi district is extensively criss-crossed by perennial streams and khads which provide congenial conditions for development of fisheries. The riverine fishery falls broadly under two categories of trout water and other waters. Exotic trout fish was introduced in the district from Kullu. These species are found in Uhl, Lambadug and Tirthan. The fisheries resources of the rivers are very rich and Mahseer fish is found in river Sutlej near Dehar and Barbustor, *Labeo diplostomus* (Gid) *Labeo dyocheilus* (Kuni) and *Oreinus sinuatus* (Himalayan Barbel), for the main food fishery are found in both the rivers of Beas and Sutlej and their tributaries. A trout hatchery is maintained well stocked at Barot on river Uhl. Pandoh, Mandi, Kunkatar, Sandhol, Dehar, Barot, Puin Bridge, Kamand, Bali Chowki are famous for trout fishing.

Industries



The district is predominantly an agricultural tract and devoid of medium and small scale industries. It is endowed with bountiful resources of hydropower, minerals & forests. All these factors provide favorable conditions for agro-based, forest based, food processing, beverages and electronics industries in the district. The setting up of these industries will also improve avenues of employment to the large number of agriculturists raising their income and standard of living. Number of small-scale industries increased in the district. At the end of year 1999 as many as 102 industries

with the capacity of 2,473 personnel were functioning in the district. During the year 1998-99, the district had 18 mechanical based industries, 12 forest based, 34 cloth industry, 4 food processing, 2 paper based, 7 processing and repairing, 34 flour mills, 5 chemical based and 9 other types of industries functioning in the district. Besides, a large number of small scale industrial units are registered with the Industry Department.

Minerals & Mining

The district is rich in minerals and is famous for its salt mines. There are three quarries of rock salt at Migal, Drang and Guma. Deposits of Magnetite and Hematite iron ores in Schists and quartzites are found in Kolikohar ridge, Thunag, Nachan, Pandoh, Chuhar and Sanor. Gold is found in small quantity in the bed of Son river, a tributary of Beas. The Copper dolomite and roofing slate are also found in Pandoh area of the district. Limestone is available in large quantity near Pongali, Dhanesari, Harabagh and Largi. Magnesium rich limestone occurs at Talwara and Baned.

Roads & Transport



Transport and communication facilities play a vital role in the development of any area. The district occupies an important place from the point of view of transport and communications as National Highway-21 and narrow gauge Pathankot-Jogindernagar railway line passes through the district. It is well connected with all weather roads with many prominent places and cities. Most of the villages and all the towns are linked with the district and Tehsil headquarters by a network of motorable roads. Even the far off villages where it is not possible to construct motorable roads, footpaths and bridle roads have been constructed. The total length of metalled and unmetalled roads in the district is 977 and 1865 kms. respectively. Part of the district is serviced by narrow gauge Railway from Pathankot to Jogindernagar, linking it with the Kangra district.

Roads and Transport in Mandi district during 1998-99

Year	Roads (in kms.)		Registered Vehicles	Nationalised Transport			Distance Covered ('000 Kms.)	No. of Depot
	Metalled	Unmetalled		Bus	Trucks	Other		
1998-99	977	1,865	2,795	207	1	4	149.04	3

Electricity & Power

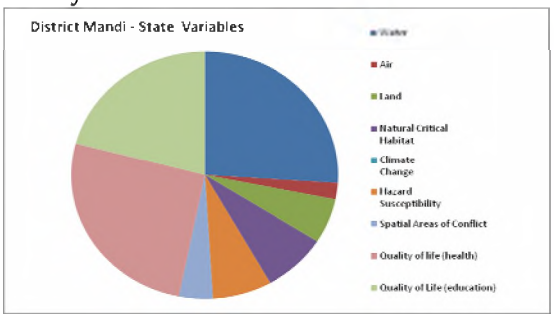
There is no shortage of the power in the district because of the setting up of three power houses at Shanan and Basi in Joginder nagar and Dehar at Slapper. All 2,818 inhabited villages of district have been electrified in mid nineties. The water of river Uhl has been harnessed at Joginder nagar and a big reservoir was constructed at Barot from where the water has been channelized and diverted to the power station at Shanan with the installed capacity of 4,800 KW. Basi power house commissioned by utilizing the water of Shanan power house has an augmented capacity of 60 MW. Besides, these are the ongoing projects which are yet to be completed in the district are Uhl Stage-III (100 MW) Larji Hydel Project (126 MW) and Kol Dam project (800 MW).

Summary of State Variables at District Level

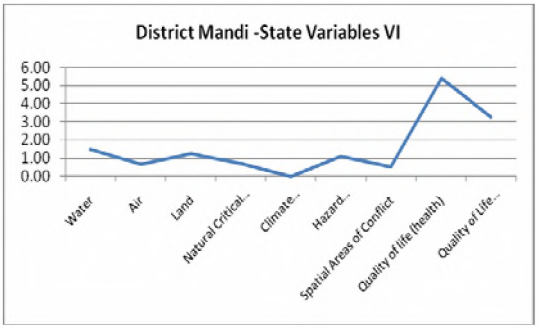
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Mandi. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Mandi	
Variable Sector	Vulnerability of State Sector V State Sector
Water	14820.70
Air	1216.65
Land	3339.27
Natural Critical Habitat	4465.82
Climate Change	0.00
Hazard Susceptibility	4089.67
Spatial Areas of Conflict	2328.52
Quality of life (health)	14795.27
Quality of Life (education)	11886.48

Mandi District- State Variables- Analysis at District Level



The analysis of data indicates that the District has adequate water resources. A substantial portion of the District is also prone to Hazards. The analysis indicates gaps in Health and Education infrastructure and services resulting in vulnerability. The Health sector is critically vulnerable.



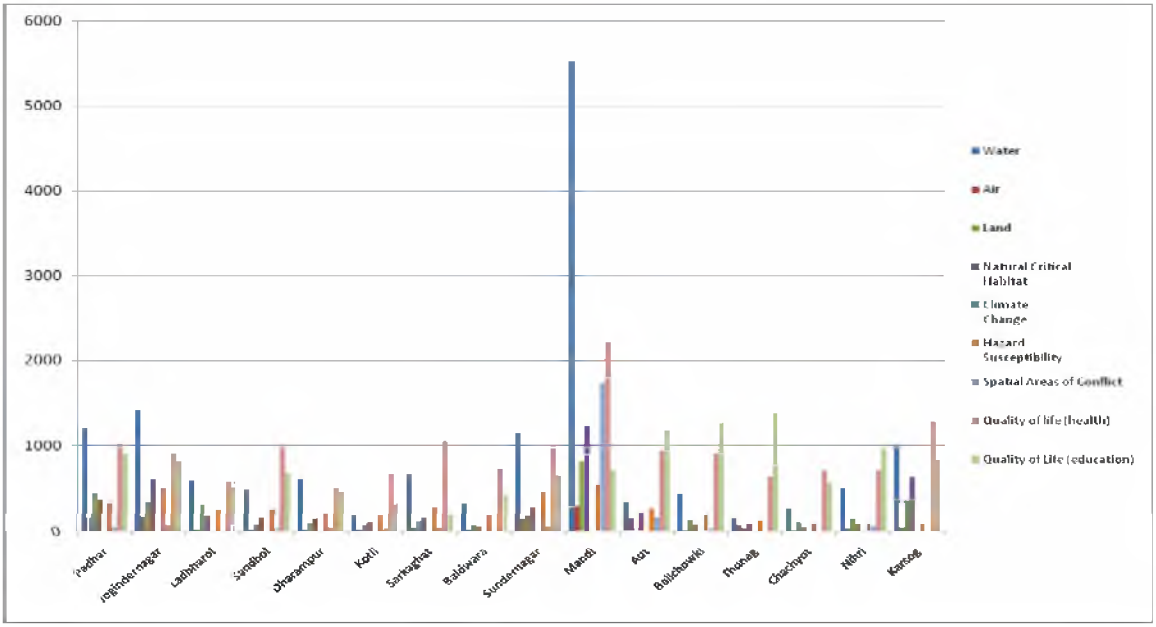
State Variables at Tehsil Level

Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

Tehsils	Water	Air	Land	Natural Critical Habitat	Climate Change	Hazard Susceptibility	Spatial Areas of Conflict	Quality of life (health)
Padhar	1199.77	160.64	449.25	349.07	0	342.6	47.06	1036.21
Jogindernagar	1409.56	172.8	332.41	601.8	0	496	72.5	897.04
Ladbharol	593.51	16.9	309.07	185.9	0	248.8	0	575.09
Sandhol	479.73	19.63	76.95	165.8	0	241.4	28.35	974.51
Dharampur	610.46	24.49	98.12	153.42	0	214.3	46.74	494.54
Kotli	193.45	16.96	75.46	110.45	0	192.4	31.66	655.95
Sarkaghat	660.16	37.22	128.45	168.4	0	273.6	45.39	1047.45
Baldwara	311.66	18.5	74.94	65.66	0	190.7	0	734.06
Sundernagar	1143.39	145.04	183.68	274.05	0	454.9	60.25	1011.29
Mandi	5540.1	280.11	802.11	1226.16	0	548.7	1732.5	2207.26
Aut	333.58	156.78	36.06	218.13	0	254.2	167.41	932.1
Balichowki	427.39	10	137.85	81.56	0	202.6	33.69	904.58
Thunag	156.78	70.58	36.06	90.88	0	130.3	0	630.51
Chachyot	253.23	14.98	102.85	53.71	0	96.3	0	698.44
Nihri	496.57	30.9	147.79	93.83	0	107.59	62.97	714.42
Karsog	1011.36	41.12	348.22	627	0	95.28	0	1281.82
Vulnerability of V State Sector	14820.70	1216.65	3339.27	4465.82	0.00	4089.67	2328.52	14795.27

Tehsils	Padhar	Jogindernagar	Ladbharol	Sandhol	Dharampur	Kotli	Sarkaghat	Baldwara	Sundernagar	Mandi	Aut	Balichowki	Thunag	Chachyot	Nihri	Karsog	Vulnerability of V State Sector
Quality of Life (education)	907.21	804.46	576.63	674.4	450.01	311.97	204.44	413	652.04	709.37	1179.48	1267.7	1388.62	556.49	951.56	839.1	11886.48

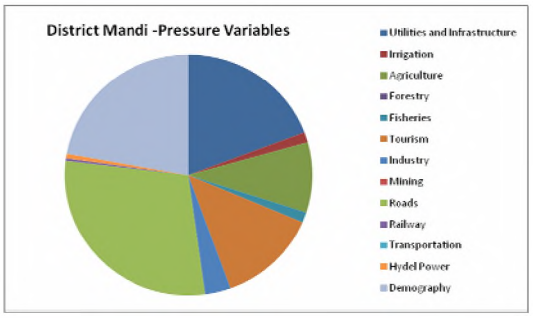


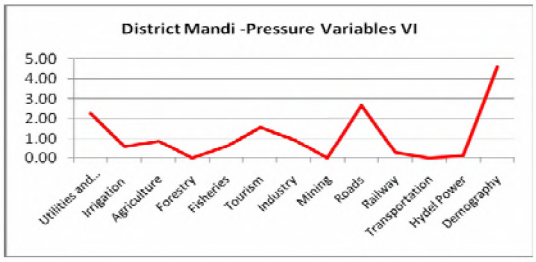
Summary of Pressure Variables at District Level

Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Mandi. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Mandi Variable Sector	Vulnerability of Pressure Sector $V_{Pressure\ Sector}$
Utilities and Infrastructure	11022.67
Irrigation	784.62
Agriculture	5374.98
Forestry	0.00
Fisheries	795.99
Tourism	7489.22
Industry	1920.67
Mining	0.00
Roads	16651.90
Railway	183.90
Transportation	0.00
Hydel Power	356.80
Demography	12688.03

The analysis of data indicates gaps in infrastructure and services in Health and Education sector. Health sector is in the critical stage in Padhar, Jogindarnagar, Sandhol, Sarkaghat, Sundernagar, Mandi, Aut, Balichowki and Karsog. Even in remaining tehsils, the health sector is in high vulnerability stage. Education sector is critically vulnerable at Aut and Thunag. The District Headquarter Tehsil of Mandi is critical in the Spatial Areas of Conflict. Water is highly vulnerable in Mandi.





Pressure Variables at Tehsil Level

Similarly, the pressure variables computed at Tehsil level for comparison is given below.

Comparison of Pressure variables at Tehsil level:

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Mandi. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

$$\frac{\sum V_{Pressure\ Sectors} : V_{State\ Sectors}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

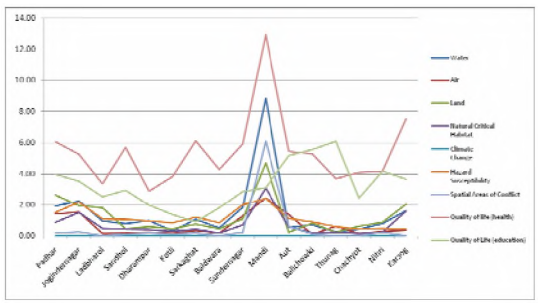
Vulnerability Index

	Padhar	Jogindernagar	Ladbharol	Sandhol	Dharampur	Kotli	Sarkaghat	Baldwara	Sundernagar	Mandi	Aut	Balichowki	Thunag	Chachyot	Nihri	Karsog
VI	4491.85	4786.17	2505.91	2660.77	2092.09	1592.32	565.11	1808.51	3924.63	13086.31	3312.00	3065.37	2652.21	1776.00	2605.64	4343.90
Denominator = 57x43	2451															
Normalized VI	1.83	1.95	1.02	1.09	0.85	0.65	1.05	0.74	1.60	5.34	1.35	1.25	1.08	0.72	1.06	1.77

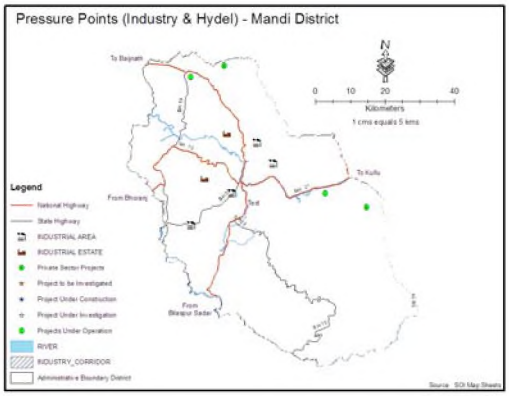
The analysis of data indicates that Mandi, the core Tehsil of the district has got a high rating on the VI, while the surrounding Tehsils have a low or very low VI. Normally, higher VI's have been observed on Tehsils bordering the neighboring states or districts with high pressures but this Tehsil is in almost the middle of the district. The high VI may be due to Mandi being a historic trading centre, as clearly depicted in the name.



The analysis of data indicates gaps in infrastructure and services in Health and Education. Both Health and Education sectors have a high vulnerability. Health sector is in the critical stage in Padhar, Jogindarnagar, Sandhol, Sarkaghat, Sundernagar, Mandi, Aut, Balichowki and Karsog. Even in remaining tehsils, the Health sector is in high vulnerability stage. Education sector is critically vulnerable at Aut and Thunag. The District Headquarter Tehsil of Mandi is critical in the Spatial Areas of Conflict. Water is highly vulnerable in Mandi.



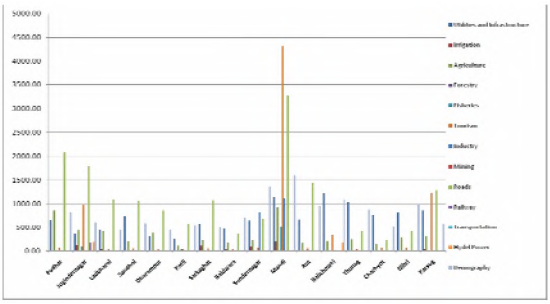




Description of Sectoral Vulnerability at Tehsil Level:

State & Pressure variables have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

District Mandi- Pressure Variables- Tehsil wise



Railway	Roads	Mining	Industry	Tourism	Fisheries	Forestry	Agriculture	Irrigation	Utilities and Infrastructure	Pressure variables
0.00	2078.22	0.00	0.00	58.39	0.00	0.00	862.47	20.21	654.00	**Padhar**
183.90	1788.95	0.00	0.00	988.67	104.39	0.00	437.19	117.07	368.22	**Jogindernagar**
0.00	1082.63	0.00	0.00	41.63	12.13	0.00	427.52	36.89	453.48	**Ladbharol**
0.00	1066.60	0.00	0.00	51.35	8.38	0.00	195.32	16.24	732.46	**Sandhol**
0.00	859.77	0.00	0.00	42.89	20.85	0.00	377.30	23.61	319.12	**Dharampur**
0.00	565.97	0.00	0.00	41.83	36.02	0.00	110.44	22.11	258.32	**Kotli**
0.00	1080.29	0.00	0.00	55.41	15.82	0.00	233.05	109.90	582.83	**Sarkaghat**
0.00	361.61	0.00	0.00	46.07	0.00	0.00	183.45	30.42	473.85	**Baldwara**
0.00	678.53	0.00	813.67	61.37	16.08	0.00	228.47	101.46	652.15	**Sundernagar**
0.00	3280.34	0.00	1107.00	4309.80	510.61	0.00	932.70	205.66	1150.34	**Mandi**
0.00	1435.45	0.00	0.00	54.81	11.31	0.00	164.53	12.82	669.92	**Aut**
0.00	0.00	0.00	0.00	333.99	12.44	0.00	208.76	14.51	1224.00	**Balichowki**
0.00	425.63	0.00	0.00	47.71	8.78	0.00	246.70	5.99	1028.64	**Thunag**
0.00	230.15	0.00	0.00	62.36	14.21	0.00	158.60	15.93	775.86	**Chachyot**
0.00	425.74	0.00	0.00	59.28	8.49	0.00	290.20	16.10	820.39	**Nihri**
0.00	1292.02	0.00	0.00	1233.66	16.48	0.00	318.29	35.70	859.09	**Karsog**

Fisheries	Forestry	Agriculture	Irrigation	Utilities and Infrastructure	Pressure variables
0.00	0.00	2.23	0.24	2.17	**Padhar**
1.21	0.00	1.13	1.36	1.22	**Jogindernagar**
0.14	0.00	1.10	0.43	1.51	**Ladbharol**
0.10	0.00	0.50	0.19	2.43	**Sandhol**
0.24	0.00	0.97	0.27	1.06	**Dharampur**
0.42	0.00	0.29	0.26	0.86	**Kotli**
0.18	0.00	0.60	1.28	1.94	**Sarkaghat**
0.00	0.00	0.47	0.35	1.57	**Baldwara**
0.19	0.00	0.59	1.18	2.17	**Sundernagar**
5.94	0.00	2.41	2.39	3.82	**Mandi**
0.13	0.00	0.43	0.15	2.23	**Aut**
0.14	0.00	0.54	0.17	4.07	**Balichowki**
0.10	0.00	0.64	0.07	3.42	**Thunag**
0.17	0.00	0.41	0.19	2.58	**Chachyot**
0.10	0.00	0.75	0.19	2.73	**Nihri**
0.19	0.00	0.82	0.42	2.85	**Karsog**

District Mandi- Pressure Variables- Tehsil wise- Vulnerability Index

Demography	Hydel Power	Transportation	Pressure variables
818.57	0.00	0.00	**Padhar**
612.89	184.90	0.00	**Jogindernagar**
451.62	0.00	0.00	**Ladbharol**
590.41	0.00	0.00	**Sandhol**
448.55	0.00	0.00	**Dharampur**
557.62	0.00	0.00	**Kotli**
487.81	0.00	0.00	**Sarkaghat**
713.12	0.00	0.00	**Baldwara**
1372.91	0.00	0.00	**Sundernagar**
1589.85	0.00	0.00	**Mandi**
963.16	0.00	0.00	**Aut**
1099.78	171.90	0.00	**Balichowki**
888.76	0.00	0.00	**Thunag**
518.89	0.00	0.00	**Chachyot**
985.44	0.00	0.00	**Nihri**
588.66	0.00	0.00	**Karsog**

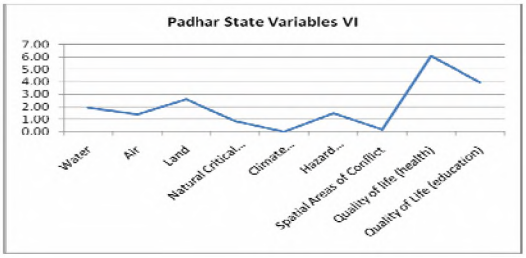
Pressure variables	Tourism	Industry	Mining	Roads	Railway	Transportation	Hydel Power	Demography
Padhar	0.19	0.00	0.00	5.37	0.00	0.00	0.00	4.76
Joginder nagar	3.28	0.00	0.00	4.62	4.28	0.00	1.08	3.56
Ladbharol	0.14	0.00	0.00	2.80	0.00	0.00	0.00	2.63
Sandhol	0.17	0.00	0.00	2.76	0.00	0.00	0.00	3.43
Dharampur	0.14	0.00	0.00	2.22	0.00	0.00	0.00	2.61
Kotli	0.14	0.00	0.00	1.46	0.00	0.00	0.00	3.24
Sarkaghat	0.18	0.00	0.00	2.79	0.00	0.00	0.00	2.84
Baldwara	0.15	0.00	0.00	0.93	0.00	0.00	0.00	4.15
Sundernagar	0.20	6.31	0.00	1.75	0.00	0.00	0.00	7.98
Mandi	14.32	8.58	0.00	8.48	0.00	0.00	0.00	9.24
Aut	0.18	0.00	0.00	3.71	0.00	0.00	0.00	5.60
Balichowki	1.11	0.00	0.00	0.00	0.00	0.00	1.00	6.39
Thunag	0.16	0.00	0.00	1.10	0.00	0.00	0.00	5.17
Chachyot	0.21	0.00	0.00	0.59	0.00	0.00	0.00	3.02
Nihri	0.20	0.00	0.00	1.10	0.00	0.00	0.00	5.73
Karsog	4.10	0.00	0.00	3.34	0.00	0.00	0.00	3.42

District Mandi- State Variables- Tehsil wise- Vulnerability Index

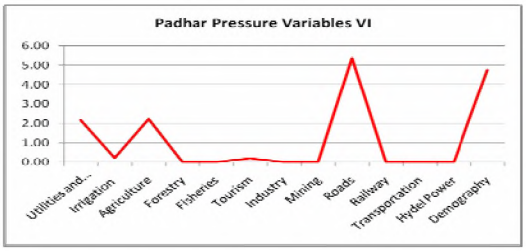
The analysis of data indicates pressure from Tourism, Demography, Road Network development and Industrial development. Fisheries sector is vulnerable. All these sectors have reached criticality. Demographic pressure is evident in many Tehsils and is creating gaps in Utilities and Infrastructure. Industrial development in Sundernagar has crossed the critical stage. Rest of the sectors is in a controllable stage.

Tehsil Wise Sector Wise Analysis

Tehsil Padhar – Overall Vulnerability Index 1.83

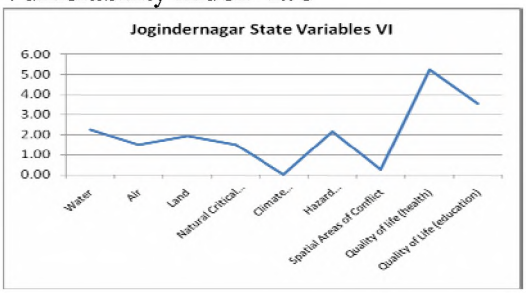


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors. Both Health and Education sectors have crossed the high vulnerability segment and are in critically vulnerable stage. All the other sectors are in controllable stage. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

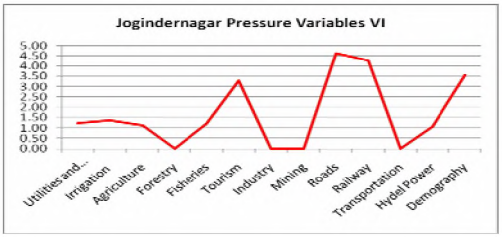


The analysis of data indicates that pressure from Road network development and Demography has resulted in high vulnerability. New road network development and expansion (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Jogindernagar – Overall Vulnerability Index- 1.95

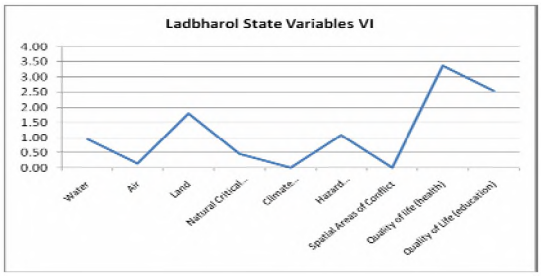


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors making them highly vulnerable. Health and Education sectors are approaching the critically vulnerable stage. All other variables are in controllable stage. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

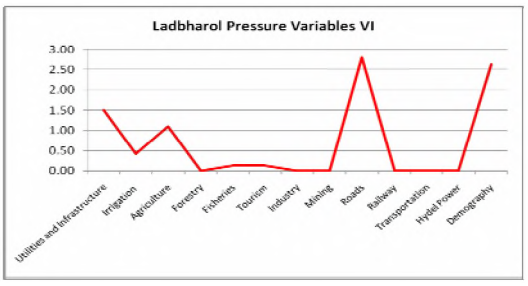


The analysis of data indicates pressure from Tourism which is growing in Tehsil. The Roads and Railway network development has made this sector moderately high vulnerable. Demography is in the moderately low segment.

Tehsil Ladbharol – Overall Vulnerability Index- 1.02

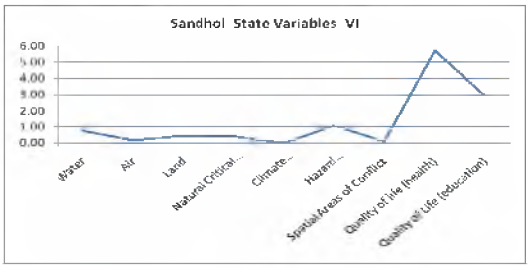


The analysis of data indicates that all the variables of the state theme have a low or very low vulnerability. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

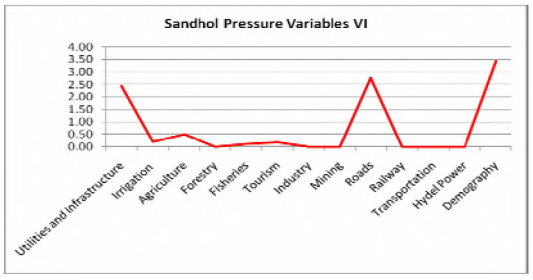


The analysis of data indicates that all variables in the pressure theme are under low vulnerability and thus do not prompt any priority/immediate action.

Tehsil Sandhol – Overall Vulnerability Index- 1.09

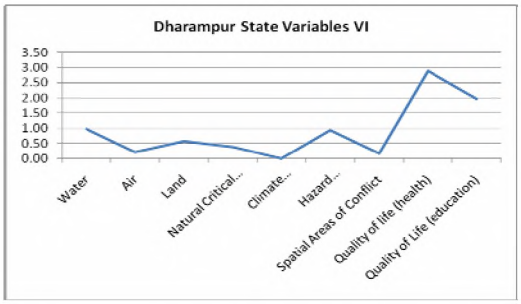


The analysis of data indicates gaps in infrastructure and services in Health and Education. Health and Education sectors have crossed into the high vulnerability segment. All the other variables are in controllable stage. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

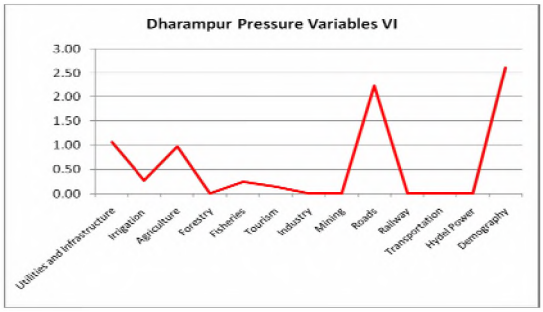


The analysis of data indicates that no variable in the pressure theme is a matter of immediate/priority concern.

Tehsil Dharampur- Overall Vulnerability Index- 0.85

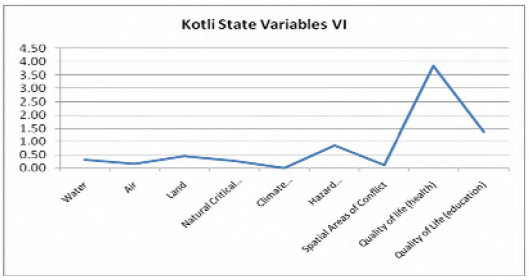


The analysis of data indicates that all variables in the state theme are in the low or very low vulnerability stage. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

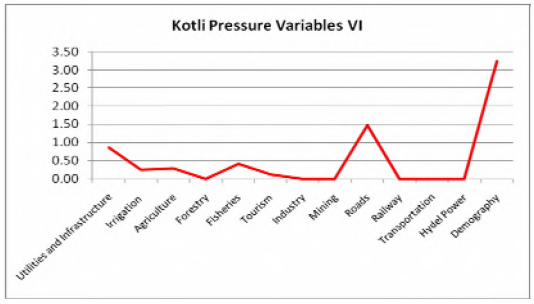


The analysis of data indicates that no variable under the Pressure theme is above the low vulnerability stage and therefore is not a matter of immediate/priority concern.

Tehsil Kotli – Overall Vulnerability Index- 0.65

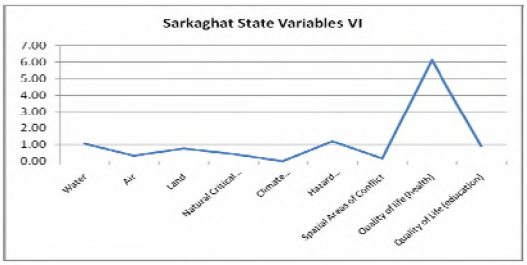


The analysis of data indicates gaps in infrastructure and services in Health and Education sector which have crossed moderately high vulnerability segment. All the other variables are in controllable stage. A programme for improving infrastructure and services in Health and Education sectors can reduce vulnerability.

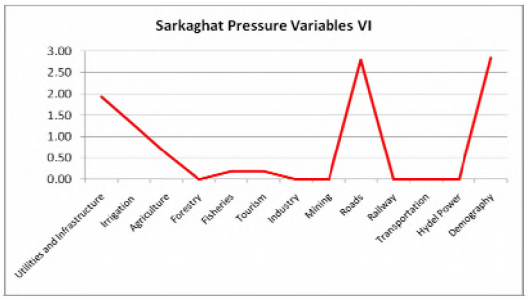


The analysis of data indicates that all variables have a very low vulnerability except for demography which is approaching the moderately low segment.

Tehsil Sarkaghat – Overall Vulnerability Index 1.05

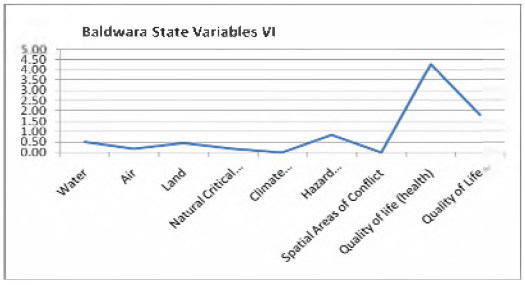


The analysis of data indicates gaps infrastructure and services in Health sector which has reached a critical stage. All other variables in the state theme are in the very low vulnerability stage and thus are not of any immediate/priority concern. A programme for improving infrastructure and services in Health sector can reduce vulnerability.

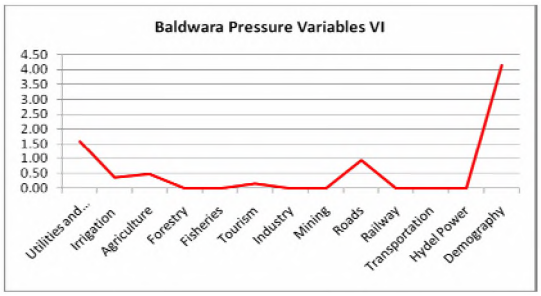


The analysis of data indicates that all variables are in low and very low vulnerability segment & are of no immediate action/priority concern.

Tehsil Baldwara- Overall Vulnerability Index 0.7

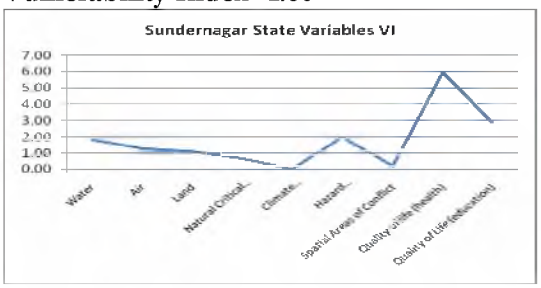


The analysis of data indicates gaps in infrastructure and services in Health sector which has reached moderately highly vulnerable stage. All other variables in the state theme are in the very low vulnerability stage and thus are of no immediate/priority concern. A programme for improving infrastructure and services in Health sector can reduce vulnerability.

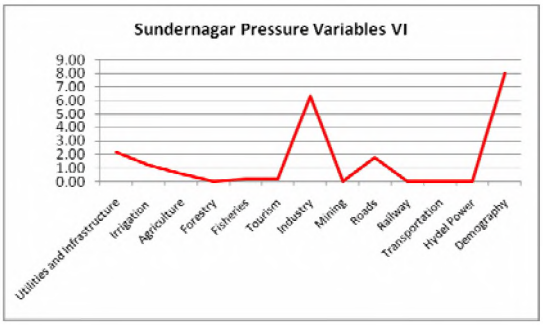


The analysis of data indicates demographic pressure which is in the moderately high segment of vulnerability. All other variables are in the very low vulnerability segment and thus are of no immediate/priority concern.

Tehsil Sundernagar- Overall Vulnerability Index -1.60



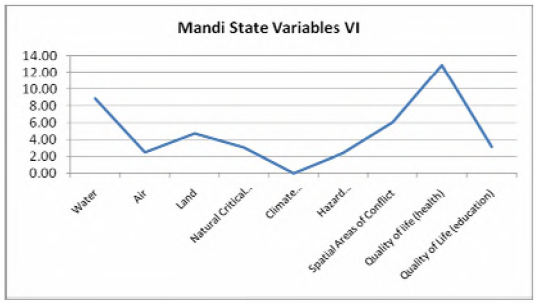
The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which have crossed the high vulnerability segment. Health sector has crossed the critically vulnerable stage. However, Education sector is in the moderately low segment. All the other variables are in controllable stage. A programme for improving infrastructure and services in Health sector can reduce vulnerability.



The analysis of data indicates pressure from Industrial development has reached a critical vulnerability stage. The location on National highway, proximity to Mandi and Industrial growth has prompted demographic growth.

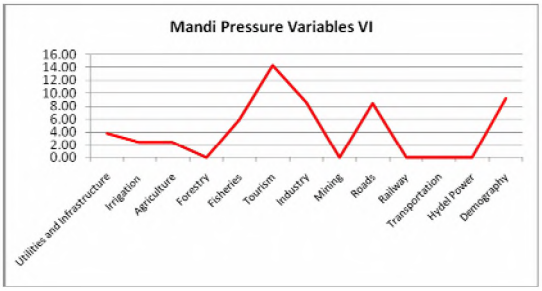
Development of new industries and expansion of existing Industries can be based on the assessment of development needs, existing skills, availability of raw materials & natural resources. All existing industries should meet Environment, Health & Safety safeguards and follow CPCB/ HPPCB regulations. The future Industrial development can follow the Comprehensive Environment Pollution Index of CPCB/MoEF.

Tehsil Mandi- Overall Vulnerability Index -5.34



The analysis of data indicates adequate water resources water. However, water sector is critically vulnerable as most of the larger settlements are on the banks of water bodies. In light of the rapid urbanization and industrialization, land is being converted from agriculture to non agricultural use, thus making it highly vulnerable. The Spatial Areas of Conflict are also critical in the Tehsil. Gaps in infrastructure and services in Health sector have crossed the critical segment.

Diversion of land for non agricultural purpose can be in conformity with development plan/ land use plan/ State Agriculture Plan/District Agriculture Plan. A programme for improving infrastructure and services in Health sector can reduce vulnerability.

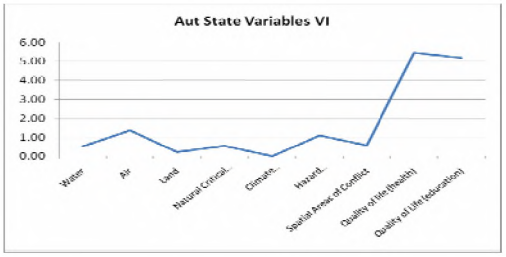


The analysis of data indicates that pressure from Tourism, Industrial development, Road network and Demography have crossed the critical stage of vulnerability. Fisheries sector is also vulnerable. A plan for tourism can be prepared as per the Tourism Master Plan as Mandi is growing fast as transit point for tourists for other tourist destinations in the district. The Demographic growth is reflected in pressure on Utilities and Infrastructure.

Industrial development has reached a critical vulnerability stage and thus further industrial development can be allowed, after assessment of development needs, existing skills, availability of raw material & natural resources. All existing industries should meet Environment Health & Safety standards, and follow CPCB/HPPCB regulations. The future Industrial development can follow the Comprehensive Environment Pollution Index of CPCB/MoEF.

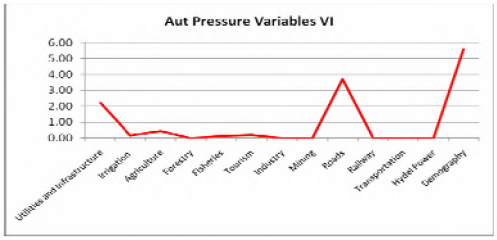
A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

Tehsil Aut- Overall Vulnerability Index- 1.35



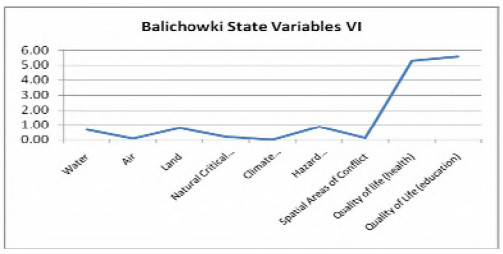
The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which have crossed into the high vulnerability segment and the critical vulnerability stage. All the other variables are in very low vulnerability segment and thus in controllable stage.

A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

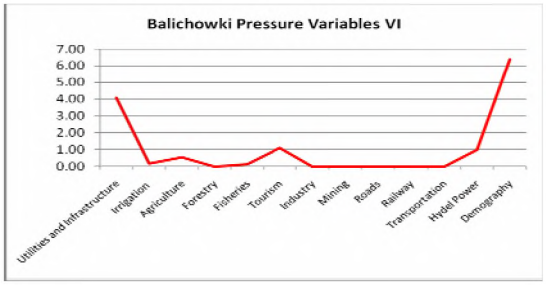


The analysis of data indicates pressure from development of Road Network and Demographic growth, which are also high vulnerability sectors. The rest are in low or very low vulnerability segments. Development of new road network, expansion of existing road, including maintenance works can be as per the development needs and concerned sectoral guidelines.

Tehsil Balichowki – Overall Vulnerability Index – 1.25

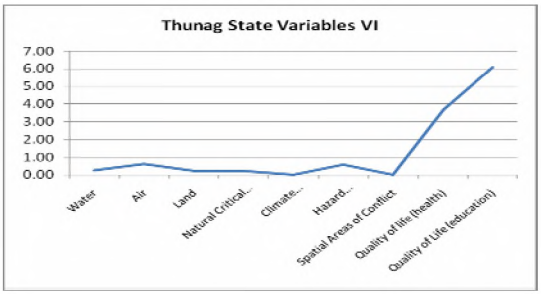


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which have crossed into the high vulnerability segment with Education sector crossing the critical vulnerability stage. All the other variables are in very low vulnerability segment and thus in controllable stage. A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

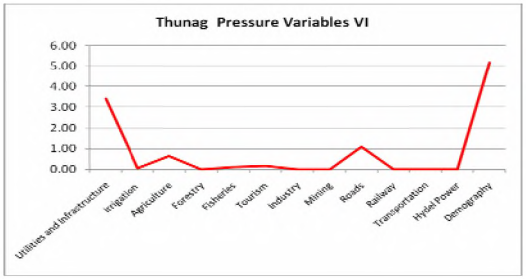


The analysis of data indicates Demographic growth and the resultant pressure on Utilities and Infrastructure. Plans and Projects for improving Utilities and Infrastructure can reduce vulnerability.

Tehsil Thunag- Overall Vulnerability Index – 1.08

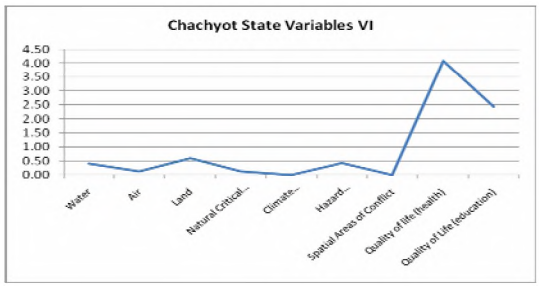


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which have crossed into the high vulnerability segment with education sector crossing the critical vulnerability stage. All the other variables are in very low vulnerability segment and thus in controllable stage. A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

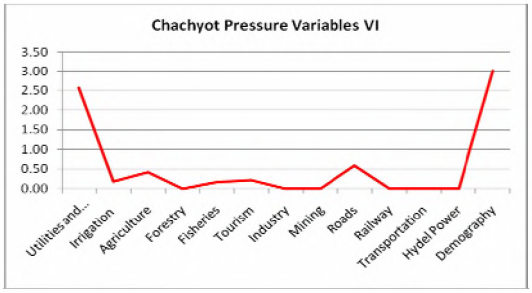


The analysis of data indicates Demographic growth and the resultant pressure on Utilities and Infrastructure. Plans and Projects for improving Utilities and Infrastructure can be prepared for reducing vulnerability.

Tehsil Chachyot- Overall Vulnerability Index- 0.72

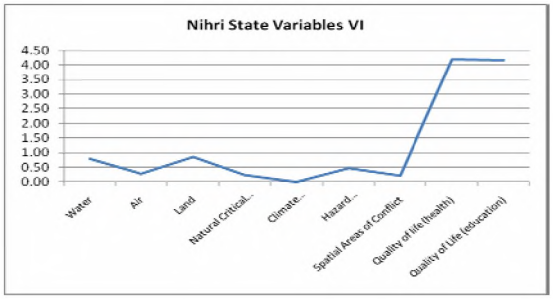


The analysis of data indicates gaps in infrastructure and services in Health and education sectors. Health sector has reached a high vulnerability stage while Education sector, is in the moderately low vulnerability segment. All other variables are in very low vulnerability segment and thus in controllable stage. A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

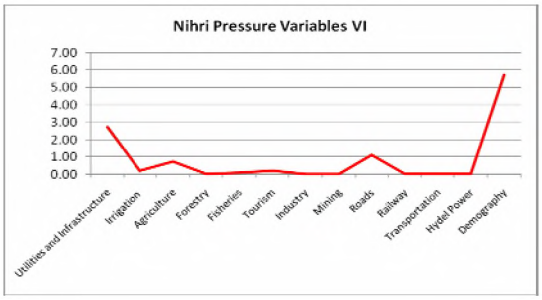


The analysis of data indicates Demographic growth and the resultant pressure on Utilities and Infrastructure. Utilities and Infrastructure sector is in the moderately low vulnerability segment. Gaps in Utilities and Infrastructure can be addressed through Plans and Projects to help in reducing the vulnerability.

Tehsil Nihri- Overall Vulnerability Index- 1.06

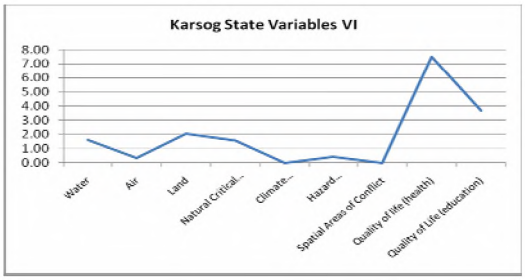


The analysis of data indicates gaps in infrastructure and services in Health and education sectors. Health and Education sectors have moved into the high vulnerability segment. All the other variables are in very low vulnerability segment and thus in controllable stage. A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.

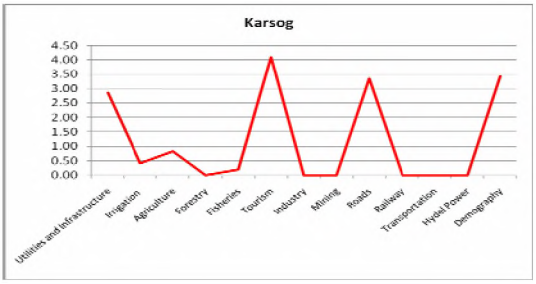


The analysis of data indicates Demographic growth and the resultant pressure on Utilities and Infrastructure. Utilities and Infrastructure sector is in the moderately low vulnerability segment. Gaps in Utilities and Infrastructure can be addressed through Plans and Projects to help in reducing the vulnerability.

Tehsil Karsog – Overall Vulnerability Index- 1.77



The analysis of data indicates gaps in infrastructure and services in Health and education sectors. Health and Education sectors are in the high vulnerability segment/critical vulnerability stage. All the other variables are in very low vulnerability segment and thus in controllable stage. A programme for improving infrastructure and services in Health and Education sector can reduce vulnerability.



The analysis of data indicates pressure from Tourism which is in the moderately high vulnerability segment, development of Roads network and Demography. A Tourism Plan can be developed for Karsog in accordance with Tourism Master Plan. Projects in Utilities & Infrastructure can be taken up to reduce gaps and the vulnerability.

Priority Tehsils for priority action are Mandi and Jogindernagar which are on the verge of crossing over to high vulnerability segment.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

Mandi

Sr. No.	Tehsil	VI	Adjoining Tehsil in Mandi District	VI	Adjoining Tehsil in Other District	District	VI
1	Padhar	1.83	Jogindernagar	1.95	Kullu	Kullu	2.60
			Kotli	0.65	Multhan	Kangra	0.66
			Mandi	5.34			
2	Jogindernagar	1.95	Ladbharol	1.02	Baijnath	Kangra	1.28
			Dharampur	0.85			
			Kotli	0.65			
			Padhar	1.83			
3	Lad Bharol	1.02	Jogindernagar	1.95	Baijnath	Kangra	1.28
			Dharampur	0.85			
			Sandhol	1.09			
4	Sandhol	1.09	Lad Bharol	1.02	Tira Sujanpur	Hamirpur	4.04
			Dharampur	0.85	Jaisinghpur	Kangra	0.82
			Sarkaghat	1.05			
5	Dharampur	0.85	Ladbharol	1.02			
			Jogindernagar	1.95			
			Kotli	0.65			
			Sarkaghat	1.05			
			Sandhol	1.09			
6	Kotli	0.65	Jogindernagar	1.95			
			Padhar	1.83			

Sr. No.	Tehsil	VI	Adjoining Tehsil in Mandi District	VI	Adjoining Tehsil in Other District	District	VI
			Mandi	5.34			
			Sarkaghat	1.05			
			Dharampur	0.85			
7	Sarkaghat	1.05	Sandhol	1.09	Bhoranj	Hamirpur	1.72
			Dharampur	0.85			
			Kotli	0.65			
			Mandi	5.34			
			Baldwara	0.74			
8	Baldwara	0.74	Sarkaghat	1.05	Ghumarwin	Bilaspur	2.10
			Mandi	5.34	Bhoranj	Hamirpur	1.72
			Sundernagar	1.60			
9	Sundernagar	1.60	Baldwara	0.74	Arki	Solan	1.10
			Mandi	5.34	Ghumarwin	Bilaspur	2.10
			Chachyot	0.72	Bilaspur Sadar	Bilaspur	4.92
			Nihri	1.06			
10	Mandi	5.34	Padhar	1.83	Kullu	Kullu	2.60
			Aut	1.35			
			Balichowki	1.25			
			Chachyot	0.72			
			Sundernagar	1.60			
			Baldwara	0.74			
			Sarkaghat	1.05			
			Kotli	0.65			
11	Aut	1.35	Mandi	5.34	Kullu	Kullu	2.60
			Balichowki	1.25	Sainj	Kullu	0.99
12	Balichowki	1.25	Mandi	5.34	Sainj	Kullu	0.99
			Aut	1.35	Banjar	Kullu	1.16
			Thunag	1.08			
			Chachyot	0.72			
13	Thunag	1.08	Balichowki	1.25	Ani	Kullu	1.05
			Karsog	1.77			
			Nihri	1.06			
			Chachyot	0.72			
14	Chachyot	0.72	Balichowki	1.25			
			Thunag	1.08			
			Nihri	1.06			
			Sundernagar	1.60			
			Mandi	5.34			
15	Nihri	1.06	Sundernagar	1.60	Seoni	Shimla	1.69
			Chachyot	0.72	Arki	Solan	1.10
			Thunag	1.08			
			Karsog	1.77			
16	Karsog	1.77	Nihri	1.06	Ani	Kullu	1.05
			Thunag	1.08	Kumharsain	Shimla	2.22
					Seoni	Shimla	1.69

Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Chamba is surrounded by various Tehsils of District Kullu, Kangra, Hamirpur, Bilaspur, Solan and Shimla. The vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils of except for Padhar, Lad Bharol, Sandhol, Sarkaghat, Baldwara Aut and Nihri. The transitional impact of vulnerability possibly will give rise to vulnerability levels in when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.

Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the programme as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken. The groundwater may be recharged through the creation of small check dams on the non- perennial khuds, which could also improve the irrigation scenario.

(ii) As is observed from the analysis, the quality of life in terms of health and education required to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Villages which do not have these facilities within the specified distance are deficient. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order)- Mandi, Karsog, Balichowki, Sundarnagar, Sarkaghat, Sandhol and Padhar.

Similarly, for the quality of life parameters for education, the district has an excellent network up-to the college level but intensive efforts are needed in establishment of Vocational training Institutions, so that villages within 25 kms radius have accessibility. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

Priority Tehsils (in descending order)- Thunag, Balichowki Aut, Nihari, Padhar and Karsog

The benchmarking of the norms has been done with a view of the profile, terrain of the State.

A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(v) It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is

very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(vi) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats i.e. Reserve forests, Wildlife sanctuaries etc can be done through a series of plans culminating into projects. It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(vii) Though almost all the Tehsils reveals a series of Probable Spatial Areas of Conflict in small quantum, Mandi Tehsil displays a sizable quantum. Most of these are primarily related to conflict with water due to the setting up of Industries or Urban Activities near water-ways, some relate to conflict with air, which are a result of traffic, industries and Plants operating in the area.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) Utilities and Infrastructure form the second highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(iii) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has increased by approximately 16% on an average in the entire district. In times to come these lands which may have been developed out of non cultivable land may fall prey to Industries and Urbanization. It can be inferred that land which was earlier under agriculture has been diverted to non agricultural purposes for particularly for Industrial development and housing facilities for industrial workers.

(iv) Rationalization of land requirement for Industrial and habitation uses can be done and policy for Industrial Growth and Urbanization can include this through norms developed on the basis of type of Industry and Urban Activities and its planned output including employment potential. Rationalization of land requirement for non agricultural use can be considered in line with existing development plans, land use plan, State Agriculture Plan and District Agriculture Plan.

(v) Tourism as a parameter is the next highest scorer in the district pressure parameters. A definite and specific plan

for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed District Level Plans for Tourism is required to be prepared.

(vi) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Variable	Policy	Plan	Programme	Project	Remarks
State					
Water		*	*		Water Utilization Plan
Quality of life (Health)			*		Programme to improve access
Quality of life (Education)			*		Programme to improve access
Natural Critical Habitat		*		*	Improvement of Resource through Buffer Zones and developmental projects
Pressure					
Roads	*				Policy to take care of State variables
Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
Agriculture	*				Policy regarding Diversion of land for non-agricultural use
Tourism		*			Tourism Plan at State, District, and Destination Level

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VULNERABILITY INDEX 2001

	Padhar	Jogindernagar	Ladibharol	Sandhol	Dharampur	Kodi	Sarkaghat	Baldwara	Sundernagar	Mandi	Aut	Balichowki	Thunag	Chachyot	Nihri	Karsog
VI	4491.85	4786.17	2505.91	2660.77	2092.09	1592.3	2565.11	1808.51	3924.63	13086.31	3312.00	3065.37	2652.21	1776.00	2605.64	4343.90
denominator = 57x43	**2451**															
Normalized VI	**1.83**	**1.95**	**1.02**	**1.09**	**0.85**	**0.65**	**1.05**	**0.74**	**1.60**	**5.34**	**1.35**	**1.25**	**1.08**	**0.72**	**1.06**	**1.77**

	Padhar	Jogindernagar	Ladbharol	Sandhol	Dharampur	Kotli	Sarkaghat	Baldwara	Sundernagar	Mandi	Aut	Balichowki	Thunag	Chachyot	Nihri	Karsog
VI	4491.85	4786.17	2505.91	2660.77	2092.09	1592.3	2565.11	1808.51	3924.63	13086.31	3312.00	3065.37	2652.21	1776.00	2605.64	4343.90
Denominator = 57x43									2451							
Normalized VI	1.83	1.95	1.02	1.09	0.85	0.65	1.05	0.74	1.60	5.34	1.35	1.25	1.08	0.72	1.06	1.77

Population Projections

Tehsil	Population 2001	Proj. Pop 2011	Proj.Pop 2021	Proj.Pop 2031	Proj Pop. 2041
Padhar	44144	55478	68442	82899	98717
Jogindernagar	75675	84261	95019	107741	122176
Ladbharol	25404	28501	32137	36274	40870
Sandhol	18443	21001	23823	26897	30210
Dharampur	30898	35110	40359	46535	53523
Kotli	23941	28337	33548	39498	46109
Sarkaghat	78469	90252	104145	120039	137812
Baldwara	40330	46594	54002	62455	71853
Sundernagar	101437	127887	156595	187592	220820
Mandi	192370	222825	258577	299273	344422
Aut	26873	33856	42240	51859	62566
Balichowki	33663	41617	51055	61821	73766
Thunag	44106	53356	64003	75935	89036
Chachyot	50435	57187	65819	76106	87822.00
Nihri	31777	40624	50635	61717	73783.00
Karsog	83379	100361	120284	142875	167869.00

Calculation of Per Capita Share of VI

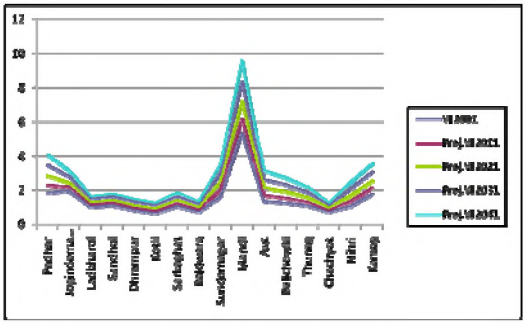
Tehsil	Population 2001	VI 2001	VI share
Padhar	44144	1.83	4.15
Jogindernagar	75675	1.95	2.58
Ladbharol	25404	1.02	4.02
Sandhol	18443	1.09	5.91
Dharampur	30898	0.85	2.75
Kotli	23941	0.65	2.72
Sarkaghat	78469	1.05	1.34
Baldwara	40330	0.74	1.83
Sundernagar	101437	1.6	1.58
Mandi	192370	5.34	2.78
Aut	26873	1.35	5.02
Balichowki	33663	1.25	3.71
Thunag	44106	1.08	2.45
Chachyot	50435	0.72	1.43
Nihri	31777	1.06	3.34
Karsog	83379	1.77	2.12

Calculation of Projected VI

Tehsil	Population 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj. Pop 2021	Proj.VI 2021	Proj.Pop2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Padhar	44144	1.83	4.15	55478	2.30	68442	2.84	82899	3.44	98717	4.09
Jogindernagar	75675	1.95	2.58	84261	2.17	95019	2.45	107741	2.78	122176	3.15
Ladbharol	25404	1.02	4.02	28501	1.14	32137	1.29	36274	1.46	40870	1.64
Sandhol	18443	1.09	5.91	21001	1.24	23823	1.41	26897	1.59	30210	1.79
Dharampur	30898	0.85	2.75	35110	0.97	40359	1.11	46535	1.28	53523	1.47
Kotli	23941	0.65	2.72	28337	0.77	33548	0.91	39498	1.07	46109	1.25
Sarkaghat	78469	1.05	1.34	90252	1.21	104145	1.39	120039	1.61	137812	1.84
Baldwara	40330	0.74	1.83	46594	0.85	54002	0.99	62455	1.15	71853	1.32
Sundernagar	101437	1.6	1.58	127887	2.02	156595	2.47	187592	2.96	220820	3.48
Mandi	192370	5.34	2.78	222825	6.19	258577	7.18	299273	8.31	344422	9.56
Aut	26873	1.35	5.02	33856	1.70	42240	2.12	51859	2.61	62566	3.14
Balichowki	33663	1.25	3.71	41617	1.55	51055	1.90	61821	2.30	73766	2.74
Thunag	44106	1.08	2.45	53356	1.31	64003	1.57	75935	1.86	89036	2.18
Chachyot	50435	0.72	1.43	57187	0.82	65819	0.94	76106	1.09	87822	1.25
Nihri	31777	1.06	3.34	40624	1.36	50635	1.69	61717	2.06	73783	2.46
Karsog	83379	1.77	2.12	100361	2.13	120284	2.55	142875	3.03	167869	3.56

Projected VI

Tehsil	VI 2001	Proj.VI 2011	Proj.VI 2021	Proj.VI 2031	Proj.VI 2041
Padhar	1.83	2.30	2.84	3.44	4.09
Jogindernagar	1.95	2.17	2.45	2.78	3.15
Ladbharol	1.02	1.14	1.29	1.46	1.64
Sandhol	1.09	1.24	1.41	1.59	1.79
Dharampur	0.85	0.97	1.11	1.28	1.47
Kotli	0.65	0.77	0.91	1.07	1.25
Sarkaghat	1.05	1.21	1.39	1.61	1.84
Baldwara	0.74	0.85	0.99	1.15	1.32
Sundernagar	1.6	2.02	2.47	2.96	3.48
Mandi	5.34	6.19	7.18	8.31	9.56
Aut	1.35	1.70	2.12	2.61	3.14
Balichowki	1.25	1.55	1.90	2.30	2.74
Thunag	1.08	1.31	1.57	1.86	2.18
Chachyot	0.72	0.82	0.94	1.09	1.25
Nihri	1.06	1.36	1.69	2.06	2.46
Karsog	1.77	2.13	2.55	3.03	3.56



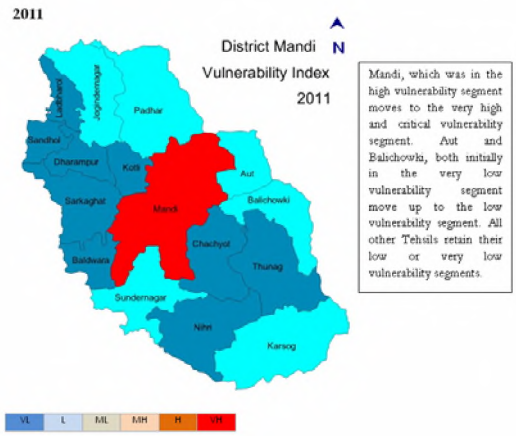


Projected Vulnerability Index- Mapping The Scenario

Range

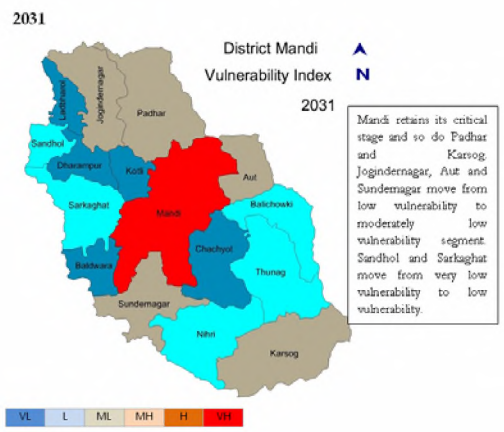
Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

2011



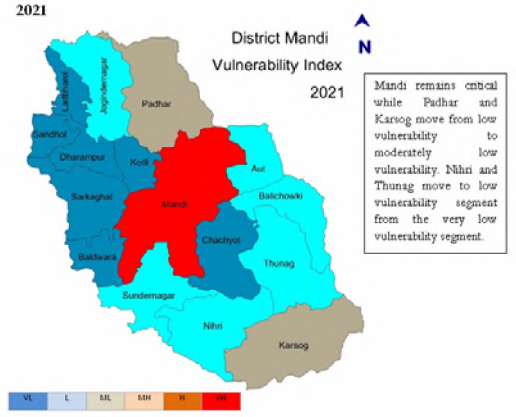
Mandi, which was in the high vulnerability segment moves to the very high and critical vulnerability segment. Aut and Balichowki, both initially in the very low vulnerability segment move up to the low vulnerability segment. All other Tehsils retain their low or very low vulnerability segments.

2031



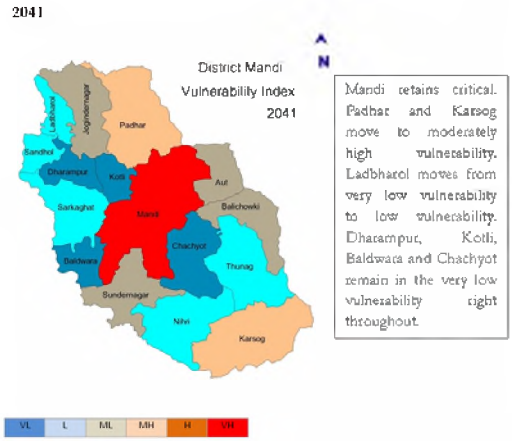
Mandi retains its critical stage and so do Padhar and Karsog. Joginderngar, Aut and Sundernagar move from low vulnerability to moderately low vulnerability segment. Sandhol and Sarkaghat move from very low vulnerability to low vulnerability.

2021



Mandi remains critical while Padhar and Karsog move from low vulnerability to moderately low vulnerability. Nihri and Thunag move to low vulnerability segment from the very low vulnerability segment.

2041

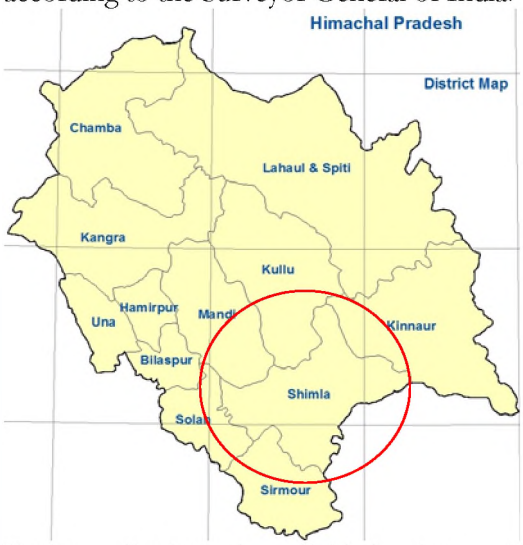


Mandi retains critical. Padhar and Karsog move to moderately high vulnerability. Ladbharol moves from very low vulnerability to low vulnerability. Dharampur, Kotli, Baldwara and Chachyot remain in the very low vulnerability right throughout.

SHIMLA

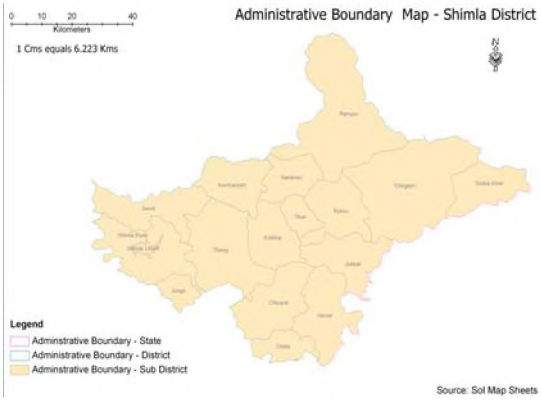
General Background

Shimla district forms a part of southern Himachal Pradesh. The district lies between the longitudes 77°0' and 78°19' east and latitudes 30°45' and 31°44' north and is bounded by Mandi and Kullu district in the north, Kinnaur in the east, the State of Uttaranchal and Sirmaur district in the south and by Solan district in the west. The shape of the district is somewhat rectangular with slight bulges on the western side intruding towards Solan district and on the northern side towards Kullu district. The district has an area of 5,131 sq. kms. out of total area of 55,673 sq. kms. of Himachal Pradesh according to the Surveyor General of India.

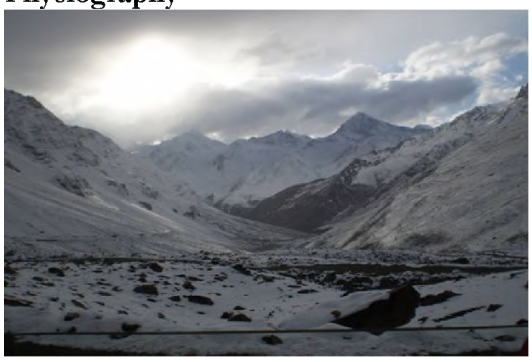


Entire district is divided into 17 administrative units as Tehsil/sub-Tehsil (area in descending order as follows):

Tehsil/Sub Tehsil	Area (Sq.Km)
Rampur	865.40
Chirgaon	771.00
Theog	471.35
Dodrakwar	367.00
Shimla (Rural)	353.90
Nerua	310.00
Jubbal	298.00
Seoni	243.70
Kumaharsain	238.10
Rohru	225.30
Kothkai	203.20
Chaupal	178.30
Nankhari	157.20
Junga	112.80
Cheta	96.83
Tikar	78.50
Shimla (Urban)	28.50



Physiography



The physiography of the district is characterized by high mountains, deep and narrow valleys and river basins. The elevation of the district ranges from 300-6,000 metres. The district has a number of peaks such as Jakhoo in Shimla Town, Siah near Chail, Churdhar in Tehsil Chaupal, Chansal in Rohru Tehsil, Hattoo in Kumharsain Tehsil and Shali in Seoni Tehsil. Mostly the terrain is rough. The prevalence of inter-locking spurs, narrow and steep sided valleys with high peaks and thick forest of deodar and kail throughout the district is part of topography of Shimla district. Almost the district is entirely mountainous except small flat patches of land which are used for cultivation. Shimla district forms the part of Northern Mountains Macro

Region (Southern Himachal Pradesh Micro Region under Himachal Pradesh Himalayas Meso Region).

The district is divided into five sub-micro regions as follows:

Shimla Greater Himalaya

It is formed by the extreme northern part of Rampur Tehsil which makes its limits with Kullu district in the north-west and Kinnaur district in north-east and Sutlej Basin in the south. This region is very rugged and mountainous and geological structure is formed by Jutogh group and Granites (unclassified). It has Orthents-Orchepts, Glaciers and Snowcap cover of soils.

***Sutlej* Basin**



This covers vast areas of Rampur Tehsil, complete Seoni Tehsil and Nankhari sub-Tehsil, northern part of Shimla rural, Theog and Kumharsain Tehsil. This basin is characterized by deep gorges, slope rises steeply from the river banks. The climatic conditions of this basin vary from hot in the lower altitudes to quite cold in higher elevations. Geological structure of the basin is mainly composed of Jutogh group, Shali-Deoban and Largi group and Shimla group formations. Soils of this basin are mainly categorised as Orthents-Orchepts. However, Udalfs Orchepts type of soil is found in the southern and north-western margins.

This region extends over the extreme eastern part of the district occupying almost whole of Dodrakwar Tehsil except its extreme western small track, northern, eastern and southern parts of Chirgaon Tehsil, adjoining small tracts of Jubbal and Rohru Tehsil and eastern and southern parts of Rampur Tehsil. The topography of this region is characterized by the criss-crossed deep gorges and high mountains. The geology is mainly of Jutogh formations and soils are Udalfs and Orthents-Orchepts.



***Pabbar* Basin**



It spreads over the eastern part of the district occupying larger parts of Rohru Tehsil and Tikar sub-Tehsil, western and central parts of Chirgaon Tehsil, adjoining extreme small area of Dodra Kwar Tehsil and northern and central parts of Jubbal Tehsil. The terrain is undulating whereas river banks are comparatively plain. Geological structure is mainly composed of Jutogh group formations and soil is Udalfs and Orthents-Orchepts.

Shimla Lesser Himalaya

Shimla Lesser Himalaya extends over the southern, central and western parts of the district. It covers whole of Kotkhai, Chaupal

and Shimla urban tehsils, Junga, Nerua and Cheta sub-Tehsil, Theog Tehsil (except its north-western part) south and south-western parts of Jubbal Tehsil, western part of Tikar sub-Tehsil, extreme south-western part of Rohru Tehsil, southern part of Kumharsain and Shimla rural Tehsil. The entire region is undulating. The geological structure mainly comprises Jutogh group, Shimla group, Shali Deoban and Largi group, Nagthat group and Rampur-Banjar formations. Soils of this region are mainly classified as Udalfs-Orchepts, Orthents-Ochrepts and Orchepts-Orthents.

Culture and Social Brief

Fairs & Festivals

A number of fairs and festivals are held in the district. These fairs are held in the honor of gods, goddesses by the local people in different places in the district. A brief account of some of the important fairs and festivals held in the district is as follows:

Winter Sports Festival: It is a recreational festival usually held during winter months for two days at Kufri which is about 13 kms. from Shimla.

Summer Festival at Shimla: With the onset of summer in May and June there is large influx of visitors and tourists in Shimla. For their recreation a festival is held on the Ridge in Shimla town for a week or 10 days depending upon the weather conditions. About 50,000 spectators enjoy the variety entertainment programmes during these festivals.

Sarahan Fair: This fair is held in village Sarahan of Tehsil Chaupal for three days in the month of Baisakha (April). The venue of the fair is the court-yard of Devta's temple. Attendance of visitors is 3 to 4 thousands.

Shawani Fair: This fair is held in village Jali in honour of Nag Devta. The fair is held on the day of Sravana Purnima (July-August).

Charyoli Fair Bodna: The fair is held in village Bodna of Tehsil Chaupal on the 2nd and 3rd of Bhadra (August) in honour of Devta Shirgul also known as Vijit Raj.

Rampari-Ki-Jatar: This fair is held in village Rampari of Tehsil Jubbal on the first day of Ashada (June). The place is about 2 kms. from Jubbal on Theog-Hatkoti road. The fair is being celebrated since ancient times and lasts for a day.

Janga Shari: This fair is held in village Shari of Tehsil It is a common festival of villages of Chamaru, Daker, Kiari Jubbal and Shari. The temples of Devta Banar and Devta Mahasu are located in the village.

Sipi Fair: This fair is held every year in Sihpur below Mashobra on the 1st of Jaistha (May) in honour of Sip Devta.

Pathar-Ka-Khel: This fair is held in village Halog of Tehsil Shimla. The fair is held on the second day of Diwali.

Vishu Fair-Purag: This fair is held in village Purag of Tehsil Kotkhai on the 9th day of Baisakha (April) for three days. The fair is held in honour of Mahadev Devta.

Mahasu Jatar: This fair is celebrated about 6 kms. from Shimla-Kotkhai road near Mahasu village on the 3rd Tuesday in the month of Baisakha (May) for two days.

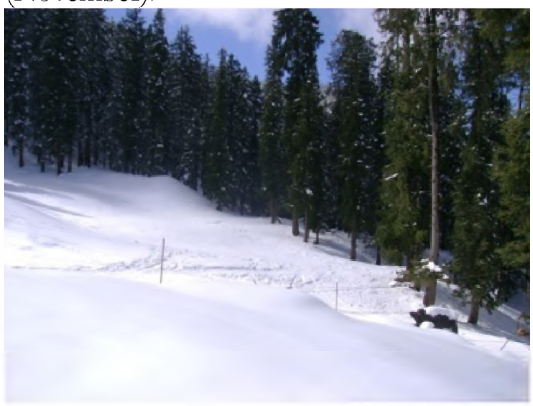
Barara Fair: This fair is held in village Barara near Kumharsain and people of all castes and creed participate. The fair is held on the 1st of Jaisth (May).

Shancha Fair: This fair is held in village Baragaon of Tehsil Kumharsain for two days every year on the 15th and 16th day of Sravana (July-August).

Dudhbahali Fair: The fair is held near village Jaodin in Tehsil Rampur on the 12th and 13th Asadha (June) every year in honour of three deities i.e. Devta Jishar, Devta

Dethu of Kharan and Devta Chaturmukh of Melon in Kumharsain tehsil.

Lavi Fair: Lavi fair of Rampur is the most important fair of the district and State. It is a commercial fair held on the 25th of Kartika (November).



Rohru Fair: This fair is held in Rohru on the 9th and 10th of Baisakha (April) on the bank of *Pabber* river in honour of Devta Shikru. It is a very old fair and is held to commemorate the supremacy of deity.

Bhoj Fair: This fair is held in village Guman in Rohru Tehsil in the month of Agrahayana (November) for three days in honour of Devta Bensor, Parshu Ram and Kilbaru. Devta Bansar is the presiding deity.

Rihali Fair: This fair is held in village Mandhor in tehsil Seoni on the 1st Saravana (July) every year since ancient times.

Chunehar Fair: This fair is held at Chunehar near Jot in Tehsil Theog every third year for two days in the month of Ashada (June-July) in honour of Devta Chitra.

Deothidhar Fair: This fair is held from 26th Saravana (August) for five days till Bhadra Sakranti in village Deothidhar in Theog Tehsil. The fair is held in the honour of Devta Chikher.

Places of Historical, Archaeological and Religious Importance and Tourist Interest

Kufri: It is about 13 kms. from Shimla on National Highway No. 22 is famous for skiing in winters.

Naldehra: It is situated at a distance of 25 kms. from Shimla on Shimla-Seoni road. The place is famous for Golf course and has acquired prominence as a picnic spot.



Narkanda: It is situated at a distance of 64 kms. from Shimla on National Highway No.22. It is about 2,900 metres above the mean sea level. Nearby Hattu peak which is about 3,300 metres from the mean sea level is a panoramic picnic spot and place for outing. The place is also famous for winter sports of skiing.

Rampur: Rampur town is situated on the left bank of the *Sutlej* river at an elevation of about 800 meters from the mean sea level and is 132 kms. from Shimla on National Highway No. 22. Rampur is a well known trade centre. There is also an ancient Tibetan temple with gigantic prayer wheel and a temple dedicated to Lord Shiva and Laxmi Narain.

Sarahan: This place is about 45 kms. north of Rampur and is about 2,400 metres high above the mean sea level. The village lies on the old Hindustan Tibet road.



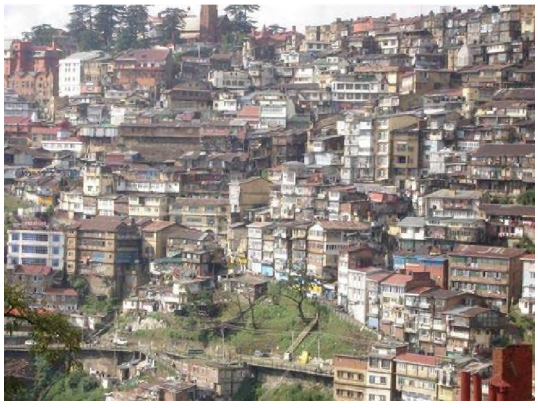
Rohru: It is about 130 kms. from north of Shimla. It lies on the right bank of the *Pabbar* river. The river offers many fishing ponds. Chirgaon, at a distance of about 16 kms. from Rohru is famous for the breeding of Trout fish.



Kotgarh: This place is about 17 kms. from Narkanda. The village and its surroundings are famous for delicious varieties of apple and cherry orchards.

Hatkoti: This place is about 115 kms. on Shimla-Rohru road and is about 1,200 metres above the mean sea level. This village is famous for Durga temple which is very ancient. This village famous for Durga temple which is very ancient.

Shimla: Shimla's climate, easy accessibility, well developed tourist facilities and numerous attractions have made it as one of the India's most popular tourist destination. The town is located at an altitude of 2,130 metres. The surrounding hills are covered with lush green forests of oak, rhododendron, cedar and pine. The ridge holds the neo-gothic structure of Christ church.



Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability vis-à-vis utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables:

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Shimla district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

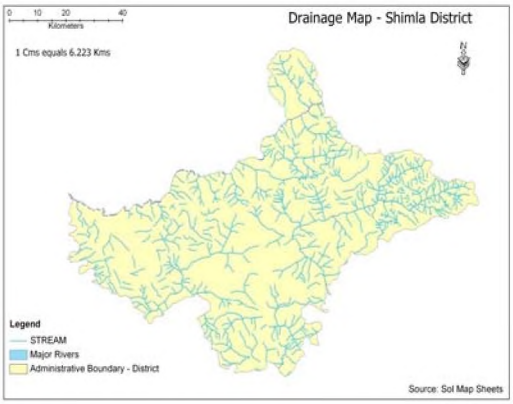
River System

Shimla district is covered by the catchment area of the rivers *Sutlej*, *Pabbar* and *Giri*. The district drained itself into these big rivers.

The *Sutlej* river enters Shimla district at Badhal in Rampur. This river forms the boundary line of Shimla district with Nermand and Ani Tehsil of Kullu district and Karsog Tehsil of Mandi district. The main tributaries of this river are *Nogli*, *Machhada*, *Bhaira* and *Kingal khads* and *Khekhar*, *Chamola*, *Savera* and *Bagh nallahs* etc. The river receives the entire drainage of northern part of the district.

All these *khads* and *nallahs* are perennial, being snow-fed and have regular flow of

water throughout the year which ensures uninterrupted discharge of the river. The *Pabbar* river rises from the base of Chandernahan peak in between Sangla Tehsil of Kinnaur district and Rohru Tehsil of Shimla district. The river takes south eastern course and passes through Tehsil Rohru, Jubbal and merges with the river *Tons* at Tiuni in Uttaranchal.



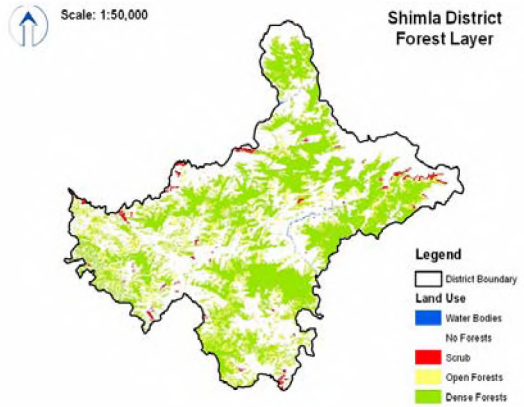
The river receives the entire drainage of these two tehsil and is fed by *Shikri, Andhra, Pejore, Hatkoti* streams/*Khads*, etc. All these streams/*khads* are also perennial. The *Giri* or *Giri Ganga* originates from the hills of *Churdhar* called *Kupar* in the north. The river collects the drainage of the whole tract of *Churdhar* and the Shimla range. It flows south-west until meeting the lines of outer Himalayas sharply turning to the south-east and passing through Kotkhai, Theog and Shimla Tehsil. The principal feeder of the *Giri* is *Ashwani khad* which rises near Mahasu in the Shimla range and after receiving a considerable contribution from the eastern face of the hill, upon which the Shimla town stands, joins the *Giri* at a point where the river turns south-east. The *Giri* and its tributaries are also perennial.

Climate: The climatic condition of district is varying according to the elevation of the area due to topographical variations. However, there are four broad seasons. Winter normally starts from mid November and continues till middle of March. December, January and February are severe cold months when the winter season is at its peak. Habitations situated in the lower reaches on the banks of rivers and streams are however as hot as in the plains. Autumn season is generally very small from mid of September to mid of November. Due to variation in altitudes, the temperature also varies considerably while minimum temperature in the higher reaches goes down much below 0°Centigrade during the winter months, the maximum temperature in the lower areas touches even 40°C during the summer months.

Precipitation/Rainfall: The upper reaches receive snow while the rains are frequent in the lower areas. Snow may fall as early as the beginning of October but usually the areas receive snow fall from the later part of December and continue till middle of March. The higher peaks experience heavier snowfall and starts melting from March. The snow is not received below 800 metres. Rainy season generally starts from mid July and extends even up to the mid September. The northern parts of the district comprising Seoni, Kumharsain and Rampur Tehsil experience comparatively low rainfalls, the areas on the eastern, western and southern parts of the remaining Tehsil record higher amount of rainfall. Bulk of the precipitation is generally received during the rainy season.

Particulars	Maximum	Minimum
Rainfall	1,254.9 mm	799.4 mm
Temperature	33.3°C	-3.1°C

Forest & Wildlife



A total of 3527.94 sq. kms. of land is under forest. Of this, 53.46 sq. kms. is reserve

forest 3420.46 sq. kms demarcated forests and 54.02 sq.kms. unclassified and other forests. In this region, above 1,500 metres from the mean sea level, the soil is generally deep and contains a thin layer of humus or leaf moulded species of Ban Oak, Chil, Kail and Deodar. In the lower elevation, scrub forest are found, while in higher altitudes of district, Chil, Deodar, Kail, Rai, Tosh and 'Bhoj Patra' trees are found. 'Bhoj Patra' trees are mostly found in the Tehsil of Dodra-Kwar in this district. In whole district, the forest lies between 300 metres to 1,800 metres or more in elevation. In the lower ranges with warmer climate and sharp slopes with deep soil and farmable conditions, species of mixed deciduous forest of scrub and bamboo are found. The main marketable forest products are resin, Chil, Deodar, Kail, fur and spruce timber, along with pulp wood, fire wood and charcoal.

There are three sanctuaries at Daranghati, Shimla water catchment area, and Talra and two game reserve areas at Ghanahatti and Taradevi in the district.'

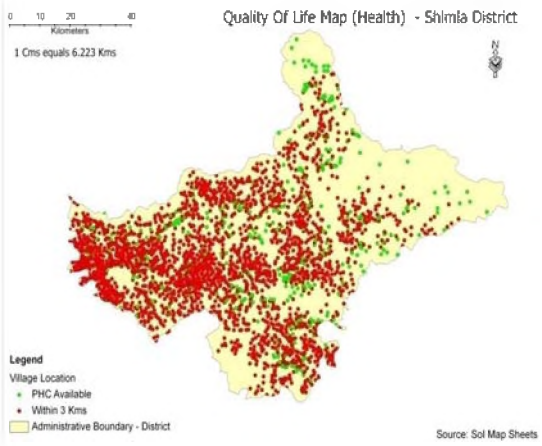
Quality of Life (Health)

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population.

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector.

Of the total 2520 inhabited villages in district, 2516 villages are deprived of Hospital facility and 2464 villages are deprived of PHC facilities. Of these 126 villages have the facility of Hospital available within 5 kms. while in respect of 223 villages the inhabitants have to cover a distance of 5-10 kms. and inhabitants of 2167 villages have to travel more than 10 kms. in order to avail this facility.

In fact, to summarize, according to 2001 Census, 56.97% villages don't have access primary health center within 3 kms. 60.61% villages don't have access to Community Health Centre within 6 kms. and 85.95% villages don't have hospital facility within 10 kms.

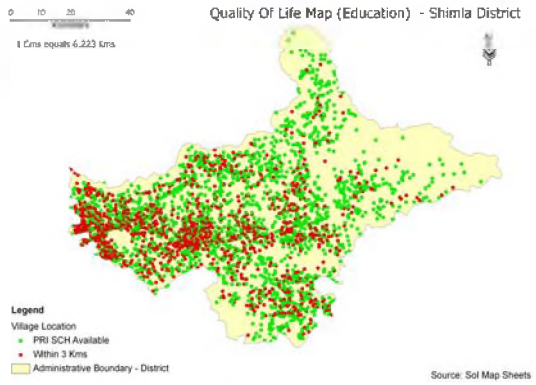


Quality of Life (Education)

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 kms. in order to make the Primary School viable.

Similar is the case of access to Educational facilities, another essential indicator of quality of life. A number of villages do not have educational facilities within the village at district level. They have to go out of their village to avail these facilities. 1156 villages do not have primary school in their villages and out of these villages, children of 1113 villages have to travel less than 5 kms. for schooling, those of 37 villages have to travel a distance of 5-10 kms. while those of 6 villages have to travel a distance of 10 or more kilometres. Out of 2520 inhabited villages as many as 2066 are deprived of middle school and 2517 of Degree College. Of these 1716 avail the facility of middle school at a distance of less than 5 kms., 307

at a distance 5-10 kms. and the remaining 43 at a distance of 10+ kms. In respect of Degree College, 122 avail this facility at a distance of less than 5 kms., 227 between 5 to 10 kms. and rest 2517 villages at a distance of 10+ kms.



To summarize, according to Census of India 2001, on an average across the district, 15.79% villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), 15.37% villages doesn't have secondary school within a distance of 6 kms. 15.21% villages don't have colleges within a distance of 15 kms. and 89.94% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.

Description of Pressure Theme Variables:

Pressure variable which are relevant in context of District Shimla such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Shimla district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to 2001 Census, the total population of Shimla district is 722,502 comprising 380,996 males and 341,506 females **(the Census of India, 2011 gives a provisional population figure of 813384 with a density of 159 per sq. km. Data at tehsil level is not available).** This population of the district forms 11.9% of the state population and ranks at 3rd place among the districts. Out of the total population of the district 76.9% lives in rural areas while 23.1% lives in urban areas. Rural population of the district is distributed among 17 Tehsil, sub-Tehsil and urban population is spread over in 10 towns. The total urban population in the district is 167,233 persons comprising 95,691 males and 71,542 females. The total rural population in this district comes to 555,269 persons and is composed of 285,305 males and 269,964 females as per 2001 Census. This rural population is distributed in 2,520 villages. Out of total 2,914 villages in the district, 2,520 are inhabited villages while 394 villages are uninhabited.

Population Growth

According to 1991 Census, the total population of the district was 617,404. During the 1991−2001 decade, there has been an addition of 105,098 people. The decadal growth rate of the district is 17%. The growth rates for the rural and urban areas of the district are 12.5% and 35.1% respectively. All the 17 Tehsil/sub-Tehsil of the district registered a positive growth rate in 2001 Census and Shimla district stand 8th in average growth rate among the districts. Out of 17 Tehsil/sub-Tehsil, Rampur Tehsil recorded the highest growth rate of 26.0% while Kothkhai Tehsil has the lowest growth rate of 2.4%. The rates of growth in Rampur, Rohru and Chirgaon tehsils and Cheta sub-Tehsil are above the district average of 17.0%.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001												
	Tehsil/Sub-Tehsil	Population						Percentage decadal variation 1991-2001			% urban population	
		1991			2001							
		Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
1	Rampur	57,175	52,833	4,342	72,026	66,373	5,653	+26.0	+25.6	+30.2	7.6	7.8
2	Nankhari	23,326	23,326	-	25,154	25,154	-	+7.8	+7.8	0.0	0.0	0.0
3	Kumharsain	39,861	39,174	687	40,577	39,864	713	+1.8	+1.7	+3.8	1.7	1.8
4	Seoni	29,950	28,679	1,271	31,425	29,896	1,529	+4.9	+4.2	+20.3	4.2	4.9
5	Shimla Rural	66,969	61,142	5,827	73,521	71,101	2,420	+9.8	+16.3	-58.5	8.7	3.3
6	Shimla Urban	102,186	-	102,186	142,555	-	142,555	+39.5	0.0	+39.5	100.0	100.0
7	Junga	11,444	11,444	-	12,422	12,422	-	+8.5	+8.5	0.0	0.0	0.0
8	Theog	68,738	65,981	2,757	77,954	74,200	3,754	+13.4	+12.5	+36.2	4.0	4.8
9	Chaupal	25,339	24,265	1,074	28,387	26,880	1,507	+12.0	+10.8	+40.3	4.2	5.3
10	Cheta	13,871	13,871	-	16,831	16,831	-	+21.3	+21.3	0.0	0.0	0.0
11	Nerua	27,052	27,052	-	31,192	31,192	-	+15.3	+15.3	0.0	0.0	0.0
12	Jubbal	31,918	30,539	1,379	33,649	32,303	1,346	+5.4	+5.8	-2.4	4.3	4.0
13	Kotkhai	33,354	32,458	896	34,155	33,006	1,149	+2.4	+1.7	+28.2	2.7	3.4
14	Tikar	11,450	11,450	-	12,590	12,590	-	+10.0	+10.0	0.0	0.0	0.0
15	Rohru	36,920	33,554	3,366	44,887	38,280	6,607	+21.6	+14.1	+96.3	9.1	14.7
16	Chirgaon	32,895	32,895	-	39,513	39,513	-	+20.1	+20.1	0.0	0.0	0.0
17	Dodra Kwar	4,956	4,956	-	5,664	5,664	-	+14.3	+14.3	0.0	0.0	0.0
	District Total	**617,404**	**493,619**	**123,785**	**722,502**	**555,269**	**167,233**	**+17.0**	**+12.5**	**+35.1**	**20.0**	**23.1**

Population Density

The overall density of population in Shimla district is 141 persons per sq. km. as against the State average of 109 persons. Among the 12 districts of the State, Shimla holds the 8th place. Keeping with the general tendency, Shimla district too displays a considerable high urban population density of 3,705 persons per sq. km. while in the rural areas it is hardly 109 persons per sq. km. Within the district, among 17 Tehsil/sub-Tehsil, there are considerable differences. Shimla rural Tehsil has the highest density of 208 persons per sq. km. while Dodra Kwar Tehsil has the least density of 15 persons per sq. km. In the case of urban areas, Rohru Nagar Panchayat with 6,175 persons per sq. km. emerges as the most densely populated area & hold the topmost place and Chaupal Nagar Panchayat hold the last place as it has a low density of only 377 persons per sq. km.

Sex Ratio

There are 896 females for every thousand males in Shimla district as against the State average of 968. The sex ratio figures for rural and urban areas of the district are 946 and 748 respectively. Proportion of females in rural area is higher than that of urban areas. Within the district, the sex ratio varies from 1,092 in Seoni Tehsil to 862 in Rampur Tehsil. In the urban areas of different Tehsil/sub-Tehsil, the sex ratio varies considerably. The lowest sex ratio is 707 in Rohru Tehsil and the highest 1,001 is in Seoni Tehsil. Out of 10 towns in the district, sex-ratio of Seoni Nagar Panchayat (1,001), Shimla, M. Corp. (756) and Theog M.Cl. (761) are above the district average of 748.

Work Participation Rate

2001 Census recorded 42.3% of the district population as main workers, 8.9% as marginal workers and the remaining 48.8% as non-workers. Among the main workers, male participation rate in the district is 51.6% while that of female is 31.9% as per 2001 Census. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or more economic activities in addition to their house duties to improve the family income. It is observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than that of the female main workers.

Literacy

As per 2001 Census, Shimla district reported 504,330 persons comprising 293,745 males and 210,585 females as literates constituting 79.1% of the total population and 87.2% males and 70.1% female population of the district. The literacy rate of males is higher than that of females. The difference of the male and female literacy rate is 17.1% in the district. The total literacy rates of rural and urban areas are 75.2% and 91.8% respectively. The proportion of males and females literate in rural area is 84.9% and 64.9% while this proportion in urban area is 93.8% and 89.0% respectively. The difference between male and female literacy rates in urban areas is 4.9% as against 20.0%. The literacy rate for Shimla district is 79.1% and it occupies 4th rank among the districts.

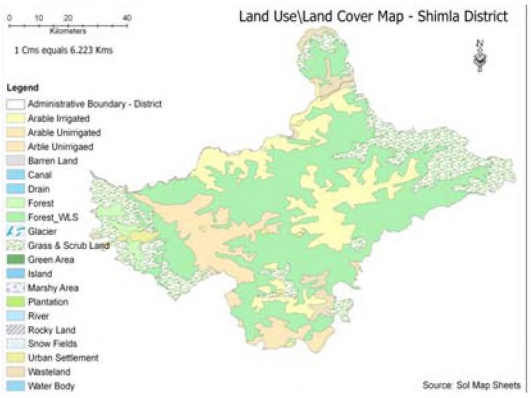
Urban Population

There are 10 towns in this district, of which 6 are categorized as Nagar Panchayats, 2 Municipal Councils, one Municipal Corporation and one Cantonment Board. The Municipal Corporation and Cantonment Board is the constituent unit of Shimla Urban Agglomeration. Shimla M. Corp. is the most populous town while Narkanda Nagar Panchayat is the smallest town in the district. Position and number of urban units in size class is as follows:

Size-Class of Town	Name & Civic Status of town	Urban Population
VI	Chaupal Nagar Panchayat	1507
VI	Jubbal Nagar Panchayat	1346
VI	Kothkai Nagar Panchayat	1149
VI	Narkanda Nagar Panchayat	713
V	Rampur Municipal Council	5653
V	Rohru Nagar Panchayat	6607
VI	Seoni Nagar Panchayat	1529
VI	Jutogh Cantonment Board	2420
I	Shimla Municipal Corporation	142555
	Shimla UA	144975
VI	Theog Municipal Council	3754

Land Use

The district is spread over in deep valleys and high elevation and cultivation is possible only in small terraces of holdings in the high hills or in the basins of stream/ khads. However, in the deep valleys though a very few in number, the cultivation is spread over in a vast area. Most of the land is under shrub forests or grassy land with chil pine trees up to the height of 1,500 metres from the mean sea level and Kail, deodar, rai, ban, mauru and *Rhododendron* and khanor on the high altitudes. It is only in the basins of the rivers, streams and khads that the land is a little bit flat and fertile and the cultivation of cereals and pulses as well as off season vegetables is extensively done.



Land Utilisation Pattern (In Sq.Km)

Total Geographical Area	4919.01
Area under Forest	1182.40
Barren & Uncultivable Land	515.26
Land under non agricultural uses	106.21
Permanent pastures & other grazing lands	2252.39
Land under Misc. Trees	53.21
Fallow land	21.72
Land under cultivation	787.82

Agriculture

The soil texture in the district varies from light sandy to heavy clay, and in the deep valleys and basins it is generally sandy and sandy loam. The district is having different types of soils and agro-climatic conditions which are quite suitable for the growing of various types of cereals, off season vegetables, temperate and stone fruits and

other cash crops. While the areas in the lower elevations are suitable for the growing of cereal crops, stones and citrus fruits, places in the higher reaches are most suitable for growing of seeds potatoes, off season vegetables and temperate fruits especially apples.

From the agricultural point of view the district can be divided into three regions viz. (1) valley and basin areas (2) mid hills and (3) high hills. The low lying areas of Rampur, Kumharsain, Seoni, Shimla, Jubbal, Kotkhai, Chaupal, Theog and Rohru Tehsil/sub-Tehsil are suitable for the growing of cereal crops. In the mid area of these Tehsil there is a great potential for the growing of cereals, vegetables and horticultural products. However, the area on higher altitudes are suitable for the growing of apples, cherry, walnuts, almonds and seed potatoes. Besides the major crops, off season vegetables are being grown in the district since long. Off season vegetables like green peas, cauliflower, cabbage, spinach, beans, ladyfinger, tomatoes etc. appear in the market. This district is known for chillies and biggest chillies growing Tehsils are Theog, Chaupal, Shimla and Seoni. Rice, Maize, Wheat, barley, Common Millets, Pulses, Potato, Chillies, Ginger and Edible Oil seeds are the major crops in the district.

Sr. No.	Particulars	Basantpur	Chirgaon	Chopal	Jubbal	Mashobra	Nankhari	Narkanda	Rohroo	Rampur	Theog	District
1.	Rainfed	514	980.16	622	570	1058	320.5	645	1338.25	1610	2273	9416.91
2.	Maize-wheat	230	140.88	160.5	37	438.5	-	110	85	312	3	1516.88
3.	Maize+pulses-wheat	55	207.2	15	61	299.5	180	2	40	265	-	1124.7
4.	Maize-barley	10	132	18	21	11	5	-	82.25	252	-	531.25
5.	Maize-pea	38	224	97	72	-	-	86	50	200	5	772
6.	Maize-potato	45	136	28	24	-	-	-	70	200	-	503
7.	Potato-fallow-wheat (biennial)	25	-	-	21	-	-	25	260	-	85	416
8.	Maize-toria-wheat	10	-	2	1	-	-	-	-	-	-	13
9.	Potato+ fallow	-	-	-	-	-	-	-	-	-	-	0
10.	Paddy-wheat	-	16	24	57	-	4	-	15	5	-	121
11.	Paddy-barley	-	32	1	12	-	-	-	20	-	-	65
12.	Pulses based	25	48	-	50	-	36.5	185	111	366	358	1179.5
13.	Oilseed based	17	-	3	31	-	-	7	10	-	22	90
14.	Vegetable based	59	4.08	223.5	179	309	60	210	145	10	1800`	2999.58
15.	Potato+ fallow	-	-	-	-	-	30	-	-	-	-	30
16.	Spices based	-	-	-	4	-	-	-	-	-	-	4
17.	Potato-pea	-	-	-	-	-	-	-	450	-	-	450
18.	Potato- rajmash	-	-	-	-	-	5	-	-	-	-	5
19.	Tomato – pea – garlic	-	-	25	-	-	-	-	-	-	-	25
20.	Tomato- pea	-	-	25	-	-	-	-	-	-	-	25
21.	Ginger – wheat	-	-	-	-	-	-	-	-	-	-	0
22.	Irrigated	208	728.12	117	76	167	-	-	-	358	-	1654.12
23.	Maize-wheat	42	64.08	9	7	-	-	-	-	100	-	222.08
24.	Maize+pulses-Wheat	4	88	1	9	-	-	-	-	-	-	102

Sr. No.	Particulars	Basantpur	Chirgaon	Chopal	Jubbal	Mashobra	Nankhari	Narkanda	Rohroo	Rampur	Theog	District
25.	Maize-barley	-	80	2	-	-	-	-	-	-	-	82
26.	Maize-pea	36	152	12	-	-	-	-	-	-	-	200
27.	Maize-potato	45	88	2	-	-	-	-	-	30	-	165
28.	Potato-fallow-wheat (biennial)	5	-	-	-	-	-	-	-	29	-	34
29.	Maize-toria-Wheat	-	-	-	-	-	-	-	-	28	-	28
30.	Chari-berseem -	-	-	1	-	-	-	-	-	-	-	1
31.	Paddy-wheat	-	144	28	-	-	-	-	-	9	-	181
32.	Paddy-barley	-	112	2	-	-	-	-	-	28	-	142
33.	Pulses based	5	-	-	-	-	-	-	-	-	-	5
34.	Oilseed based	4	-	1	-	-	-	-	-	-	-	5
35.	Vegetable based	67	0.04	50	60	166	-	-	-	10	-	353.04
36.	Sugarcane based	-	-	-	-	-	-	-	-	124	-	124
37.	Spices based	-	-	-	-	-	-	-	-	-	-	0
38.	Potato-pea	-	-	-	-	-	-	-	-	-	-	0
39.	Cauliflower-bell pepper	-	-	-	-	-	-	-	-	-	-	0
40.	Cauliflower-bean-pea	-	-	-	-	-	-	-	-	-	-	0
41.	Tomato –pea	-	-	10	-	-	-	-	-	-	-	10
42.	Ginger-wheat	-	-	-	-	1	-	-	-	-	-	1

Irrigation

The scope of irrigation in the district is limited because the entire terrain is mountainous with deep valleys. Whatever irrigation is possible is provided through "Kuhls" from the perennial *khads*. Other system of irrigation is not possible in the district as irrigation by well, ponds and tube wells are almost nonexistent. People are also using tool pumps etc. for irrigation with the availability of electricity. The total irrigated area in the district is 34.49 sq. kms which is totally irrigated by local "kuhls".

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as ***kuhls****, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square meters in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl, the fall is utilized to drive a simple machinery, like flour mills.*

Tehsil wise Position of Irrigated Area in (ha.)

Blocks/ schemes	Number	No. of village covered	Beneficiaries (No.)	Command area (Ha)	Actual area (Ha)
Basantpur	**132**	**124**	**1141**	**270.87**	**270**
Lift	11	14	220	98.46	98
Tubewell	0	-	-	-	-
Kuhl	21	21	421	72.41	72
Canal	0	-	-	-	-
Tank	100	90	500	100	100
Chirgaon	**22**	**27**	**2648.50**	**815.29**	**39.07**
Lift	2	2	16.5	39.07	-
Tubewell	-	-	-	-	-
Kuhl	20	25	2632	776.22	776.22

Blocks/ schemes	Number	No. of village covered	Beneficiaries (No.)	Command area (Ha)	Actual area (Ha)
Canal	-	-	-	-	-
Tank	-	-	-	-	-
Chopal	**42**	**56**	**8245**	**1005.54**	**675.5**
Lift	1	-	-	-	-
Tubewell	-	56	8245	1005.54	675.5
Kuhl	41	-	-	-	-
Canal	-	-	-	-	-
Tank	-	-	-	-	-
Other	-	-	-	-	-
Jubbal	**27**	**61**	**492**	**430.73**	**197.39**
Lift	4	9	82	55.12	34.15
Tubewell	-	-	-	-	-
Kuhl	23	52	410	375.61	163.24
Canal	-	-	-	-	-
Tank	-	-	-	-	-
Mashobra	**9**	**12**	**1200**	**161.91**	**74.11**
Lift	-	-	-	-	-
Tubewell	-	-	-	-	-
Kuhl	9	12	1200	161.91	74.11
Canal	-	-	-	-	-
Tank	-	-	-	-	-
Nankhari	**14**	**19**	**225**	**90**	**65**
Lift	-	-	-	-	-
Tubewell	-	-	-	-	-
Kuhl	4	10	200	75	50
Canal	-	-	-	-	-
Tank	10	9	25	15	15
Narkanda	**10**	**100**	**200**	**-**	**200**
Lift	-	-	-	-	-
Tubewell	-	-	-	-	-
Kuhl	10	100	200	-	200
Canal	-	-	-	-	-
Tank	-	-	-	-	-
Rohroo	**33**	**77**	**765**	**169.60**	**169.60**
Lift	4	7	422	92.99	92.99
Tubewell	-	-	-	-	-
Kuhl	6	44	283	63.61	63.31
Canal	-	-	-	-	-
Tank	23	26	60	13	13
Rampur	**49**	**90**	**3714**	**7987.5**	**1762.5**
Lift	-	-	-	-	-
Tubewell	-	-	-	-	-
Kuhl	24	65	3188	7498	1273
Canal	-	-	-	-	-
Tank	25	25	526	489.5	489.5
Theog	**89**	**88**	**226**	**181.81**	**105.15**
Lift	5	8	142	139.81	75.15
Tubewell	-	-	-	-	-
Kuhl	-	-	-	-	-
Canal	-	-	-	-	-
Tank	84	80	84	42	30
District	**427**	**655**	**18856.50**	**11113.25**	**4334.54**
Lift	27	40	**882.5**	425.45	339.36
Tubewell	-	-	**-**	-	-
Kuhl	158	385	**16779**	10028.30	3347.68
Canal	-	-	**-**	-	-
Tank	242	230	**1195**	659.50	647.5

Livestock

Livestock is the main wealth next to agriculture in the district. The entire terrain in the district is mountainous with high slopes and deep valleys. The development of Agriculture is, therefore, broadly dependent upon the development of animal husbandry. Almost every household keeps a few cows or buffaloes, sheep, goat, pigs and poultry birds. As per livestock Census of 1992 the total number of livestock in the district was 582,368 as compared to 649,052 in 1982. It included 327,690 cattle, 22,450 buffaloes, 1,150 horses and ponies, 364 donkeys, 3,329 mules, 129,949 sheep, 96,378 goats, 1,031 pigs and 27 other type of animals in the district. Besides these, 45,050 poultry birds were also recorded during the livestock Census of 1992 as against the 59,657 poultry birds recorded in the cattle Census of 1982. It seems that the decrease in the number of livestock and poultry birds in the district is lack of interest by the people, shortage of fodder and grazing land due to uncertainty of rains and fencing of grazing land by the forest department and restrictions imposed by the department.

Horticulture

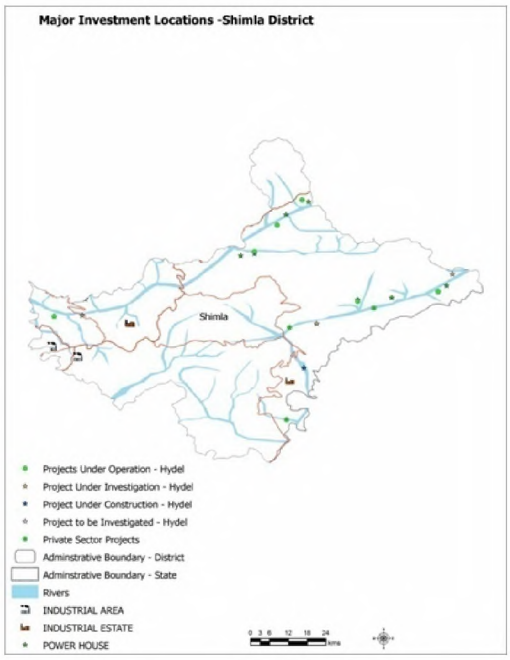
The agro-climatic conditions prevailing in the major parts of the district are most suitable for the growing of temperate fruits. Shimla is the biggest apple growing district in Himachal Pradesh. It also grows other Temperate fruits, Sub-tropical fruits, citrus fruits and Nuts and Dry fruits.

Bee keeping has attained importance since it helps in pollination of apple crops for setting of fruits. Sufficient bee flora is available in the district for the bees for extraction of honey. An AGMARK laboratory where honey is processed, packed under AGMARK label, is working at Kotkhai. In addition to AGMARK laboratory, seven bee keeping stations at Hat Koti, Sawra, Annu, Nerua, Dodra-Kwar, Gauna and Shimla are functioning in the district. There are, at present 60 commercial private units and 500 small private bee keeping units who are running their own bee keeping units in the district.

Fisheries

There is a vast net work of perennial rivers, streams and *khads* in the district and there is a great scope for the development of fish culture. The main fisheries activities in the district may be divided into three categories i.e. (i) development of sport fisheries (ii) conservation of riverine fisheries (iii) development of pond fisheries in rural areas. The *Pabbar* river support good trout fishery which is an attraction to the tourists and foreign anglers.

Industry



The economic development of a place is directly related with the industrialization of that area. Due to peculiar conditions prevailing in the district, the chances of setting up large scale industries are rare. However, there is a much scope for small and medium sized industries, because of the availability of abundant natural hydro electric power resources and infrastructural facilities which are essential for carrying out the diversified economic activity. Presently the

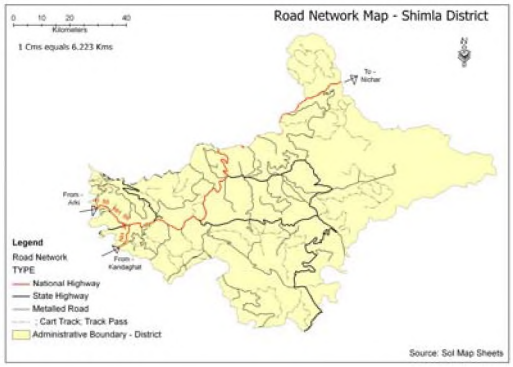
economy of the district is confined to agriculture and horticulture. In order to provide infrastructural facilities to the entrepreneurs, industrial areas were established at Shoghi. Four large and medium scale units viz. M/s Bhillai Wires Pvt. Ltd., M/s Durha Machine Pvt. Ltd., M/s Indian Magnetics Ltd. & M/s Ramson Communication Ltd. were established in 1992.

There are many cottage and small scale registered units in the district. Among the agro- based industries, the units functioning in the district are atta chakki, cotton carding, thresher, oil expeller, bakery, fruit canning and preservation etc. Forest based industries in the district are engaged in the manufacturing of wooden packing cases, wooden furniture, toys, sticks, joinery, beehives and other wooden novelties. Mineral based industrial units in the district mainly consist of stone crusher and earthen pottery while textile based industrial units are manufacturing of hosiery products, woolen shawls, patties, chaddars, thread balls, fancy handicrafts etc. The district is rich in raw material for the establishment of cottage and small scale industries.

Minerals & Mining

Following minerals reported in the district are Limestone, quartzite, slabs, Barytes, Lead and byrite are found in the district but these minerals are not of commercial significance except limestone and slabs slate. Alluvial gold in the Himalayan Rivers is a common feature: Alluvial gold is reported to occur at Chagaon near Urni but it is not of economic importance. Hematite iron ore banded as well as lense like in character is found in Rohru. More important deposits are found distributed in the Banoti valley around Narain and Shakal. The ore found here is more concentrated and is found in the form of lenses and pocketed with very often as big as 283 cubic meters in garnetiferious mica schists on both sides of the river Banoti near Narain. In the Keonthal area and to the south of Shimla, general lenticular bands of iron pyrites occur as slates of Bio-leaugunge stage of Jutogh Series. Iron pyrite is recorded from Kyari (Shamri) nala; Badhaighat 228.6 metres upstream of its confluence with the Kyari nala, North of Rehana; South of Chhota Shimla. An occurrence of pyrite is recorded from Matiana which is situated on the National Highway No. 22, about 48 kilometres from Shimla. Kyanite is abundant in the schists and granites near parts of Bushahr in the western Himalayas. Limestone is reported from Naldehra and Basantpur in the district. A portion of these deposits may be of cement grade. Slates are quarried at many places in the outer Himalayas of Shimla Hills.

Roads & Transport



Road transport is the life line of economy of the district because potential for the development of railways and other means of transport are meager. National Highway No. 22 passes through district which provides supports to the economy of district. Apart from this, narrow gauge Kalka-Shimla rail line, which enter in the district at Shoghi is serving since 1905 A.D. 16 Tehsil/sub-Tehsil of the district have been connected by the motorable roads including (Shimla urban Tehsil) only Dodra-Kwar Tehsil is yet to be provided such facilities and approach to this Tehsil headquarters is on foot. Most of the villages are connected with the Tehsil/sub-Tehsil headquarters by a vast network of motorable roads. The far off villages in the district where there is no road, only foot path and bridle paths have been constructed. An attempt has been made to connect every village with road, but due to

the topography of district less progress has been made in this regard. Since the district has mountainous terrain throughout and rail transportation is difficult, roads are the only means of transportation. The total roads length in the district is 3641 kms. of which 311 kms. are double lanes, 2,786 kms. single lane, 69 kms. jeepable and 475 kms. less than jeepable. Besides these road lengths, there are 4.4 kms. of pucca metalled roads; 383.3 kms. of Kutcha unmetalled road and 1450.6 kms. bridle path.

Length of Roads in Kms. including National Highways

Year	Motorable Double Lane	Motorable Single Lane	Jeepable Road	Less than Jeepable Road	Total Road Length	Motorable Road Per 100 sq. kms. of Area	Pucca Metalled Roads	Kutcha Un-metalled Road
1998-99	311	2,786	69	475	3,641	60.36	4.4 kms.	383.3 kms.

Electricity & Power

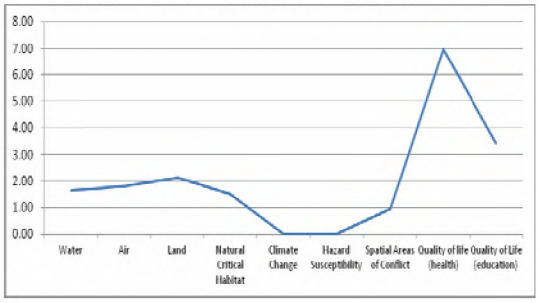
The State has a vast hydel power potential and it has been estimated that 12,700 MW of Hydel power can be generated in the State by constructing various major, medium, small and mini/micro Hydel project on the five river basins. In addition, a large number of unidentified areas are still in the river basins which can contribute substantially to the available power potential. The development of agriculture and industries can hardly be accelerated without the availability of power. In addition, the electricity for domestic use has become indispensable in the modern days. In the field of rural electrification, the State had made remarkable achievement. Inspite of the fact that the state was late starter in field of rural electrification difficult and mountainous terrain, all the inhabited villages were electrified by the end of June, 1988. In Shimla district too, all the villages are electrified as the rural electrification plays a significant role in bridging the socio-economic gap between the rural and urban areas and raising the quality of life even in the remote corner of the district. Three Hydel power houses Nogli, Andhara and Chaba are generating electricity in the district since mid eighties.

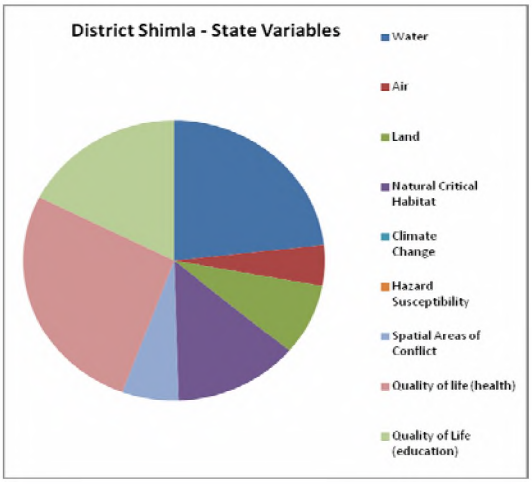
Summary of State Variables at District Level

Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kangra. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Variable Sector	Shimla Vulnerability of State Sector $V_{\text{State Sector}}$
Water	17519.82
Air	3503.42
Land	6215.20
Natural Critical Habitat	10119.31
Climate Change	0.00
Hazard Susceptibility	0.00
Spatial Areas of Conflict	4549.18
Quality of life (health)	20233.22
Quality of Life (education)	13251.20

District Shimla – State Variables VI





As can be seen from the table as well as the chart, the District has abundant water resources. The high scores of Quality of Life indicators in terms of non accessibility to Health and education facilities points out the deficiencies in these sectors. The VI graph also substantiates that the VI in the Quality of Life variables is high.

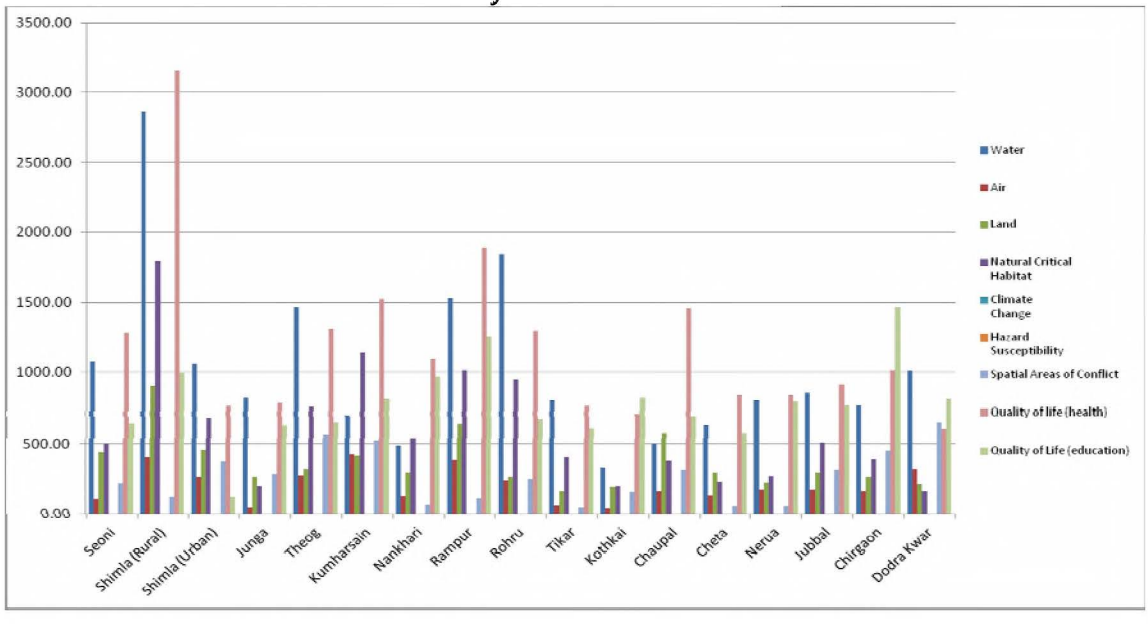
State Variables at Tehsil Level

Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

State variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar	Vulnerability of State Sector $V_{State\ Sector}$
Water	1074.45	2860.63	1060.05	816.86	1462.43	698.24	486.59	1532.41	1844.75	803.76	330.86	500.51	627.86	799.92	850.00	764.00	1006.50	17519.82
Air	105.93	404.32	264.38	47.58	274.60	428.23	125.34	384.03	240.73	61.86	41.47	161.60	134.64	171.38	175.07	163.62	318.64	3503.42
Land	441.61	904.69	454.88	266.02	318.51	414.93	296.77	634.85	265.56	162.87	193.72	567.43	295.44	222.61	294.44	264.86	216.01	6215.20

Shimla District- State Variables – Analysis at the Tehsil Level

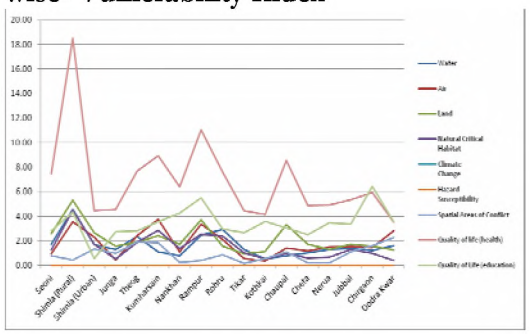


District Shimla- State Variables- Tehsil wise- Vulnerability Index

Quality of Life (education)	Quality of life (health)	Spatial Areas of Conflict	Hazard Susceptibility	Climate Change	Natural Critical Habitat
639.09	1281.15	221.20	0.00	0.00	504.59
991.99	3158.71	124.28	0.00	0.00	1795.58
122.58	762.68	374.31	0.00	0.00	678.67
621.97	781.34	284.25	0.00	0.00	197.28
645.05	1312.86	550.61	0.00	0.00	754.15
812.34	1526.81	521.10	0.00	0.00	1140.57
968.32	1096.50	64.81	0.00	0.00	540.23
1258.60	1890.02	113.80	0.00	0.00	1013.47
675.64	1299.16	247.61	0.00	0.00	948.51
603.39	761.43	48.94	0.00	0.00	404.76
818.63	708.16	155.88	0.00	0.00	198.74
695.96	1458.03	315.61	0.00	0.00	382.57
565.89	835.42	57.35	0.00	0.00	228.13
791.39	838.42	57.06	0.00	0.00	270.37
763.84	911.33	317.57	0.00	0.00	508.20
1463.29	1012.26	451.40	0.00	0.00	388.93
813.23	598.94	643.40	0.00	0.00	164.57
13251.20	20233.22	4549.18	0.00	0.00	10119.31

State variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
Water	1.71	4.56	1.69	1.30	2.33	1.11	0.78	2.44	2.94	1.28	0.53	0.80	1.00	1.28	1.36	1.22	1.61
Air	0.93	3.55	2.32	0.42	2.41	3.76	1.10	3.37	2.11	0.54	0.36	1.42	1.18	1.50	1.54	1.44	2.80
Land	2.58	5.29	2.66	1.56	1.86	2.43	1.74	3.71	1.55	0.95	1.13	3.32	1.73	1.30	1.72	1.55	1.26
Natural Critical Habitat	1.26	4.50	1.70	0.49	1.89	2.86	1.35	2.54	2.38	1.01	0.50	0.96	0.57	0.68	1.27	0.97	0.41
Climate Change	0	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	0.00	0.00	0.00
Hazard Susceptibility	0	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	0.00	0.00	0.00
Spatial Areas of Conflict	0.78	0.44	1.31	1.00	1.93	1.83	0.23	0.40	0.87	0.17	0.55	1.11	0.20	0.20	1.11	1.58	2.26
Quality of life (health)	7.49	18.47	4.46	4.57	7.68	8.93	6.41	11.05	7.60	4.45	4.14	8.53	4.89	4.90	5.33	5.92	3.50
Quality of Life (education)	2.8	4.35	0.54	2.73	2.83	3.56	4.25	5.52	2.96	2.65	3.59	3.05	2.48	3.47	3.35	6.42	3.57

District Shimla- State Variables- Tehsil wise- Vulnerability Index



The analysis of data indicates gaps in infrastructure and services in health and education sector. The gaps in health and education sector are in the critical segment in 12 Tehsils and the remaining 5 are in the high vulnerability segment. Chirgaon and Rampur are critical while Shimla Rural is in the high vulnerability segment. Land is under pressure and is very highly vulnerable in Shimla Rural, because of growth of Shimla city is spreading out in Shimla Rural & its hinterland.

Summary of Pressure Variables at District Level

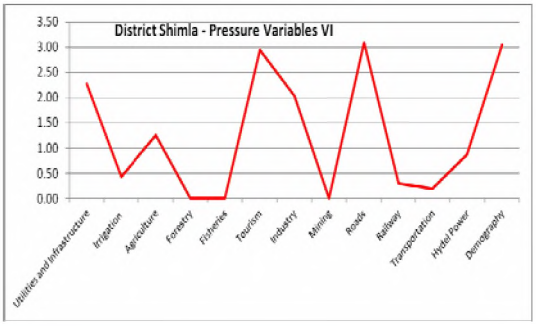
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Kangra. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Shimla District- Pressure Variables – Analysis at the District Level

Variable Sector	Shimla Vulnerability of Pressure Sector

V Pressure Sector	
Utilities and Infrastructure	11597.09
Irrigation	642.09
Agriculture	8233.03
Forestry	0.00
Fisheries	0.00
Tourism	15072.59
Industry	4470.61
Mining	0.00
Roads	20332.50
Railway	217.31
Transportation	146.32
Hydel Power	2543.00
Demography	8912.75

The analysis of data indicates pressure on account of development of Road network. Demographic pressures are increasing the Gaps in Utilities and Infrastructure. Further, analysis indicates that while all the other variables have a controllable Vulnerability index, the Demographic pressure has crossed the critical stage.



Pressure Variables at Tehsil Level

Similarly the pressure variables quantified at Tehsil level are given below:

Comparison of Pressure variables at Tehsil level

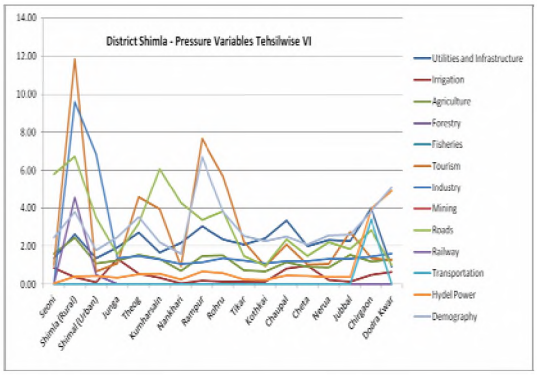
Pressure variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
Utilities and Infrastructure	407.82	786.02	407.40	582.26	818.59	499.45	655.17	913.11	707.41	631.00	723.27	1009.46	598.17	699.30	677.09	1206.62	274.95
Irrigation	73.67	31.81	8.73	115.39	46.30	30.43	3.98	17.49	12.33	10.51	10.41	69.76	84.00	18.51	11.76	42.41	54.60
Agriculture	620.95	940.93	420.84	480.13	596.84	510.51	266.79	579.38	581.89	284.77	256.09	442.56	354.61	343.41	594.83	458.66	499.85
Forestry	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	0.00	0.00	0.00	0.00
Fisheries	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	0.00	0.00	0.00	0.00

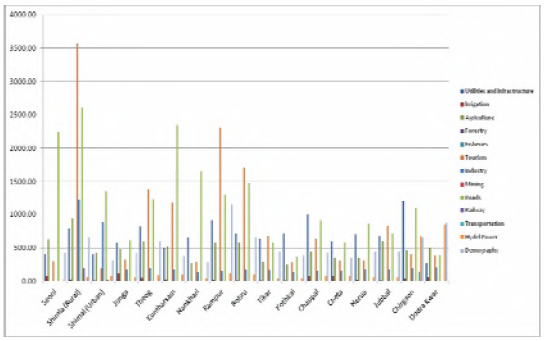
Pressure variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
Tourism	299.85	3563.73	199.57	325.37	1372.80	1187.37	279.25	2311.43	1714.22	669.46	280.69	626.04	309.13	316.24	823.80	407.47	386.17
Industry	0.00	1235.60	882.75	175.00	192.10	168.54	137.08	149.76	177.56	160.94	141.34	158.16	157.50	170.14	172.48	186.58	205.08
Mining	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	0.00	0.00	0.00	0.00
Roads	2250.00	2605.22	1355.92	611.70	1240.30	2350.66	1655.21	1303.28	1477.55	578.18	372.21	908.32	572.83	852.93	712.32	1094.53	391.34
Railway	0.00	196.01	21.30	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	0.00
Transportation	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	0.00	0.00	0.00	0.00
Hydel Power	8.73	67.64	75.20	60.52	91.04	97.07	40.66	115.79	101.58	43.98	39.89	81.10	72.62	62.82	62.02	677.08	845.26
Demography	421.74	655.10	305.63	425.23	606.20	379.19	277.47	1152.90	654.29	438.25	387.53	432.47	356.27	441.80	446.45	659.21	873.02

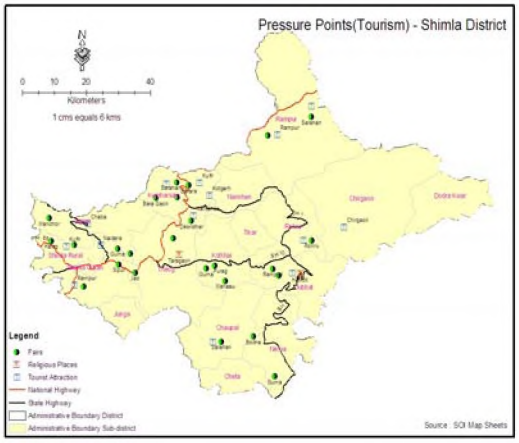
District Shimla- Pressure Variables –Tehsil wise Vulnerability Index

Pressure variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
Utilities and Infrastructure	1.35	2.61	1.35	1.93	2.72	1.66	2.18	3.03	2.35	2.10	2.40	3.35	1.99	2.32	2.25	4.01	0.91
Irrigation	0.86	0.37	0.10	1.34	0.54	0.35	0.05	0.20	0.14	0.12	0.12	0.81	0.98	0.22	0.14	0.49	0.63
Agriculture	1.60	2.43	1.09	1.24	1.54	1.32	0.69	1.50	1.50	0.74	0.66	1.14	0.92	0.89	1.54	1.19	1.29
Forestry	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	0.00	0.00	0.00	0.00
Fisheries	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	0.00	0.00	0.00	0.00

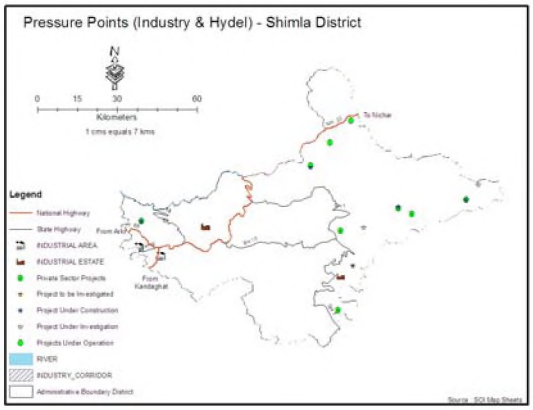
Pressure variables	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
Tourism	1.00	11.84	0.66	1.08	4.56	3.94	0.93	7.68	5.70	2.22	0.93	2.08	1.03	1.05	2.74	1.35	1.28
Industry	0.00	9.58	6.84	1.36	1.49	1.31	1.06	1.16	1.38	1.25	1.10	1.23	1.22	1.32	1.34	1.45	1.59
Mining	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	0.00	0.00	0.00	0.00
Roads	5.81	6.73	3.50	1.58	3.20	6.07	4.28	3.37	3.82	1.49	0.96	2.35	1.48	2.20	1.84	2.83	1.01
Railway	0.00	4.56	0.50	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	0.00
Transportation	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	0.00	0.00	3.40	0.00
Hydel Power	0.05	0.39	0.44	0.35	0.53	0.56	0.24	0.67	0.59	0.26	0.23	0.47	0.42	0.37	0.36	3.94	4.91
Demography	2.45	3.81	1.78	2.47	3.52	2.20	1.61	6.70	3.80	2.55	2.25	2.51	2.07	2.57	2.60	3.83	5.08







The analysis of data indicates that Shimla Rural and Rampur Tehsils face cumulative Pressure. Both these Tehsils have crossed the critical stage as far as Tourism pressure is concerned. This indicates that a large number of accommodation and other facilities for tourists have been developed in Shimla Rural. Tourism and Industries development in Shimla Rural and Shimla Urban has made them, critically vulnerable. Demographic pressure has crossed the critical stage in Rampur and is in the high vulnerability segment in Dodra Kwar.

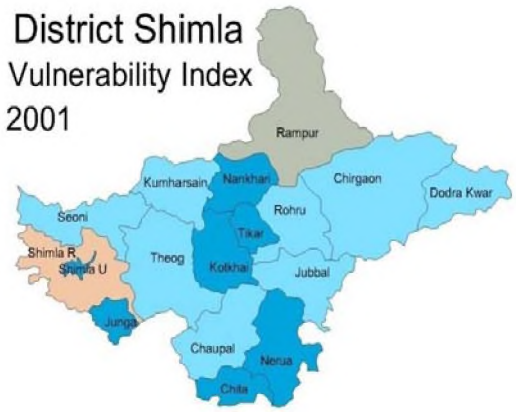


Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Kangra. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case

may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
VI	4132.91	10092.86	3677.33	2988.61	5180.18	5436.21	3528.61	6543.12	5426.83	2818.01	2424.43	4087.47	2718.14	3118.20	3713.74	4432.65	3743.27
denominator = 57x43	**2451**																
Normalized VI	**1.69**	**4.12**	**1.50**	**1.22**	**2.11**	**2.22**	**1.44**	**2.67**	**2.21**	**1.15**	**0.99**	**1.67**	**1.11**	**1.27**	**1.52**	**1.81**	**1.53**

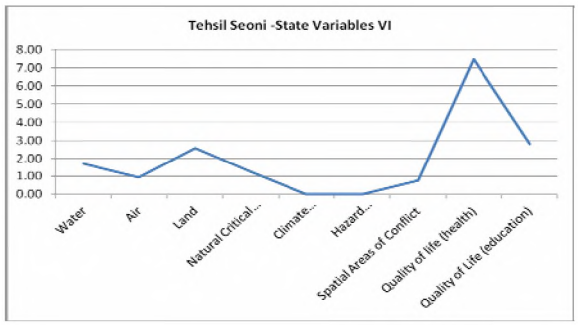


The analysis of data indicates that Vulnerability Index ranges of all the Tehsils in the District of Shimla, almost all the Tehsils are in the very low or low vulnerability range with the exception of the entry points to the district, Shimla Rural, which is in the moderately high vulnerability segment and Rampur, which is in the moderately low vulnerability segment. Interestingly, Shimla Urban, the State Capital is in the very low vulnerability segment, while the Shimla Rural, encircling the Shimla Urban is in the highest vulnerability segment. This is on account of the activities taking place in the surrounding areas from the State Capital and thus Shimla Rural is under pressure.

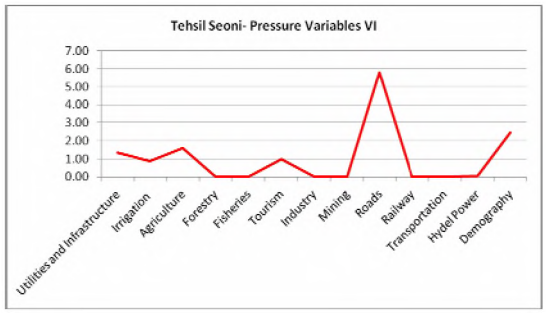
Description of Sectoral Vulnerability at Tehsil Level:

State & Pressure variables have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Tehsil Suni- Overall Vulnerability Index-1.69

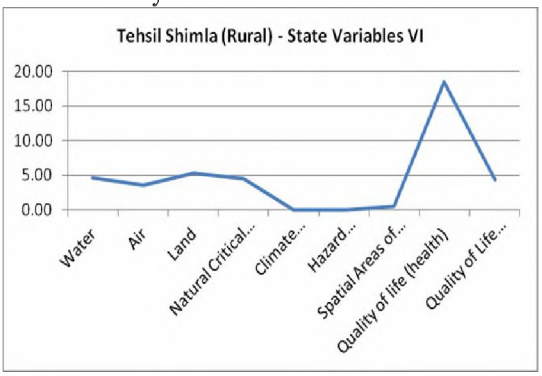


The analysis of data indicates gaps in infrastructure and services in Health sector which has already crossed the critical vulnerability stage. All other variables are in controllable stage. A programme for improving infrastructure and services in Health sector can reduce the Vulnerability.

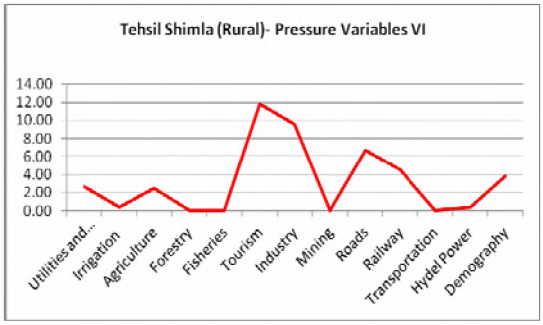


The analysis of data indicates pressures on account of development road network which has crossed the critical vulnerability. New and expansion of existing road network (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Shimla Rural- Overall Vulnerability Index- 4.12



The analysis of data indicates that Land which is under pressure and in the high vulnerability segment is also approaching the critical stage. Further, the gaps in infrastructure and services in health sector is way beyond the critical stage. Gaps in infrastructure in education sector, though not yet critical, are also in the high vulnerability segment Land use can be in accordance with development plan / land use plan / State Agriculture Plan / District Agriculture Plan. Programme for improving infrastructure and services in health and education sector can reduce the Vulnerability.

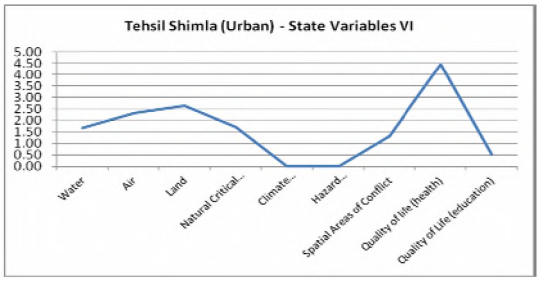


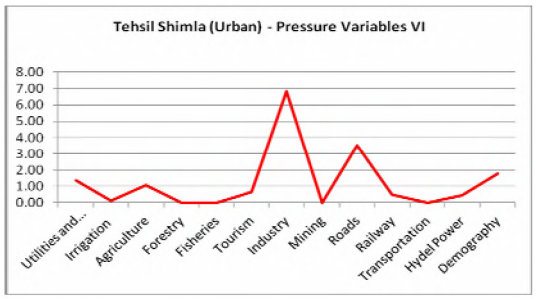
The analysis of data indicates that pressure from Tourism and Industrial development on Land has crossed the critical stage. Expansion of existing and new Industries and Tourism development can be as per current and future needs and in accordance with Tourism Master Plan and concerned sectoral guidelines. Pressure from road network development is also critical. New and expansion of existing road network (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Shimla Urban- Overall Vulnerability Index- 1.50

The analysis of data indicates gaps in infrastructure and services in health sector, which is in the moderately high vulnerability segment, but approaching high segment. All other variables are in controllable low or very low vulnerability segments

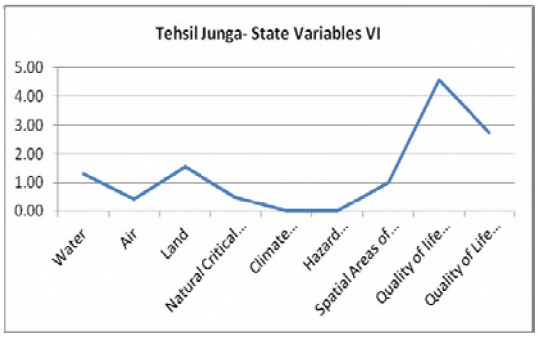
A programme for improving health infrastructure and services can reduce the VI.



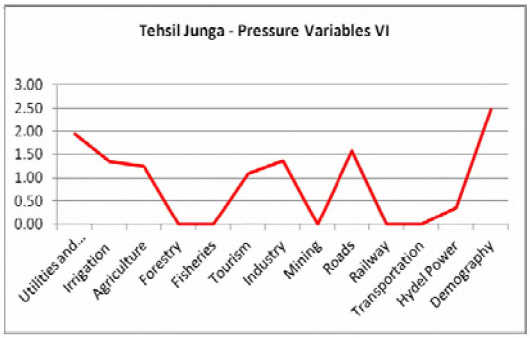


The analysis of data indicates that pressures on account of Industrial development in the Tehsil have crossed the critical stage. Pressures from road network development is in moderately low vulnerability segment. New and expansion of existing road network (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Junga- Overall Vulnerability Index- 1.22

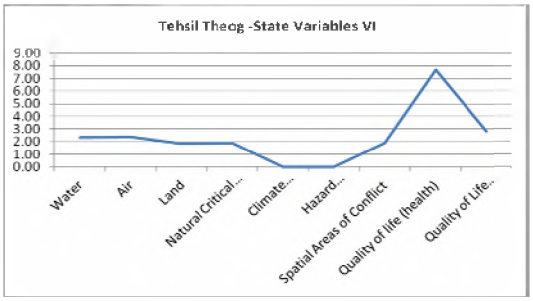


The analysis of data indicates gaps in infrastructure and services in health sector. All other variables are within controllable limits. A programme for improving health infrastructure and services can reduce the VI.

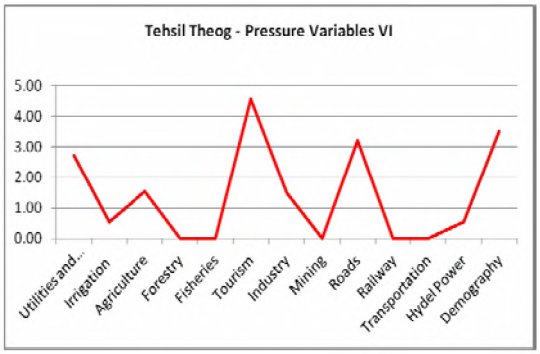


The analysis of data indicates that all the variables are in the low or very low vulnerability segments.

Tehsil Theog- Overall Vulnerability Index- 2.11



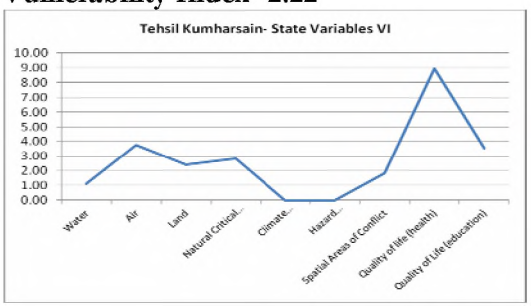
The analysis of data indicates gaps in infrastructure and services in health sector. All other variables are in the very low vulnerability and low vulnerability segment. A programme for improving health infrastructure and services can reduce the VI.



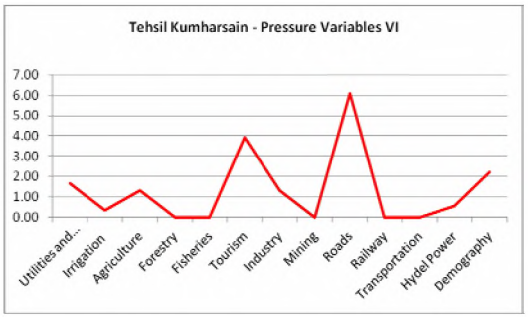
The analysis of data indicates pressure from Tourism, which is in the moderately high vulnerability segment. Gaps in Utilities & Infrastructure, Roads network development and Demography are in the moderately low vulnerability segment. All other segments are in the very low vulnerability segment.

Preparation of a Plan for Tourism, as per Tourism Master Plan along with projects for improving Utilities & Infrastructure can reduce Vulnerability Index.

Tehsil Kumaharsain- Overall Vulnerability Index- 2.22

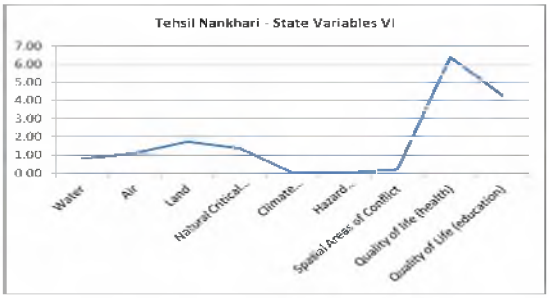


The analysis of data indicates gaps in infrastructure and services in health sector which have crossed the critical stage. Gaps in education infrastructure is in the moderately high vulnerability segment. All other variables are within controllable segments. A programme for improving health and education infrastructure and services can reduce the VI.

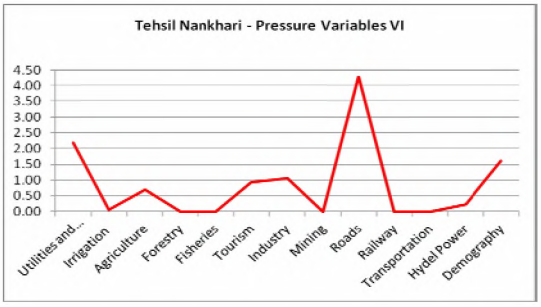


The analysis of data indicates pressure from Tourism development and Road network development. Plan for Tourism can be prepared as per Tourism Master Plan. New and expansion of existing road network (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Nankhari- Overall Vulnerability- 1.44

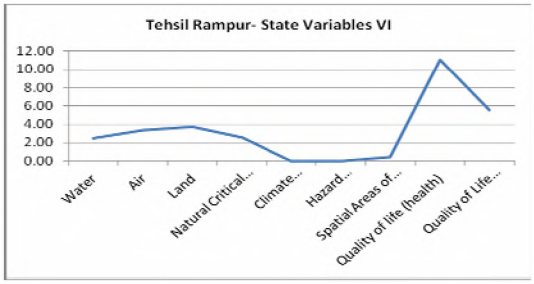


The analysis of data indicates gaps in infrastructure and services in health sector which has reached beyond the critical stage. Similarly, gaps in education sector though in a moderately high vulnerability segment is approaching the high vulnerability segment. A programme for improving health and education infrastructure and services can reduce the VI.

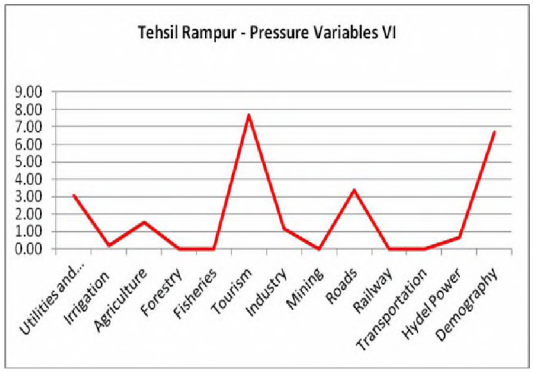


The analysis of data indicates pressure from development of Road network. All other variables are in the low or very low vulnerability segment.

Tehsil Rampur- Overall Vulnerability Index-2.67

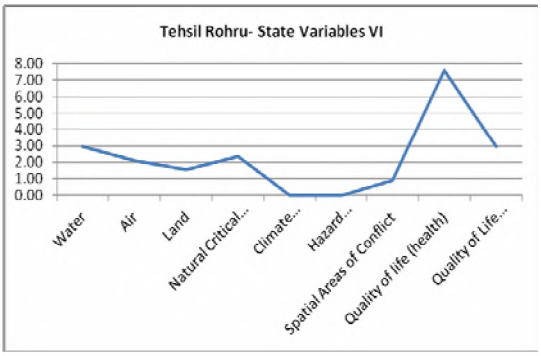


The analysis of data indicates gaps in infrastructure and services in health and education sector which have crossed the critical vulnerability segment. Land is under pressure, due to diversion of land for non agricultural use. The Tehsil is used as a transit to Kinnaur and that is reflected in the Air quality which is in the moderately high vulnerability segment. Other than these, all the other variables are under controllable stages. A programme for improving infrastructure and services in health and education sector can reduce vulnerability.

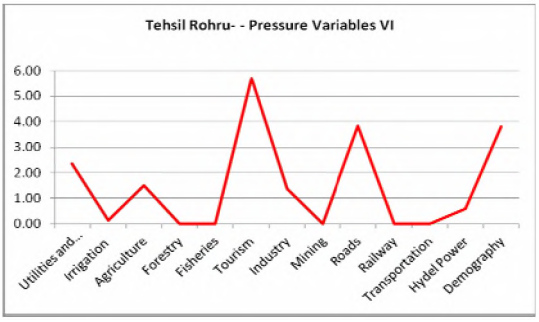


The analysis of data indicates pressure from Tourism development and demographic growth which have crossed the critical vulnerability stage. All other variables are under controllable segments. Plan for Tourism can be prepared as per Tourism Master Plan to reduce vulnerability.

Tehsil Rohru- Overall Vulnerability Index- 2.21

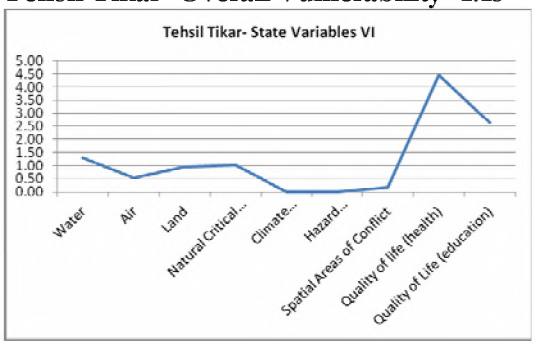


The analysis of data indicate gaps in infrastructure and services in health sector which has crossed the critical vulnerability segment. Other than these, all the other variables are under controllable stages. A programme for improving infrastructure and services in health sector can reduce the VI.

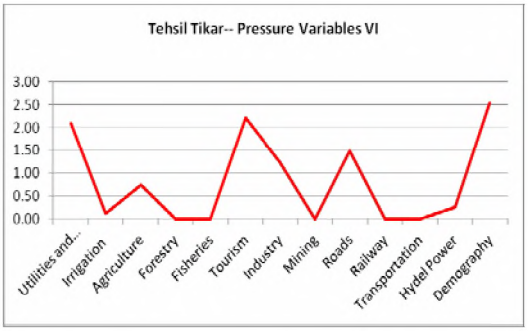


The analysis of data indicates that pressure from Tourism development and demographic growth has crossed the critical vulnerability stage. Pressure from Road network development has reached moderately high vulnerability segment. All other variables are under controllable segments.Plan for Tourism can be prepared as per Tourism Master Plan to reduce vulnerability. New and expansion of existing road network (including maintenance works) can be as per development needs and concerned sectoral guidelines.

Tehsil Tikar- Overall Vulnerability- 1.15

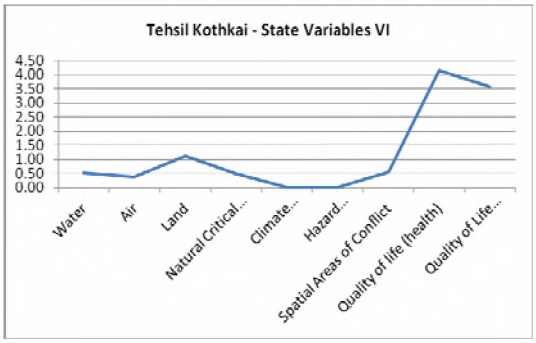


The analysis of data indicates gaps in infrastructure and services in health sector which is currently in the moderately high vulnerability segment but close to the high vulnerability segment. Gaps in infrastructure in Education sector is in the moderately low vulnerability segment. All the other variables are either in the very low or low vulnerability segment. A programme to improve infrastructure and services in Health & Education sector can reduce vulnerability.

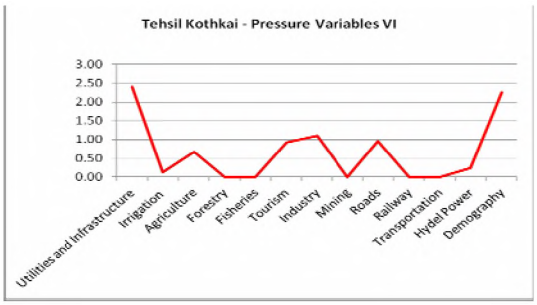


The analysis of data indicates that all variables are in controllable segments.

Tehsil Kothkai- Overall Vulnerability Index- 0.99

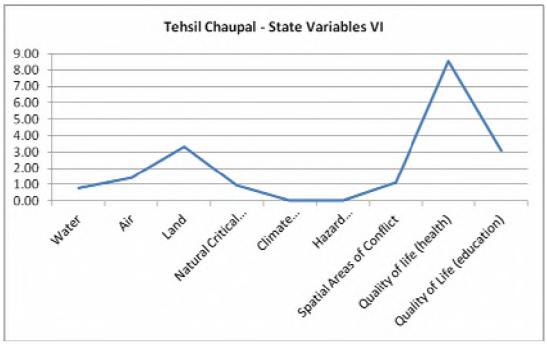


The analysis of data indicates gaps in infrastructure and services in health and education sector. Education sector is in high vulnerability segment and health is in moderately high vulnerability segment. A programme to improve infrastructure and services in health and education sector can reduce Vulnerability.

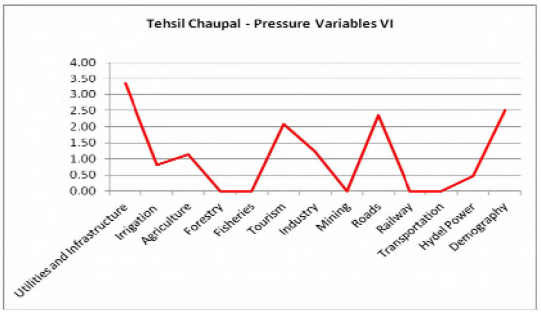


The analysis of data indicates that all the variables are in the low or very low vulnerability segment and thus there is no cause for immediate/priority concern.

Tehsil Chaupal- Overall Vulnerability Index- 1.67

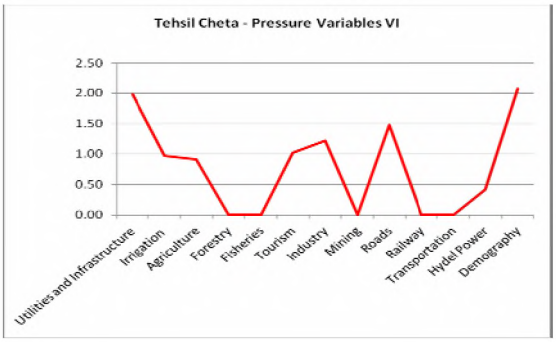


The analysis of data indicates gaps in infrastructure and services in Health. A programme to improve gaps infrastructure and services in health sectors can help in reducing the vulnerability.



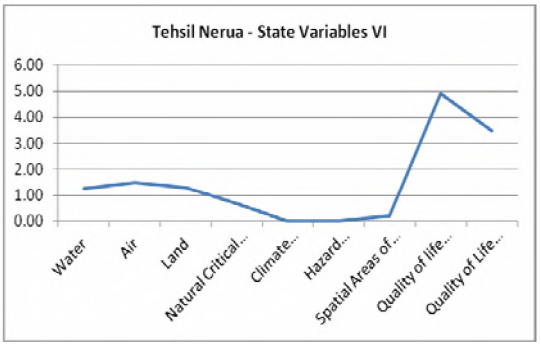
Gaps in Utilities and Infrastructure are evident though it is in the moderately low segment. All other variables are in the low or very low vulnerability segment and thus can be controlled. Further, projects to improve Utilities and Infrastructure can reduce vulnerability.

Tehsil Cheta- Overall Vulnerability Index- 1.11

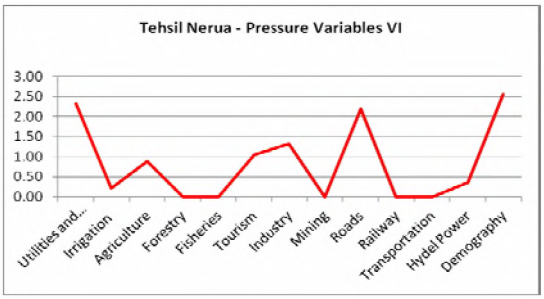


The analysis of data indicates gaps in infrastructure and services in Health and education sectors which are in the moderately high vulnerability segment. All other variables are in low or very low vulnerability segments. A programme to improve infrastructure and services in health and education sectors can reduce the overall vulnerability which is currently very low. The analysis of data indicates that all the variables are in the low or very low vulnerability segment.

Tehsil Nerua – Overall Vulnerability Index – 1.27

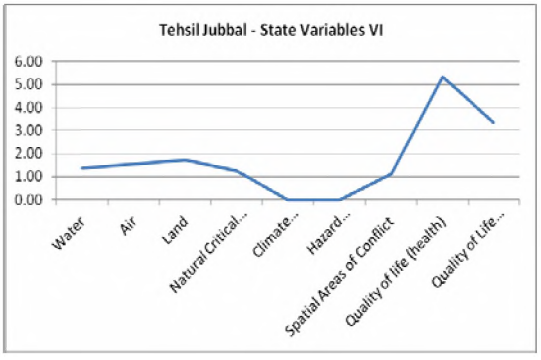


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors. The Health sector is in the high vulnerability segment while Education sector is in the moderately high vulnerability segment. A programme to improve infrastructure and services in Health and Education sectors can reduce the vulnerability.

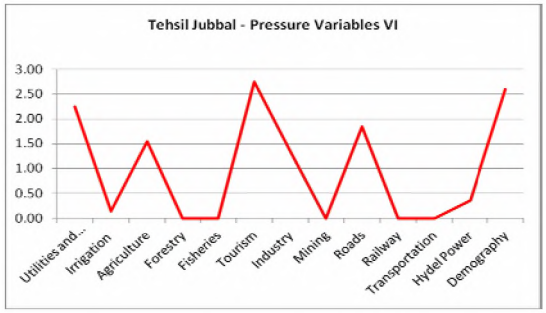


The analysis of data indicates that all the variables are in the low or very low vulnerability segments. A plan to improve the Utilities & Infrastructure can reduce the VI.

Tehsil Jubbal- Overall Vulnerability Index- 1.52

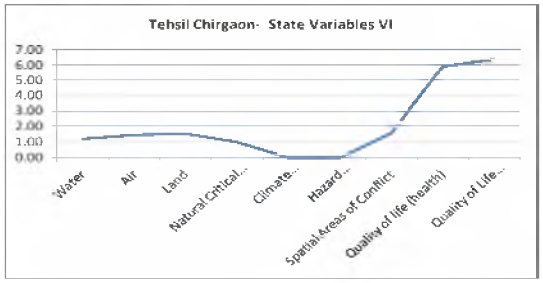


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors. The Health sector is in the high vulnerability segment while Education sector is in the moderately low vulnerability segment. All other variables are in the low or very low vulnerability segment. A programme to improve infrastructure and services in Health and Education sectors can reduce the vulnerability.

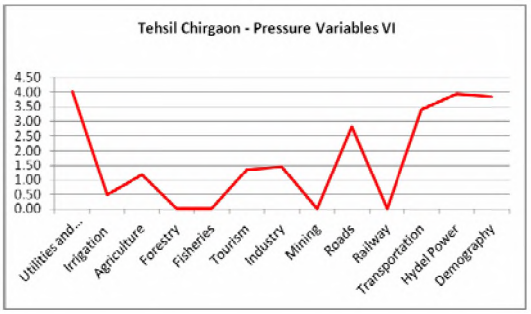


The analysis of data indicates that no variables are a cause of immediate/priority concern.

Tehsil Chirgaon - Overall Vulnerability Index- 1.81

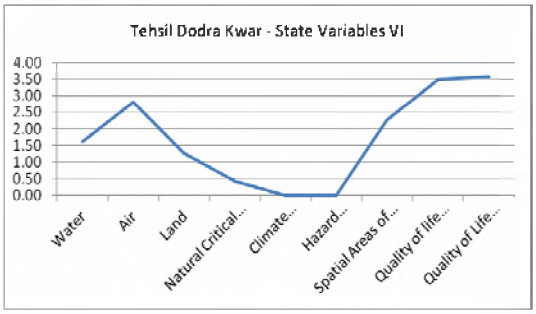


The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which have crossed the critical vulnerability stage. A programme to improve infrastructure and services in Health and Education sectors can reduce the vulnerability.

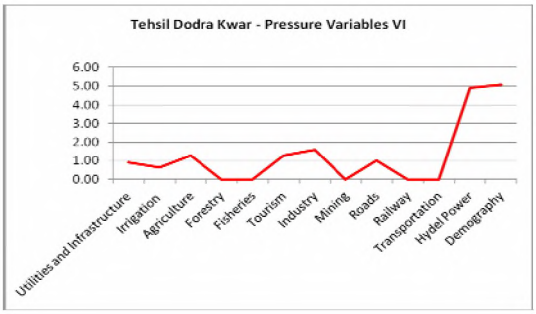


The analysis of data indicates gaps in Utilities and Infrastructure and Demographic pressures, both are in the moderately high vulnerability segments. Pressure from Road network development is in the moderately low vulnerability segment. A Plan to improve the gaps in Utilities and Infrastructure can help in reducing the vulnerability.

Tehsil Dodra Kwar- Overall Vulnerability Index- 1.53



The analysis of data indicates gaps in infrastructure and services in Health and Education sectors which are in the moderately high vulnerability segments. A programme to improve infrastructure and services in Health and Education sectors can reduce the vulnerability.



The analysis of data indicates that all variables are in the very low vulnerability segment. On an overall basis, by addressing gaps in infrastructure and services in Health and Education sectors, in utilities and infrastructure, and carrying out a capacity based tourism plan in accordance with Tourism Master Plan, the Vulnerability can be reduced. Similarly, conflict resolutions at the Spatial Areas of Conflict can reduce the vulnerability.

Vulnerability Levels in Regional Context:

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

Having assessed the VI for Shimla District, it would be interesting to juxtaposition these VI values with values for adjoining Tehsils of other Districts. The matrix below displays the relationship-

Shimla

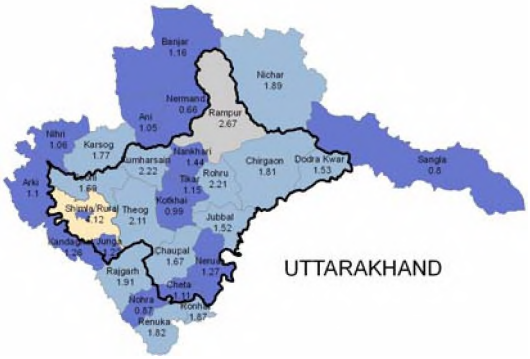
Sr. No.	Tehsil	VI	Adjoining Tehsil in Shimla District	VI	Adjoining Tehsil in Other District	District	VI
1	Rampur	2.67	Nankhari	1.44	Nichar	Kinnaur	1.89
			Rohru	2.21	Nermand	Kullu	0.66
			Chirgaon	1.81	Banjar	Kullu	1.16
2	Nankhari	1.44	Rampur	2.67	Nermand	Kullu	0.66
			Rohru	2.21			
			Tikar	1.15			
			Kothkai	0.99			
			Kumharsain	2.22			

Sr. No.	Tehsil	VI	Adjoining Tehsil in Shimla District	VI	Adjoining Tehsil in Other District	District	VI
3	Kumharsain	2.22	Nankhari	1.44	Karsog	Mandi	1.77
			Kothkai	0.99	Ani	Kullu	1.05
			Theog	2.11			
			Seoni	1.69			
4	Seoni	1.69	Kumharsain	2.22	Arki	Solan	1.10
			Theog	2.11	Karsog	Mandi	1.77
			Shimla (Rural)	4.12	Nihri	Mandi	1.06
5	Shimla Rural	4.12	Seoni	1.69	Rajgarh	Sirmaur	1.91
			Theog	2.11	Arki	Solan	1.10
			Junga	1.22	Kandaghat	Solan	1.26
6	Shimla Urban	1.50	Shimla (Rural)	4.12			
7	Junga	1.22	Shimla (Rural)	4.12	Rajgarh	Sirmaur	1.91
					Kandaghat	Solan	1.26
8	Theog	2.11	Kumharsain	2.22	Rajgarh	Sirmaur	1.91
			Kothkai	0.99			
			Chaupal	1.67			
			Shimla Rural	4.12			
			Seoni	1.69			
8	Chaupal	1.67	Jubbal	1.52	Rajgarh	Sirmaur	1.91
			Nerua	1.27	Nohra	Sirmaur	0.87
			Cheta	1.11			
			Theog	2.11			
			Kothkai	0.99			
9	Cheta	1.11	Nerua	1.27	Nohra	Sirmaur	0.87
			Chaupal	1.67	Renuka	Sirmaur	1.82
					Ronhat	Sirmaur	1.87
10	Nerua	1.27	Jubbal	1.52	Ronhat	Sirmaur	1.87
			Cheta	1.11			
			Chaupal	1.67			
11	Jubbal	1.52	Chirgaon	1.81			
			Rohru	2.21			
			Kothkai	0.99			
			Chaupal	1.67			
			Nerua	1.27			
12	Kothkai	0.99	Nankhari	1.44			
			Tikar	1.15			
			Rohru	2.21			
			Jubbal	1.52			
			Chaupal	1.67			
			Theog	2.11			
			Kumharsain	2.22			
13	Tikar	1.15	Rohru	2.21			
			Kothkai	0.99			
			Nankhari	1.44			
14	Rohru	2.21	Chirgaon	1.81			
			Jubbal	1.52			
			Kothkai	0.99			
			Tikar	1.15			
			Nankhari	1.44			
			Rampur	2.67			
15	Chirgaon	1.81	Dodrakwar	1.53	Nichar	Kinnaur	1.89
			Jubbal	1.52	Sangla	Kinnaur	0.80
			Rohru	2.21			
			Rampur	2.67			
16	Dodrakwar	1.53	Chirgaon	1.81	Sangla	Kinnaur	0.80

Range

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Shimla is surrounded by various Tehsils of District Kinnaur, Kullu Mandi, Solan and Sirmaur. The vulnerability levels of all surrounding areas are less than that of what is prevailing in various Tehsil/ Sub tehsils except for Junga, Chaupal and Nerua. The transitional impact of vulnerability possibly will give rise to vulnerability levels in when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the programme as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken. There is a need felt to recharge the ground water by developing the small check dams on the non perennial *khuds* and tributaries to improvise the irrigation scenario in the district.

(ii) As is observed from the analysis, the quality of life in terms of health and education required to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

The quality of life parameters for health include accessibility to a Primary Health Center within a distance of 3 Kilometres, Community Health Center within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometers. Villages which do not have these facilities within the specified distance are deficient. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils(in descending order)-. Shimla Rural, Rampur, Seoni, Tikar, Rohru and *Theog*

Similarly, for the quality of life parameters for education, the district has an excellent network up-to the college level but intensive efforts are needed in establishment of Vocational training Institutions, so that villages within 25 kms radius have accessibility. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

Priority Tehsils (in descending order)-)-. Chirgaon, Rampur, Nankhari, Shimla Rural, Seoni, Tikar and *Kotkhai*

The benchmarking of the norms has been done with a view of the terrain in the State.

A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(iii) The district has a number of Demarcated and un-demarcated Protected forests. Creation of buffer zones around these Natural Critical Habitats may in future, upgrade them to the Reserve Forest level. This has to be done through a series of plans culminating into projects.

It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

(iv)Though almost all the Tehsils, reveals probable Spatial Areas of Conflict in small quantum, Shimla Tehsil displays a sizable quantum of Spatial Areas of Conflict. Most of these are primarily related to conflict with water due to the setting up of Hydro power projects, Industrial development or Urban development near water bodies.

Pressure Parameters

(viii) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ix) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(x) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has increased by approximately 16% on an average in the entire district. In future, the current agriculture land use can change to non agriculture land use, for instance, Industrial development and Urbanization. Rationalization of land requirement for Industrial and habitation can be done and policy for Industrial Growth and Urbanization may include this through norms developed on the basis of type of Industry and Urban Activities and its planned output including employment potential.

(xi) Tourism as a parameter is the next highest scorer in the district pressure parameters. A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed District Level

Plans for Tourism is required to be prepared.

(xii) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Variable	Policy	Plan	Program	Project	Remarks
State					
Water		*	*		Water Utilization Plan
Quality of life (Health)			*		Program to improve access
Quality of life (Education)			*		Program to improve access
Natural Critical Habitat		*		*	Improvement of Resource through Buffer Zones and developmental projects
Pressure					
Roads	*				Policy to take care of State variables
Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
Agriculture	*				Policy regarding Diversion of land for non-agricultural use
Tourism		*			Tourism Plan at State, District, and Destination Level

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VULNERABILITY INDEX 2001

	Seoni	Shimla (Rural)	Shimla (Urban)	Junga	Theog	Kumharsain	Nankhari	Rampur	Rohru	Tikar	Kothkai	Chaupal	Cheta	Nerua	Jubbal	Chirgaon	Dodra Kwar
VI	1.69	4.12	1.5	1.22	2.11	2.22	1.44	2.67	2.2	1.1	0.99	1.7	1.11	1.3	1.5	1.8	1.53

Population Projections

Tehsil	Population 2001	Proj. Pop 2011	Proj. Pop 2021	Proj. Pop 2031	Proj Pop. 2041
Seoni	31425	33780	36439	39402	42660
Shimla (Rural)	75941	90270	106607	133777	159595
Shimla (Urban)	142555	180119	225380	277948	337762
Junga	12422	14063	15940	18039	20344
Theog	77954	90184	104500	120774	138853
Kumharsain	40577	43265	46130	49169	52379
Nankhari	25154	28467	32222	36396	40960
Rampur	72026	88005	107237	129377	154101
Rohru	44887	52665	62556	74652	89083
Tikar	12590	13638	14059	16531	18329
Kothkai	34155	36983	39968	43116	46431
Chaupal	28387	32419	37139	42514	48500
Cheta	16831	20330	24521	29329	34685
Nerua	31192	36513	42814	50009	58005
Jubbal	33649	36988	40700	44783	49221
Chirgaon	39513	46584	55203	65199	76407
Dodra Kwar	5564	6613	7730	9001	10411

Calculation of Per Capita Share of VI

Tehsil	Population 2001	VI 2001	VI share
Seoni	31425	1.69	5.38
Shimla (Rural)	75941	4.12	5.43
Shimla (Urban)	142555	1.5	1.05
Junga	12422	1.22	9.82
Theog	77954	2.11	2.71
Kumharsain	40577	2.22	5.47
Nankhari	25154	1.44	5.72
Rampur	72026	2.67	3.71
Rohru	44887	2.21	4.92
Tikar	12590	1.15	9.13
Kothkai	34155	0.99	2.9
Chaupal	28387	1.67	5.88
Cheta	16831	1.11	6.59
Nerua	31192	1.27	4.07
Jubbal	33649	1.52	4.52
Chirgaon	39513	1.81	4.58
Dodra Kwar	5564	1.53	0.000275

Calculation of Projected VI

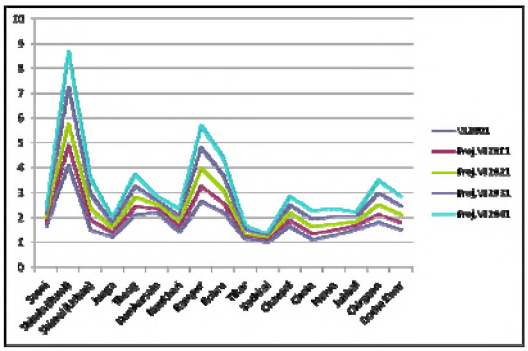
Tehsil	Population 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj.Pop2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Seoni	31425	1.69	5.38	33780	1.82	36439	1.96	39402	2.12	42660	2.29
Shimla (Rural)	75941	4.12	5.43	90270	4.90	106607	5.78	133777	7.26	159595	8.66
Shimla (Urban)	142555	1.5	1.05	180119	1.90	225380	2.37	277948	2.92	337762	3.55
Junga	12422	1.22	9.82	14063	1.38	15940	1.57	18039	1.77	20344	2.00
Theog	77954	2.11	2.71	90184	2.44	104500	2.83	120774	3.27	138853	3.76
Kumharsain	40577	2.22	5.47	43265	2.37	46130	2.52	49169	2.69	52379	2.87
Nankhari	25154	1.44	5.72	28467	1.63	32222	1.84	36396	2.08	40960	2.34
Rampur	72026	2.67	3.71	88005	3.26	107237	3.98	129377	4.80	154101	5.71
Rohru	44887	2.21	4.92	52665	2.59	62556	3.08	74652	3.68	89083	4.39
Tikar	12590	1.15	9.13	13638	1.25	14059	1.28	16531	1.51	18329	1.67
Kothkai	34155	0.99	2.9	36983	1.07	39968	1.16	43116	1.25	46431	1.35
Chaupal	28387	1.67	5.88	32419	1.91	37139	2.18	42514	2.50	48500	2.85
Cheta	16831	1.11	6.59	20330	1.34	24521	1.62	29329	1.93	34685	2.29
Nerua	31192	1.27	4.07	36513	1.49	42814	1.74	50009	2.04	58005	2.36

Tehsil	Population 2001	VI 2001	VI share	Proj. Pop 2011	Proj.VI 2011	Proj.Pop 2021	Proj.VI 2021	Proj.Pop2031	Proj.VI 2031	Proj Pop. 2041	Proj.VI 2041
Jubbal	33649	1.52	4.52	36988	1.67	40700	1.84	44783	2.02	49221	2.22
Chirgaon	39513	1.81	4.58	46584	2.13	55203	2.53	65199	2.99	76407	3.50
Dodra Kwar	5564	1.53	0.000275	6613	1.82	7730	2.13	9001	2.48	10411	2.86

Projected VI

Tehsil	VI 2001	Proj.VI 2011	Proj.VI 2021	Proj.VI 2031	Proj.VI 2041
Seoni	1.69	1.82	1.96	2.12	2.29
Shimla (Rural)	4.12	4.90	5.78	7.26	8.66
Shimla (Urban)	1.5	1.90	2.37	2.92	3.55
Junga	1.22	1.38	1.57	1.77	2.00
Theog	2.11	2.44	2.83	3.27	3.76
Kumharsain	2.22	2.37	2.52	2.69	2.87
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Rampur	2.67	3.26	3.98	4.80	5.71
Rohru	2.21	2.59	3.08	3.68	4.39
Tikar	1.15	1.25	1.28	1.51	1.67
Kothkai	0.99	1.07	1.16	1.25	1.35
Chaupal	1.67	1.91	2.18	2.50	2.85
Cheta	1.11	1.34	1.62	1.93	2.29
Nerua	1.27	1.49	1.74	2.04	2.36
Jubbal	1.52	1.67	1.84	2.02	2.22
Chirgaon	1.81	2.13	2.53	2.99	3.50
Dodra Kwar	1.53	1.82	2.13	2.48	2.86

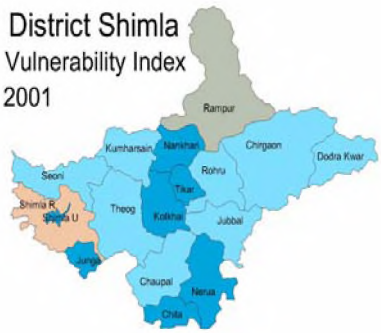
Projected Vulnerability Index- Mapping the scenario

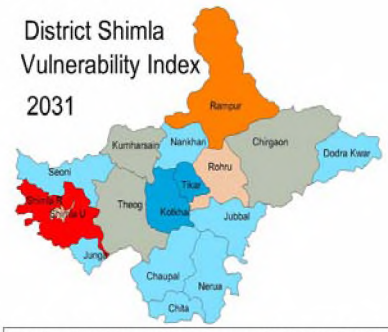


Range

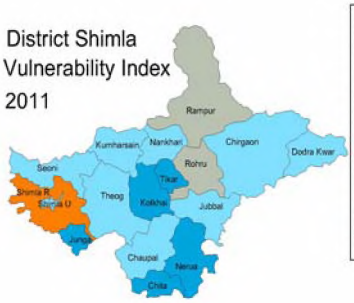
Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

2001

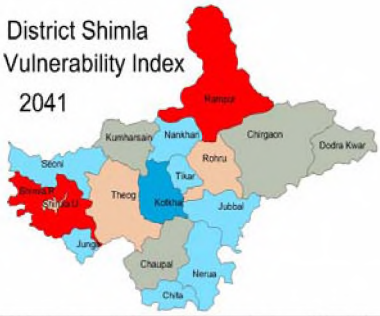




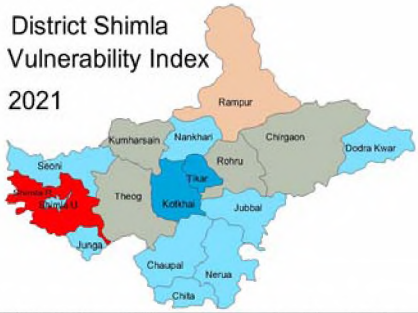
While Shimla Rural remains critical, Rampur too moves to the high vulnerability segment. Shimla Urban moves to the moderately high vulnerability segment. Rohru moves to moderately high vulnerability segment while Theog, Kumharsain and Chirgaon retain their moderately low vulnerability segment. Tikar and Kothkai remain in the very low vulnerability segment while Seoni, Nankhari, Chaupal, Dodra Kwar, Junga, Cheta, Nerua and Jubbal remain in the low vulnerability segment.



As can be seen, Shimla Rural have moved from the moderately high vulnerability segment to high vulnerability segment. Rampur retains its moderately low vulnerability segment and Rohru joins it. Shimla Urban, Nankhari and Jubbal move from very low vulnerability segment to low vulnerability segment while Seoni, Theog, Kumharsain, Dodra Kwar and Chirgaon retain their low vulnerability segment. Tikar, Kothkai, Nerua, Cheta and Junga remain in the very low vulnerability segment.



While Shimla Rural remains critical, Rampur joins it in the critical segment. Shimla Urban moves to the high vulnerability segment. Rohru and Theog too move to high vulnerability segment while Kumharsain and Chirgaon retain their moderately low vulnerability segment and are joined by Chaupal and Dodra Kwar. Kothkai remain in the very low vulnerability segment while Seoni, Nankhari, Junga, Cheta, Nerua and Jubbal remain in the low vulnerability segment and are joined by Tikar in this segment.

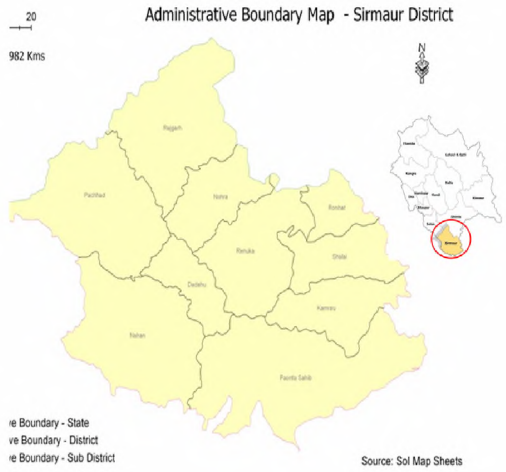


While Shimla Rural gets critical, Rampur too moves to moderately high vulnerability segment. Rohru retains its moderately low vulnerability segment and is joined by Theog, Kumharsain and Chirgaon. Tikar and Kothkai remain in the very low vulnerability segment while Seoni, Shimla Urban, Nankhari, Chaupal and Dodra Kwar are joined by Junga, Cheta, Nerua and Jubbal in the low vulnerability segment.

SIRMAUR

General Background

Sirmaur district falls in the south-eastern parts of Himachal Pradesh. It lies between $30^0$27' 30" and 31°02' 20" north latitude and 77° 01' 12" and 77°49' 40" east longitude. Shimla district bounds it in the north, Solan district in the North-West, state of Haryana in the west and south while state of Uttaranchal and Uttar Pradesh make its eastern boundary. According to the Surveyor General of India, the district has a total area of 2,825 km^2 which is 5.07 % of the total area of the state. It ranks 8th position among districts in terms of area in the state.



It is divided into 10 administrative units as Tehsil/Sub-Tehsil (area in descending order as follows):

Sr. No.	Tehsil	Area in sq. kms.
1.	Rajgarh	412.5
2.	Nohra	191.5
3.	Pachhad	406.5
4.	Renuka	294.8
5.	Dadahu	125.4
6.	Nahan	172.2
7.	Paonta Sahib	224.3
8.	Kamrau	148.2
9.	Shalai	166.4
10.	Ronhat	105.7

Physiography



The terrain of this district is predominantly mountainous with deep valleys lying between Shiwalik ranges of varying elevations between 358 metres and 3,544 metres above the mean sea level. The Kiardun valley in Paonta Sahib Tehsil is flat and fertile and remaining areas of this district are mostly rugged. This district has many *dhars*/ranges and prominent among them are *Chur Dhar* or popularly known as *Chur Chandani-ki-Dhar*, *Nohra Dhar*, *Haripur Dhar*, *Juni Dhar*, *Shalai Dhar*, *Kamrau Dhar* etc. All these *Dhars*/ranges are located in Trans Giri region of this district. *Sain Dhar* and *Dharati Dhar* are other important *Dhars*, which are located in Cis-Giri region. *Chur Dhar* attains maximum height of 3,544 metres in this region. The terrain of Upper Sirmaur Forested Region is very rugged and mountainous with elevation ranging from 518 metres to 3,544 metres above the mean sea level. Among the mountain ranges/*dhars*, *Chur Dhar* is a prominent, which also forms boundary between Shimla and Sirmaur districts. From this lofty mountain extend two ranges of which one in the north-west direction called *Dhar Taproli Jadol* and other *Dhar Nohra* in the south-east direction toward Haripur Fort from where it is again divided into two ranges, one of which runs towards to the Tons valley. These ranges separate the district as well as region from Shimla district in the northern part. *Juni*, *Shalai* and *Kamrau Dhars* are

located in the eastern part of this region. The Cis-Giri Region is rugged and undulating and contains generally fertile valleys of rivers/streams. The elevation of this region generally varies between 622 metres and 2,278 metres above the mean sea level. The main hill ranges in this region are *Sain Dhar* and *Dharati Dhar*. *Sain Dhar* stretches parallel to the *Giri* river from north-west to south-east direction and terminates on left bank of the *Giri* river at Dadahu. *Dharti Dhar* runs parallel to *Sain Dhar* and continues along the boundary of this region towards south-east, north-eastern part of this region is relatively higher in elevation. The terrain of Sirmaur Shiwalik is undulating with altitude ranging from 355 metres to 1,442 metres above the mean sea level. Important hill ranges in this region are *Dharati Dhar* and *Kaluwala ki Dhar*. *Dharati Dhar* lies in northern part of this region and runs in north-west to south-east direction. It attains maximum height of 1,442 metres on its western part and is densely covered by Chil forests while eastern part of this *Dhar* where the elevation rises upto 1,344 metres is covered by Sal forests. *Kaluwala ki Dhar* is quite a low range at 631 metres. It lies in western part and runs in south-eastern direction. The Kiardun valley region spreads in southern and central parts of Paonta Sahib tehsil. This valley is wider in the middle and becomes narrower in the corners. Area adjoining the state of Haryana is hilly with the maximum height of 619 metres. The remaining area of this valley is smooth, flat and fertile. These areas have been cultivated extensively.

Culture and Social Brief

Fairs & Festivals

The people of the Sirmaur district celebrate various types of festivals with considerable gusto almost around the year. Not even a single month passes when one or the other type of festival is not celebrated in one or the other part of the district in one form or the other. Bishu fair is celebrated every year in the month of March-April and Haryali in June-July. Diwali coincides with the government calendar. Magh festival is the greatest of all the festivals, which is celebrated by all sections of people with tremendous enthusiasm. Janamashtmi, the birthday of Lord Krishna, is also celebrated in the month of August/September every year. Two fairs namely Bawandwadshi fair and Guga Naumi fair are celebrated at Nahan which is the main attractions for the local folks. The Hola Mohalla and Baisakhi fairs in Paonta Sahib attract a large number of Sikhs from the far off villages besides local people. A new festival named 'Sharad Mahotsava' is being celebrated every year at Paonta Sahib in the memory of Yamunaji on Sharad Purnima since 1982. Baisakhi fair is also celebrated at Rajgarh where people from far and near places come in large number to witness the local folk dances. A fair is held at Trilokpur twice a year in the months of Chaitra and Asvina. A large number of pilgrims visit this fair. Trilokpur fair is one of the famous fairs of the district. The Renuka Lake is visited by thousands of pilgrims every year on Kartika-Ekadashi. On this occasion, the famous historic Renuka fair is celebrated, which is one of the main attraction for the people of this place. To this fair the brass idol of Parshuram is brought from village Jamu, his permanent abode, in a silver palki accompanied by musical instruments with great pomp and show.

Places of religious, historical, archaeological importance and Tourist interest

Nahan: It is situated over an isolated ridge in the Shiwaliks. It has several temples and an ancient palace just in heart of town which attracts tourists. Just below palace is beautiful garden Ranital Bagh.

***Churdhar* Peak:** It is the Shiwalik range at height of 11965 feet (highest peak in Southern Himachal Pradesh). It is blessed with beautiful landscapes.

Jaitak Fort: It is a historical place in Sirmaur situated at 1479 metres above mean sea level.



Haripur Dhar: A fort was built on Haripur Range. The range was meant to guard the state frontiers with neighbouring Jubbal State.



Shiwalik Fossil Park: It is situated in Shiwalik hills in Markanda valley. It is meant for preservation of prehistoric animal sites, restoration of their natural environment.

Trilokpur: This is famous for temple of goddess Bala Sundri. An important fair is held at Trilokpur twice the year.

Sirmaur: It is located 16 kms northwest of Paonta Sahib on southern bank of Giri. Close by lies a tank called Sirmauri Tal which is now completely dry and is mostly under cultivation.

Sarahan: It commands a panoramic view of plains on one side and an attractive Chur Dhar on other side. It is about 42 kms. from Nahan.

Renuka Ji: Situated on the banks of the picturesque Renuka lake, about 40 kms. from Nahan, the temple is venerated by a large number of people. Renuka Wildlife Sanctuary also adjoins.

Paonta Sahib



Paonta Sahib is situated at a distance of about 28 miles from Nahan on the Nahan-Dehra Dun road. It is an important pilgrim centre for the Sikhs. The town houses a famous Gurudwara where fairs are held on the occasion of Hola in March and Baisakhi in April. The Gurudwara is visited by thousands of pilgrims on the occasion of the Hola festival. It also has a fine Hindu temple, built by the daughter of Raja Fateh Parkash on the bank of the *Jamuna.*

Assessment of District Vulnerability

As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability vis-à-vis utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been

indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables:

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Sirmaur district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.



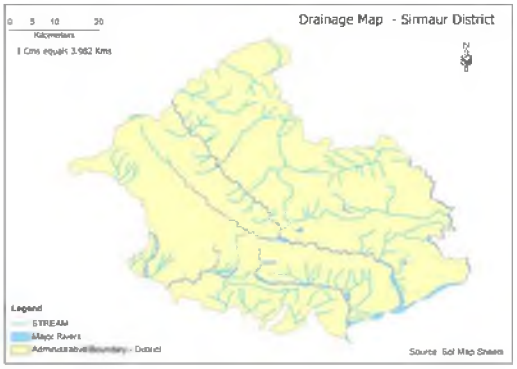
River System

The district is drained by a number of rivers, rivulets and streams. Of these, river *Giri* is the biggest river in the district, which is tributary of river *Yamuna*. The main rivers of the district are *Giri, Bata, Yamuna, Tons, Ghagghar* and *Markanda*. Only *Bata, Ghagghar* and *Markanda* rivers rise in the district. The *Giri* river takes south-eastern course and merges in *Yamuna* river at Bata Mandi. *Bata* and *Yamuna* rivers flow south-westerly directions. *Tons* river, a tributary of *Yamuna* river forms eastern boundary while *Yamuna* river forms its south-eastern boundary and they separate this district from Dehradun district of Uttaranchal. *Giri* river originates at Kupar Tibba in Jubbal Tehsil of Shimla district and passes through the hills of Kotkhai and Theog of Shimla district and enters Sirmaur district at village Mariog from north side. It flows almost in the middle of the district and merges with *Yamuna* river at Rampura Ghat. *Jalal* river an important tributary of *Giri* river joins it on its right bank at Dadahu. In the sub-micro region of Upper Sirmaur Forested region, the *Nora* river flows from west to east direction forming the boundary of Kamrau sub-Tehsil and Shalai Tehsil. *Tons* river enters in this region in east at Kharkan and flows from north to south direction and ultimately merges with *Yamuna* river in south. *Tons* river also forms its eastern boundary and separate it from Uttaranchal Pradesh. *Sainj* river is a tributary of *Tons* river and joins it in this region. *Giri* river and its tributary *Basari* river form its north-western boundary and *Giri* river also makes its extreme southern boundary. The *Giri* river, the life belt of Cis Giri region enters in north-west at Nalsar Anoti and flows almost in the centre of this region and then towards south-eastern direction. This river then leaves this region at Hiyon Nar and enters into Kamrau sub-Tehsil. The principal tributary of this river is *Jalal* river which originates in this region and flows between *Sain Dhar* and *Dharati Dhar* and ultimately merges in *Giri* river at Dadahu.



Other tributaries of *Giri* river are *Pervi, Nait, Palor* and *Jagat Nals* and they join the *Giri* river on its left bank while *Kamali Nal* meets it on its right bank. *Ghagghar* river also originates in north-western part forming district boundary and flows in westerly direction. It leaves the district as well as this region at Prit Nagar and enters into Haryana state. The main river in Sirmaur Shiwalik region is *Markanda* which originates from the south-eastern part of Nahan Tehsil and flows in south-westerly direction. It forms its own valley named *Markanda* valley in this region which is flat and fertile. It leaves this region at Kala Amb and enters into Haryana. *Bata* river takes birth in this region and takes

easterly course. The Kiardun valley region is mainly drained by *Bata* river which enters this region in extreme west near Kolar and flows south -easterly direction before merging with *Yamuna* river at *Bata* Mandi. *Giri* River and *Yamuna* River have their own valleys in this region. *Yamuna* river enters the district as well as this region in extreme east at Majiri Paharuwala, taking south-westerly course and leaves the district as well as this region at Behral which attains the minimum height of 358 metres. *Giri* river which is a major tributary to Yamuna River meets it on its right bank at Rampur Ghat. All these rivers provide irrigation facilities to this valley. The only lake in the district is at *Renuka*. It is situated close to Dadahu.



Climate: The district possesses a variety of climate varying according to elevation. Summer months are extremely and exceedingly hot in Kiardun valley and water is scarce. The hilly areas have a temperate climate though Dharati range is hot. The Trans Giri tract, Pajota and Sain are cool even in the hot weather. In Trans Giri area, snow falls every winter while in Dharati it falls rarely. The climate of upper Sirmaur forested region is cool in summer and cold in winters. Maximum parts of this region receive snow fall in winter. In upper area of Cis-Giri region, the climate is cold in winters and mild in summer while lower areas are hot in summer and cool in winter. The cold season starts from December to about middle of March. The hot season which follows lasts till the middle of June. Upto middle of September is monsoon season and October and November constitutes the post monsoon season. In cold, summer and post monsoon seasons, the air is dry particularly in the afternoon while during the monsoon season, the air is humid. Skies are generally clear or lightly clouded except during monsoon season when they are heavily clouded to overcast. Winds are light to moderate but during the monsoon season they become stronger. In monsoon season, winds are from the directions between south-west to north-west, the westerly being more frequent. In post monsoon season they are predominately from the north-east or east. Easterlies and south easterlies are common in the cold season. By the end of March, westerlies and north-westerlies appear and these predominate in summer.

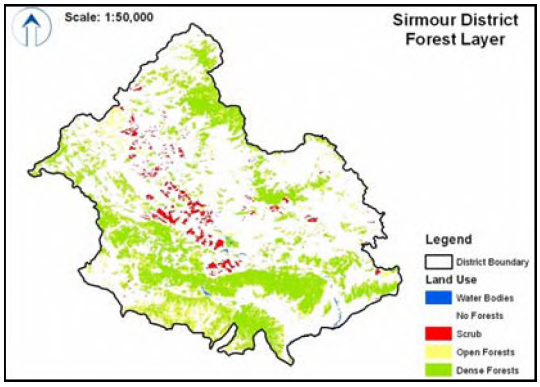
Precipitation/Rainfall: Though Sirmaur Shiwalik region contains hills of varying altitudes it has hot and moist climatic conditions. The Kiardun valley region is exceedingly hot during summer months and has a considerable rainfall in this valley. The rainy season usually begins in the middle of June and lasts till the middle of September. Rainfall occurs in April and May. The April and May rains also bring hailstorms. The snowfall on higher reaches begin in December and lasts till March. *Chur Dhar* remains snow clad for major part of the year. During monsoon, rains are more active in the month of July and August. About 80% of the rainfall is received by the district during July and August months.

Particulars	Maximum	Minimum
Rainfall	1660 (average)	-
Temperature	30° C	-2° C

Forest & Wildlife

Forests play a vital role in shaping the climatic conditions of the area. The forests provide valuable timber, medicinal herbs, and raw materials for large and small scale industries, provide employment and also play a vital role in conserving the soil and ensure timely and sufficient rains. The forests range between scrub, sal and bamboo

forests of the low hills to the fur and alpine forests to the higher hills situated at higher elevations. The area under forests in the district is 1677.99 sq. kms. Of these, 1065.57 sq. kms. are under reserved forests, 56.58 sq. kms. as protected, 20.46 sq.kms. unclassified and 555.38 sq. kms. is categorized as other forests Moreover, there is an area of 4.26 sq.kms. of forest land not under the control of forest department which are occupied by the institutions and households. According to "Forests types of India and Burma" by H. G. Champion, the belt and patches of forests that can be recognized in the tract are Dry Shiwalik Sal, Moist Shiwalik Sal, Moist High Level Alluvial Sal, Sub Tropical Pine (Chir Forests) Khair – Sissu Forests and Ban Oak Forests.



Dry Shiwalik Sal is ill distributed and is met with all over the Shiwalik in sand and conglomerate out crops at an elevation of 1,000 to 2,500 feet. Moist Shiwalik Sal also occurs mainly in Shiwaliks where the soil and moisture conditions are better. This type is found at altitudinal range of 1,000 to 2,500 feet. Moist high level alluvial Sal is found mainly on deep, rich and old soil of the Dun and is well represented by forests like Gorakhpur, Rajban Lamotua, Kukron and Bias.

Khair Sissu forests are found along all the big rivers like Yamuna and Giri on new sandy or alluvium soil. Ban Oak forests occur at an elevation of 5,000 to 6,000 feet. There is a wide overlap in shelter wood places with sal and in spurs with Chir at altitudes from 300 to 5,000 feet. Chir pine forests are found on the Dharati ridge which runs parallel to the *Sain Dhar* in the south.

Chir pine by its nature forms almost pure forests of its own. In shady places, low level Oak, *Cassia fistula*, *Anogeissus latifolia* and other broad leaved species are found, though its universal associates are *Carissa spinarum* and *Adhatoda vasica*. To the south of *Chur Dhar*, high level forest containing, Oaks, Firs, Yew, birch and blue pine form a belt of about 32 kilometres length and of width varying from 2 to 8 kilometres. They provide some grazing pasture for the buffaloes of the right holders. Deodar forests mixed with Kail, Oak and Chir pine are found to the south of the alpine forests and to the north of the Giri River. *Sain Dhar* forests are situated between the *Giri* river in the north and the *Jalal* stream in the south.

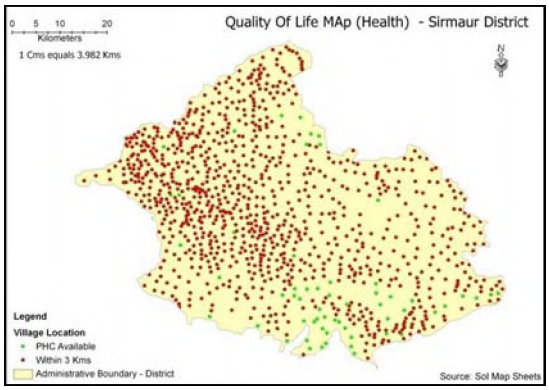
The spur is generally denuded to the valuable forests and is covered with scrub jungle, chir pine being found in small patches. The timbers mostly in demand are Sal, Sain, Chir, Sissu, Tun and Khair. In Dharati ranges and the Cis Giri area, Cheel and Pine forests are of great value for extraction of the resin.

The resin extracted from the chil forests is supplied to the Himachal Resin and Turpentine Factory, Nahan. Other minor forests products are bhabbar grass, gum, hides, horns and Munj grass. There are 3 wildlife sanctuaries namely Renuka Wildlife Sanctuary (Rajgarh Forest Division), Simbalbara (Nahan Forest division); and *Churdhar* (Renuka/Chaupal).

Quality of Life (health): Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector. Of the total 966 inhabited villages 963 villages doesn't have hospital facility and 943 villages doesn't have Primary Health Centres. In case of Primary Health Centres 275 villages have it at less than 5 kms; 237 have it between 5-

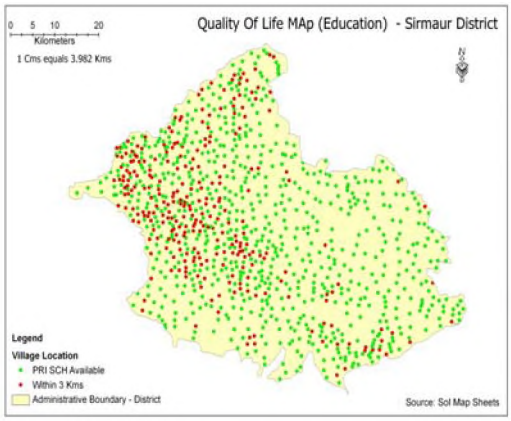
10 kms. while inhabitants of 431 villages have to cover distance of 10 or more kms. With regards to hospital 58 villages have it at less than 5 kms, 92 have this at 5-10 kms. while inhabitants of 813 villages have to cover distance of more than 10 kms.

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.



Quality of Life (Education): Similar is the case of access to Educational Facilities, another essential indicator of quality of life. With regards to educational facility of the total 966 villages 272 villages don't have any primary school, 739 don't have middle school while 965 villages don't have degree college. Of these children of 267 villages have to travel less than 5 kms while those of 5 villages have to travel distance between 5-10 kms. With regards to middle school inhabitants of 514 villages have to travel less than 5 kms; those of 205 villages have to cover distance between 5-10 kms while those of 20 villages have to cover distance of more than 10 kms. In case of degree colleges inhabitants of 23 villages have to travel distance of less than 5 kms, of 34 villages cover 5-10 kms. while an overwhelming number of 908 villages have to cover distance of more than 10 kms.

To summarize, according to Census of India 2001, on an average across the district, 36.77% villages do not have access to Primary School within a distance of 2 Kms. (a distance which could be walked by the child), 47.99% villages doesn't have secondary school within a distance of 6 Kms., 55.26% villages doesn't have colleges within a distance of 15 Kms. and 60.52% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 Kms.



Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Sirmaur such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Sirmaur district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Sirmaur district is 458,593 persons comprising 241,299 males and 217,294 females **(the Census of India, 2011 gives a provisional population figure of 530164 with a density of 188 per sq. km. Data at tehsil level is not available).** This population of the district forms 7.5% of the State population and ranks at 6th place

among the districts. Out of the total population of the district 89.6 % lives in rural areas while 10.4% lives in urban areas. Rural population of the district is distributed among 10 Tehsil/sub-Tehsil and the urban population is spread over in 3 towns. The urban population in the district is 47,670 persons comprising 25,643 males and 22,027 females. The total rural population comes to 410,923 persons comprising 215,656 males and 195,267 females as recorded in 2001 Census. The rural population is distributed in 966 villages. Out of total 971 villages in the district, 966 are inhabited villages while 5 villages are uninhabited. The concentration of villages is mainly on undulating slopes and valleys of rivers/streams.

Population Growth

According to the 1991 Census the total population of the district was 379,695 persons which rose to 458,593 persons as per 2001 Census. There has been net addition of 78,898 persons during 1991-2001. The decadal growth rate of district comes to 20.8%. The growth rates for rural and urban areas of the district are 19.9 and 29.3% respectively. The growth rate in urban population is high in the district due to development in the industrial field.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001

Tehsil/ Sub-Tehsil	Population 1991			Population 2001			Percentage decadal variation 1991-2001			Percentage urban population	
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
Rajgarh	37,349	35,569	1,780	44,207	41,680	2,527	+18.4	+17.2	+42.0	4.8	5.7
Nohra	18,450	18,450	-	21,036	21,036	-	+14.0	+14.0	-	-	-
Pachhad	39,195	37,986	1,209	46,020	46,020	-	+17.4	+21.1	-100.0	-	-
Renuka	33,723	33,723	-	40,122	40,122	-	+19.0	+19.0	-	-	-
Dadahu	13,492	13,492	-	15,438	15,438	-	+14.4	+14.4	-	-	-
Nahan	58,834	36,956	21,878	71,976	45,923	26,053	+22.3	+24.3	+19.1	37.2	36.2
Paonta Sahib	105,382	92,175	13,207	132,202	113,112	19,090	+25.5	+22.7	+44.5	12.5	14.4
Kamrau	29,972	29,972	-	35,048	35,048	-	+16.9	+16.9	-	-	-
Shalai	27,710	27,710	-	32,922	32,922	-	+18.8	+18.8	-	-	-
Ronhat	15,588	15,588	-	19,622	19,622	-	+25.9	+25.9	-	-	-
District Total	**379,695**	**341,621**	**38,074**	**458,593**	**410,923**	**47,670**	**+20.8**	**+20.3**	**+25.2**	**10.0**	**10.4**

Density

The density of population in Sirmaur district comes to 162 persons per Sq. km against state average of 109 persons. At Tehsil/sub-Tehsil level Paonta Sahib Tehsil ranks first with 589 persons per Sq. Km. Rajgarh Tehsil ranks 10th in term of density of population occupying the lowest position with 107 persons per Sq. Km. among the Tehsil/sub-Tehsil in the district. The density of population varies between 589 persons to 107 persons per Sq. Km. In rural areas the density of population works out 146 persons per Sq. Km. while in urban areas it comes to 2,802 persons.

Sex Ratio

There are 901 females for every thousand males in Sirmaur district. The sex ratio in rural and urban areas of Sirmaur district works out to 905 and 859 females per thousand males respectively. It is observed that the proportion of females in rural areas is slightly higher than that of urban areas.

Workers Participation Rate

The work participation rate is defined as percentage of total workers to total population. In the same way it is defined for main-workers and marginal workers. According to 2001 Census, the total workers including main and marginal workers constitute 49.3% of the total population of the district, as a whole. Of the total workers the share of the main workers is 38.4% and the marginal workers come to 10.9%. The remaining 50.7% of the population belongs to the category of non-workers. According to 2001 Census, the participation rate of

male main workers in the district comes to 48.8% and that of females is 26.7%. The percentage of males and females marginal workers is 7.6 and 14.6% respectively. The proportion of female marginal workers is higher than that of males as the females have engaged themselves in one or more economic activities in addition to their daily household duties to improve the family economy. The percentage of main workers among males is 49.2 % while in case of females it is 28.6 % in rural areas. The proportion of male and female main workers in urban areas is comparatively low which comes to 45.4 and 9.7% at district level respectively.

Literacy

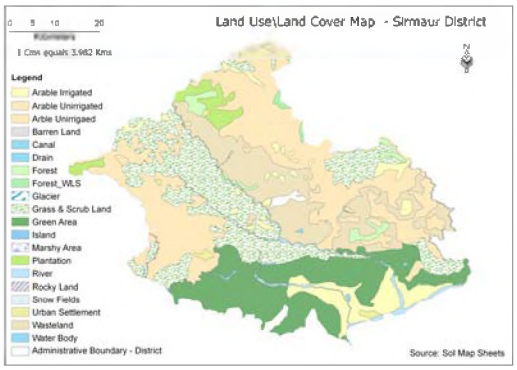
A person who can both read and write in any language with understanding is taken as literate in Census. All the children in the age-group 0-6 years have been treated as illiterates. As per 2001 Census Sirmaur district has reported 274,643 persons as literate constituting 70.4% of total population excluding the population of age-group of 0-6 years. The proportion of male and female literates is 79.4 and 60.4 % respectively. The total literacy rates of rural and urban areas are 68.3 and 87.8 % respectively. The proportion of male and female literates in rural areas is 77.8 and 57.7 % while in urban areas this proportion is 91.7 and 83.2 % respectively. Thus it is clear that the females in urban areas are better educated than their counterparts in the rural areas of the district.

Urban Population

The statement given below shows the position and number of urban units by size class for 2001 Census:

Size Class of Town	Name and Civic Status of Town	Urban Population		
		P	M	F
III	Nahan M.Cl.	26,053	13,982	12,071
IV	Paonta Sahib M.Cl.	19,090	10,246	8,844
VI	Rajgarh N.P.	2,527	1,415	1,112

Land Use



Most of the district is spread over in deep valleys and high elevations and cultivation is possible only in small holdings in the deep valleys or in the river basins. The rest of the land is either covered under shrubs or alpine trees, small nallahs, rivulets and waste land. It is the only Kiardadun valley where land is flat and fertile.

Tehsil wise Land Utilization Pattern (sq.km.)

	Rajgarh	Pachhad	Dadahu	Nahan	Nohra	Renuka	Shalai	Kamrau	Paonta Sahib	Ronhat
Total geographical Area	412.43	406.49	124.20	173.43	191.48	294.79	166.35	148.24	224.28	105.74
Area under Forest	152.07	83.74	11.86	19.95	58.46	73.12	33.14	12.73	5.81	33.25
Fallow Land	6.66	49.04	3.92	10.47	4.05	8.04	1.75	3.88	11.12	2.83
Total Cropped Area	87.21	88.80	26.34	81.01	39.22	71.86	58.97	57.55	215.95	31.51

Agriculture

The district can be divided taken into three distinct regions from agriculture point of view. One, the hilly parts of tehsils Pachhad, Rajgarh, Renuka and Paonta Sahib. Two, Nahan Tehsil which can be divided in Dharthi range and valley of Nahan and Paonta Sahib and third, Kiardadun valley. In the high elevation, maize is the predominant crop. Apart from this the ginger and turmeric are grown in summer. Still in higher elevations, potato and wheat are grown. The Kiar-da-dun valley is known for wheat and quality rice. At one time poppy used to be grown in the district which has been banned by the government by law. Agriculture is the main stay of economy of the district and about eighty per cent of the population is mainly dependent on the agriculture. Sirmaur district has about eighty five per cent small and marginal farmer families and the holdings are very small and scattered. The yield of crops is below the norm. Major food crops are grouped in three categories namely cereals, pulses and other food crops like chillies, ginger, sugarcane and turmeric. Non food crops are of two kinds viz. oil seeds and other crops such as cotton, tobacco and fodder etc. During the decade 1991-2001, the agriculture production of various crops has increased two to three folds. Maize, potato and off season vegetable crops have become popular in the district. The cultivation of vegetables like peas, tomato, cabbage, cauliflower and potato has become more popular in the district. Improved varieties of peas, tomato and potato have been introduced. In order to encourage the cultivation of sugarcane in the district, the state government has started a Khandsari plant at Paonta Sahib so as to provide market for the sugarcane product.

The district has been experiencing changes in the area under agriculture over the last two decades. Except for Rajgarh, Pachhad, Dadahu, Renuka and to some extent Nohra Tehsils, which show more land being put under agriculture, Tehsils like Nahan, Shalai, Kamrau, Ronhat and off course, Paonta sahib have shown a decrease in area under agricultural use. The reason may be attributed to the increase in mining and industrial activities in the Tehsils.

Tehsil-Wise Area under Principal Crops

Cropping Pattern (Ha)

Crops	Pachhad	Rajgarh	Nahan	Sangrah	Shillai	Paonta	District
Cereal							
Maize	1600	1990	8664	5071	2375	17502	37201
Paddy	188		766			2920	4874
Wheat	1448	1239	10244	4480	1407	16703	35521
Barley		94		600	175	423	1292
Pulses							
Mash	156	218	136	215	130	230	1085
Rajmash				131	129		260
Others	56	38	64	164	77	52	293
Oilseeds							
Toria			3 24	246		460	829
Sarson	120	105		103	23	235	586
Others	19	25	32	19	16	26	137
Vegetables							
Potato		381	68	347	320	22	138
Peas	138	374		245	143	178	1078
Tomato	289	455	158	248	228	143	1521
Cauliflower							
Beans	62	118			217		397
Capsicum	32	156			28	26	242
Fruit plants							
Apple	0	750	0	264	450	0	1463

Crops	Pachhad	Rajgarh	Nahan	Sangrah	Shillai	Paonta	District
Citrus	36	30	50	20	24	112	272
Mango	0	0	196	0	0	252	448
Stone fruits	256	847	72	252	228	98	1753
Strawberry						135	135
Spices							
Ginger	295	110	172	321	441	237	1576
Garlic	360	468	58	252	150	68	1356
Onion				369		222	591
Sugarcane						1750	1750

Irrigation

An area of 144.05 sq.kms. has been irrigated by various sources in the Sirmaur district. An area of 60.30 sq.kms. in Paonta Tehsil; 15.13 sq.kms. in Rajgarh; 13.63 sq.kms. in Nahan; 11.66 sq.kms. in Pachhad and 10.01 sq.kms. in Renuka has been irrigated by the Govt. canals/kuhls, Govt. Tube-wells, Private Tube-wells, tank, government and private Kuhl and lift irrigation schemes. Minor irrigation is also carried out in the villages of Shalai, Kamrau, and Dadahu, Nohra Dhar and Ronhat tehsils and sub-tehsils. The maximum areas of the district are irrigated by the private Kuhls followed by the government Kuhls and canals.

Irrigated area (source-wise) from 1998-99 to 1999-2000

District/ Tahsil/Sub-Tehsil	Govt. Canal	Govt.Tube-well	Private Tube-well	Tank	Govt. Kuhl	PrivateKuhl	Govt. Irrigation Scheme	Private Lift Irrigation Scheme	Total Area Irrigated
Sirmaur	3,337	1,635	865	-	662	7,772	133	1	14,405
Rajgarh	-	-	-	-	3	1,510	-	-	1,513
Nahan	55	697	2	-	112	369	129	1	1,365
Pachhad	-	-	-	-	218	948	-	-	1,166
Renuka	-	-	-	-	149	848	4	-	1,001
Shalai	-	-	-	-	5	873	-	-	878
Paonta Sahib	3,282	895	803	-	77	973	-	-	6,030
Kamrau	-	43	60	-	98	555	-	-	756
Dadahu	-	-	-	-	-	549	-	-	549
Nohra Dhar	-	-	-	-	-	837	-	-	837
Ronhat	-	-	-	-	-	310	-	-	310

Livestock

Livestock is the chief wealth next to agriculture to the population of the district. Every house invariably keeps a few cows or buffaloes, sheep, goats, pigs and ponies. The rearing of different animals and poultry is carried out on commercial lines by some people. Besides rearing of animals by the individual households, a large number of sheep and goats etc. are added to the existing stock of animals in the district which are brought by inhabitants of Kinnaur and Chamba districts during winter months when these districts become snowbound and provision of fodder becomes extremely difficult due to unfavourable weather. In addition, Gujjars who mostly are migrants also bring large flocks of buffaloes and cows to the Dun valley and adjacent areas of Nahan during the winter months. The livestock census shows that the growth of livestock is gradual and steady. According to livestock census in 1966 there were 389,889 animals including mules and camels in the district. This number according to 1982 and 1992 Census rose to 410,276 and 437,668 respectively. There were 40,059 buffaloes, 234,405 cows, 27,621 sheep, 115,892 goats, 2,310 pigs, 2,826 other animals and 34,287 poultry birds in the district according to 1992 Cattle Census.

Horticulture

The topography and agro-climatic condition of the district are quite suitable for the raising of the various fruits. The topography of the district can be grouped into three categories namely high hill areas located at higher elevation, mid hill areas and low lying valley areas. Fruits of different varieties depending upon the terrain, climatic conditions and soil, ranging from apples in the higher slope areas to mango, litchi, mandarins, sweets oranges, lime, lemon and guava in the lower hill and valley areas are grown in the district. Some fruits like almond and walnut are grown in the mid hill areas. Apple cultivation has made tremendous progress during the last four decades. The Rajgarh Tehsil has acquired a dominating position not only in the district but in whole of the state for growing different varieties of apples like royal, golden and delicious royal. Plum is being grown in Rajgarh as well as in Pachhad Tehsils. Walnuts are grown all over the district and of late commercial varieties of walnuts have found great favour. Paonta Sahib area grows Kagzi lemon which has been further propagated in lower areas of Nahan and Pachhad tehsils particularly Dun valley. Orange cultivation has also not lagged behind, the popular variety being Kinnu. The Dussehri and Langra varieties of mango have also found favour with the people in the valley.

Fisheries

Sirmaur district is extensively divided by rivers and the streams, most of which are perennial, with water flow of considerable volume. As a result; fishing in the rivers and the streams has been a pretty old activity in the district. It is stated that *Yamuna* and *Giri* rivers were known for their abundance of fish and other streams as well. The fishing grounds in *Yamuna* River are *Naoghat* and *Ganguwal* in Paonta Sahib Tehsil where Mullee, Mahseer and Gid varieties of fish are available. Mirror carp was introduced in the pucca tank of Nahan for the first time in 1955 and it has spread considerably ever since. With the result, Himachal Pradesh is one of the big suppliers of this fishes to the rest of the country. This variety of fish has been extended to other districts also where the finger-lings have been distributed. The major attempt for fishing activity in the district has been the management of riverine fisheries resources extending over 250 kms. River/stream length of *Yamuna* river 35 kms, the *Giri* river 90 kms, the *Bata* river 30 kms. and other rivulets and seasonal rivulets 100 kms. through effective enforcement of legislation restricting fishing to the maximum sustained yield only. The fishing in *Renuka* Lake and certain areas in *Yamuna* river have been prohibited under the Fishing Act.



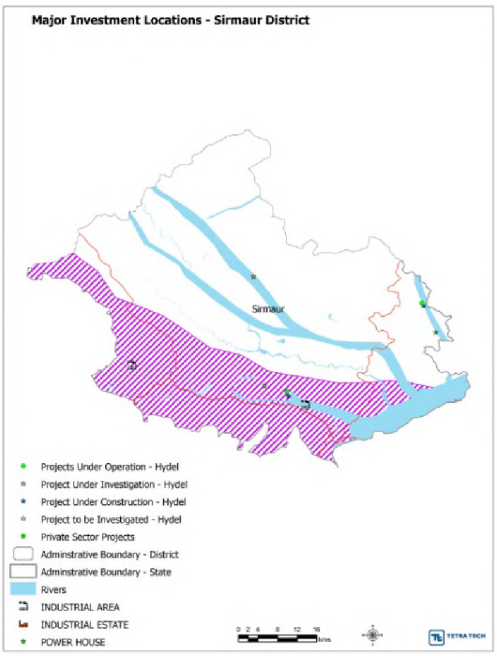
Industries



The district does not have a strong industrial past. Only a few industries were established in the late nineteenth and early twentieth centuries, one of them being the Nahan Foundry Ltd. which was set up in 1875 A.D. This was taken over by the Himachal

Pradesh Government in 1964. The main items of the production of this factory were cane, crusher, cast iron and black sheets panes, flour mills; centrifugal mono blocks pump sets and other agricultural implements and accessories. The factory however, ran into losses due to old and obsolete plant and machinery. The State Govt. decided to convert it into H.P.P.W.D. & I.P.H. state workshop and transferred all operational assets within factory premises to the said workshop in 1988. Resin and turpentine factory in Nahan is another oldest factory, which has its raw material from the extraction of chil trees, which are in abundance in the district. This factory was opened in 1945 and came into operation from 1949 onwards. The control and administration of the factory has been completely taken over by the State Government in 1957. The Cement corporation of India has set up cement factory at Rajban with an installed capacity of 600 metric tonnes per day that has generated an employment to about 750 persons. Other important factories being Himachal Mineral and Chemical, Paonta Sahib, Himachal Shoddy Mill Ltd., Paonta Sahib, Nahan Ceramics, Paonta Sahib, Farm Fresh Fruit Pvt. Ltd., Bata Mandi, Paonta Sahib, Himachal Pradesh Surgical, Paonta Sahib, Govt. Ayurvedic Pharmacy, Majra, Himachal Turpentine Products Ltd., Kala Amb, Himachal Mine Quartts, Bata Mandi. There are numerous units in the district registered with the Industries Department which includes industries like saw mills, leather units, utensil repairs and making, weaving and atta chakkis etc. There were 24 large scale industrial units registered in the district. Apart from these, 87 Small Scale Serviceable units were also functioning. As many as 1,199 small scale units were registered .In order to accelerate the pace of the industrialization, three growth centres/industrial areas namely Kala Amb, Dhaula Kuan and Paonta Sahib have been set up in the district during the early nineties.

Nature of Industries	Units	Capital Investment Rupees in Lakhs	No. of workers
Large and Medium Scale Industries	24	45,285.97	4,608
Small/Marginal Scale Industries	1,199	9,026.65	6,449
Small Scale Serviceable Units	87	64.56	178
Total	1,310	54,377.18	11,235



As can be seen from the adjoining map, almost one third of the district is proposed to be covered under the proposed Industrial corridor which encompasses, apart from Sirmaur district, the districts of Solan, Bilaspur, Una and Kangra. The Tehsils in this corridor in the Sirmaur district are Paonta Saheb, Nahan and parts of Pachhad.

Minerals & Mining

The district covering an area of 2,825 sq.kms. is fairly rich in mineral wealth. The important minerals found are limestone, gypsum and barytes. These are being used by local industries as well as the sugar and

paper industries of the adjoining states. The approximately 4,500 hectares of land has been leased out in the district to exploit the mineral resources of the district. An account of the main minerals found in the district follows:

Limestone

Huge deposits of limestone varying from cement grade to chemical grade occur at Sataun, Manal, Hyona to Kamrau, Tilor Dhar to Lalag. Paonta Sahib to Bharli, Barthal, Kanor, Borli, Sangrah, Nohra and Bhangri. Its total reserves are of the order of 200 million tonnes. To exploit the mineral wealth of the district, a CCI cement plant at Rajban with a capacity of 600 metric tonnes per day and eight mini cement plants in private sector have been set up. The limestone produced is used in the manufacture of cement, ordinary lime, and hydrated lime and in sugar and paper industries.

Barytes

Barytes occurs in the pockets at Kandi Mashwa, Tatyana and Ashnong. Three mines have been sanctioned for its production and it is mostly used in the paint industry. The mineral is white in colour and fine grained. It is associated with Krol limestone, dolomite, crystalline dolomite and calcite at these places.

Gypsum

Deposits of gypsum occur at Bharli and Korga, though at present the Bharli deposit is being exploited. Only one mine has been sanctioned for its production and recently the Korga deposit has also been applied for lease. It is used by the cement factory at Rajban.

Copper

Malachite (copper carbonate) stains are noted at the function of Blaini boulder bed and subathus in a nala cast of Sataun village.

Iron-Pyrites

Occurrences of pyrite are recorded in the form of lenses and veins in the limestone and slates at Sayash and Diyandon.

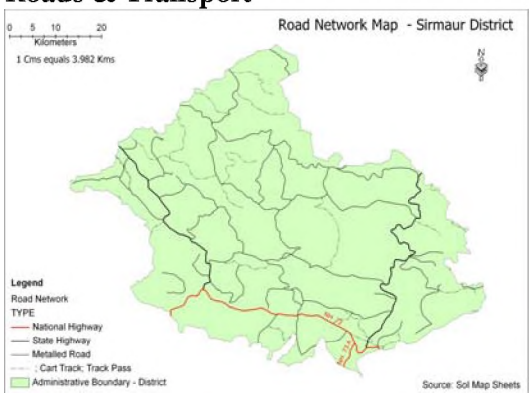
Mica

Some traces of mica are available near the Chur Dhar at village Chhog Tali. In village Jogar of Renuka on the hill of Baira, mica mixed Clay is found which suggests the existence of some mica there. On the southern slopes of the Chur mountains, there are several places like Kanda and Kaura, Baleri, Tango, Chur etc where pegmatites are seen enclosing variable sizes of blocks of muscovite of somewhat greenish tint. Along with it tourmaline also occurs in abundance in crystals of variable sizes.

Slates

At village Siyun and Balara situated in Renuka, there are slate quarries exploited by local inhabitants and the slates used to cover the roofs of their houses.

Roads & Transport



The total road length in Sirmaur district is 2,152 kms. Of these, 201 kms were double lane motorable road, 1,630 kms. Single lane motorable road, 21 kms. Jeepable lane only and 300 kms less than jeepable. The district is linked primarily by two types of roads. One is state highway and other is other

roads. There are 803 kms of metalled roads and 1,104 kms of *unmetalled roads in the district.*

The district is not connected with any railway line and the nearest railway station is Dehradun and Ambala from Poanta Sahib and Nahan respectively. The road transport is the life line of the economy of the hills because potentialities for the development of railways and other means of transportation are very meager. The district has been extensively linked with the roads where the regular buses ply. The transportation of goods is entirely in the hands of private operators while the passenger transport is controlled by the State Transport Corporation.

Length of Roads in Kms. including National Highways

Year	Motorable Double Lane (in kms.)	Motorable Single Lane (in kms.)	Jeepable Road (in kms.)	Not Jeepable Road (in kms.)	Total Road Length	Pucca Metalled Roads (in kms.)	Kutcha Un-metalled Road (in kms.)
1998-99	201	1,630	21	300	2,152	803.37	1,105.54

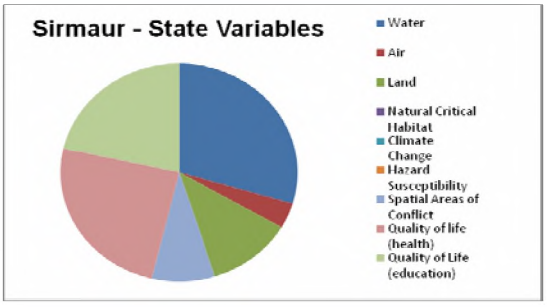
Electricity and power

The development of agriculture and industry cannot be accelerated without the availability of power. Hydro electric power station was completed across the *Giri* River in the year 1978-79 with an installed capacity of 60 MW. The power from the Station is being transmitted by four 132 KV lines. All the inhabited villages in Sirmaur district have been electrified. A couple of Hydro Power projects are also contemplated in the district.

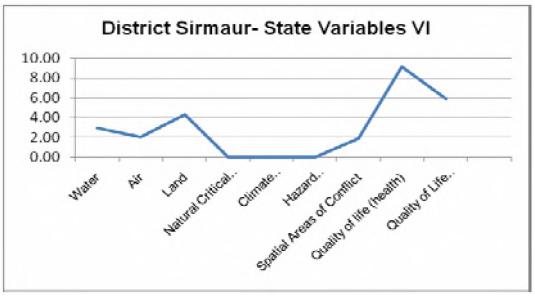
Summary of State Variables at District Level

Based on the database for State variable, computations of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Mandi. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($V_{State\ Sector}$) as a total for that particular system.

Sirmaur	
Variable Sector	Vulnerability of State Sector $V_{State\ Sector}$
Water	13037.83
Air	1644.73
Land	5167.30
Natural Critical Habitat	0.00
Climate Change	0.00
Hazard Susceptibility	0.00
Spatial Areas of Conflict	3803.45
Quality of life (health)	10918.54
Quality of Life (education)	9439.79



The analysis of data indicates adequate availability of water. Further analysis indicates gaps in infrastructure and services in health and education sector. Land and Spatial areas of conflict also indicate vulnerability. A substantial portion of the District is also prone to Hazards.



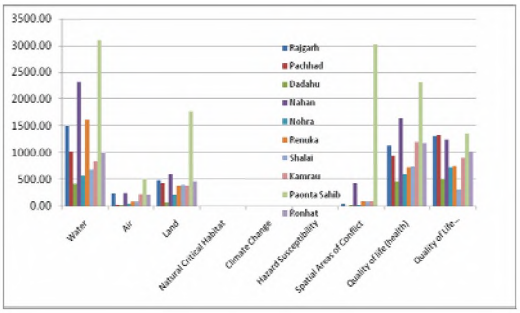
State Variables at Tehsil Level

Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

STATE VARIABLES

District Sirmaur- State Variables Tehsil wise

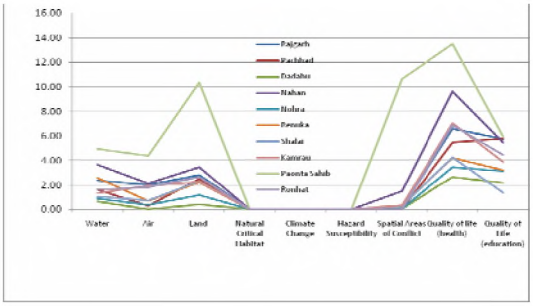


State Parameters

	Rajgarh	Pachhad	Dadahu	Nahan	Nohra	Renuka	Shalai	Kamrau	Paonta Sahib	Ronhat
Water	1495.31	1015.24	413.09	2312.77	563.50	1612.52	674.75	835.89	3109.97	1004.79
Air	230.40	31.37	2.00	246.58	42.60	80.05	84.26	219.32	500.00	208.15
Land	482.00	431.17	73.55	592.14	204.18	379.71	392.02	384.41	1768.96	459.16
Natural Critical Habitat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hazard Susceptibility	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spatial Areas of Conflict	33.89	0.00	20.03	427.16	13.46	100.45	82.86	98.20	3027.40	0.00
Quality of life (health)	1133.81	941.56	454.67	1650.16	594.41	723.88	728.92	1205.38	2307.14	1178.61
Quality of Life (education)	1317.26	1329.21	497.90	1251.18	722.34	741.54	312.06	891.18	1360.03	1017.09

The analysis of data indicates adequate availability of water in all Tehsils with the exception of Dadahu, Nohra and Shalai. Gaps in infrastructure and services in health and education sector exist in all Tehsils. Land is under pressure in Paonta Sahib because of its proximity to neighbouring districts/states in plains. Spatial Areas of Conflict is evident in Paonta Sahib because of Industrial development within and along its borders.

District Sirmaur- State Variables Tehsil wise VI



The analysis of data indicates vulnerability of Water, Air and Land in Paonta Sahib while rest of tehsils is within a controllable range of vulnerability. The analysis indicates gaps in infrastructure and services in health and education sector in Paonta Sahib and Nahan making them vulnerable.

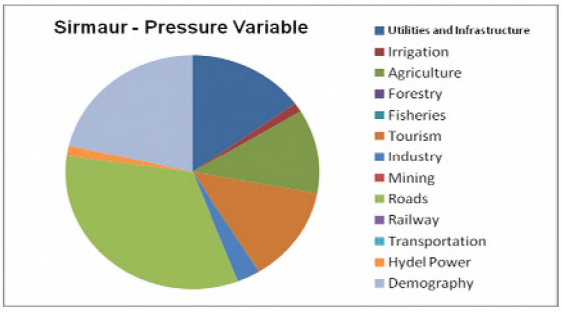
Summary of Pressure Variables at District Level

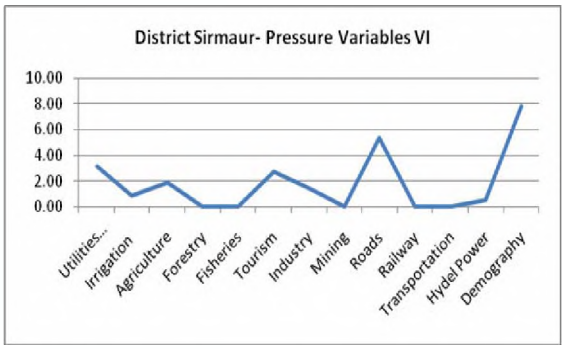
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Sirmaur deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor (N_F 'pressure'). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator

sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Sirmaur Variable Sector	Vulnerability of Pressure Sector V Pressure Sector
Utilities and Infrastructure	6604.76
Irrigation	549.52
Agriculture	5147.69
Forestry	0.00
Fisheries	0.00
Tourism	5817.78
Industry	1305.32
Mining	0.00
Roads	14537.05
Railway	0.00
Transportation	0.00
Hydel Power	658.26
Demography	9382.78

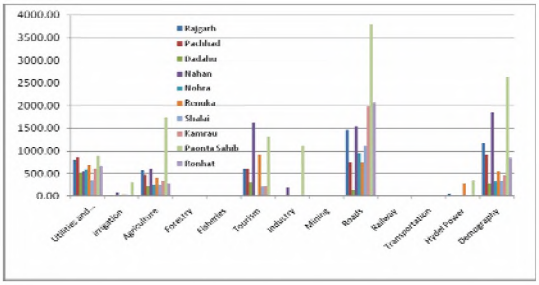
The analysis of data indicates development of Road network. Being a border District, Demographic pressures create gaps in Utilities & Infrastructure followed closely by Tourism, which is predominantly pilgrimage. Agriculture is also vulnerable on account of pressures due to pressure on land and land use changes.





PRESSURE VARIABLES:

District Sirmaur- Pressure Variables Tehsil

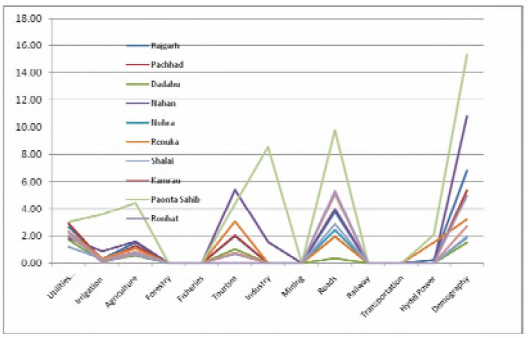


	Rajgarh	Pachhad	Dadahu	Nahan	Nohra	Renuka	Shalai	Kamrau	Paonta Sahib	Ronhat
Utilities and Infrastructure	804.73	875.82	520.75	556.53	595.85	690.95	363.64	610.00	908.99	677.50
irrigation	26.23	15.64	14.07	74.20	25.88	31.72	26.72	22.86	308.80	3.40
Agriculture	582.68	489.52	214.84	618.92	241.97	423.20	239.44	330.38	1732.06	274.68
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fisheries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tourism	599.77	616.52	310.81	1629.88	0.00	917.50	203.56	222.60	1317.14	0.00
Industry	0.00	0.00	0.00	200.42	0.00	0.00	0.00	0.00	1104.90	0.00
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Roads	1462.28	754.41	137.72	1546.04	945.05	759.51	1105.95	1979.75	3787.50	2058.84
Railway	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydel Power	42.96	0.00	0.00	0.00	0.00	259.90	0.00	0.00	355.40	0.00
Demography	1174.00	924.31	263.05	1857.10	319.42	555.36	335.56	468.79	2631.81	853.38

The analysis of data indicates development of Road network. Demographic pressure and tourism development creates pressure on Utilities & Infrastructure. Agriculture is under pressure. Demographic pressure is higher in Paonta Sahib and Nahan, both being border and industrialized Tehsils. The analysis indicates that that Tourism pressure in Nahan is higher than Paonta Sahib as Nahan is the District Headquarters. Paonta

Sahib is visited by pilgrims and visitors for business.

District Sirmaur- Pressure Variables Tehsil wise VI



The analysis of data indicates vulnerability due to demographic pressure in Paonta Sahib, Nahan, Rajgarh, Pachhad and Kamrau. In fact, the first three tehsils being border districts have crossed the critical vulnerability segment. Pachhad borders Haryana, and Kamrau borders Uttarakhand. Rajgarh adjoins Solan and thus demographic pressure is evident in all these Tehsils. Paonta Sahib has crossed the critical segment of vulnerability in the Industry Sector, while Paonta Sahib and Nahan are on the verge of criticality in the Tourism Sector.

Pressure Variables at Tehsil Level

Similarly, the pressure variables computed at Tehsil level for comparison is given below.

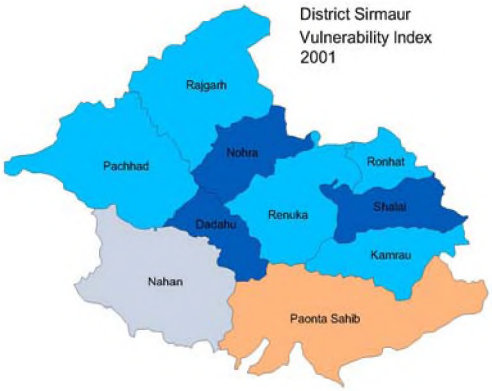
Comparison of Pressure variables at Tehsil level:

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Sirmaur. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

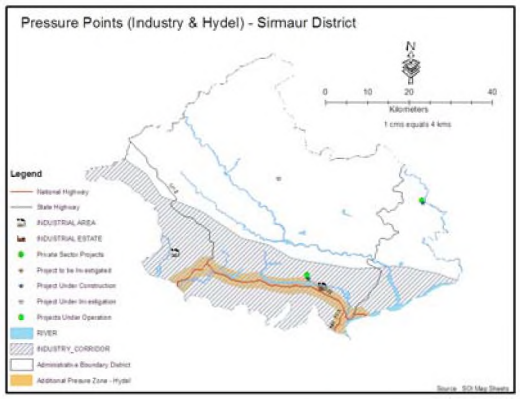
$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

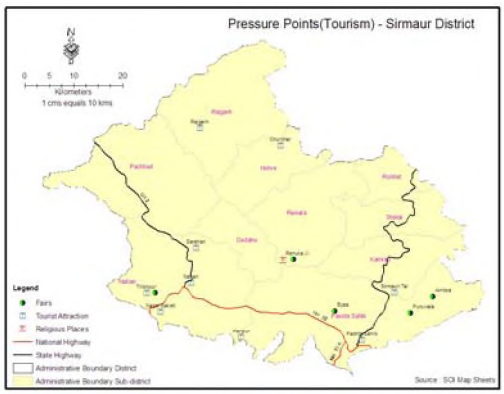
Vulnerability Index

	Rajgarh	Pachhad	Dadahu	Nahan	Nohra	Renuka	Shalai	Kamrau	Paonta Sahib	Ronhat
VI	4692.66	3749.55	1461.25	6483.08	2128.18	4449.22	2930.45	4195.91	10937.76	4580.97
Denominator = 57x43					**2451**					
Normalized VI	**1.91**	**1.53**	**0.60**	**2.65**	**0.87**	**1.82**	**1.20**	**1.71**	**4.46**	**1.87**

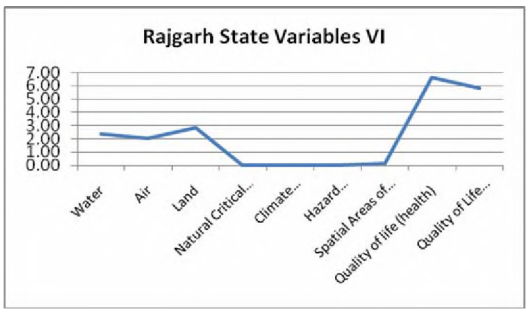


The analysis of data indicates that Tehsils bordering the neighboring states have a higher VI. Paonta Sahib and Una have accessibility from the plains which creates pressure. Nahan and Paonta Sahib are the only two Tehsils in the District through which a National Highway passes. Thus, the cumulative impact of being adjoining to neighboring states and better connectivity through the National Highway creates pressure and resultant vulnerability. Though Pachhad also borders Haryana, yet the Tehsil is not highly vulnerable due to the fact that the accessibility is not very good. All other Tehsils have low vulnerability.

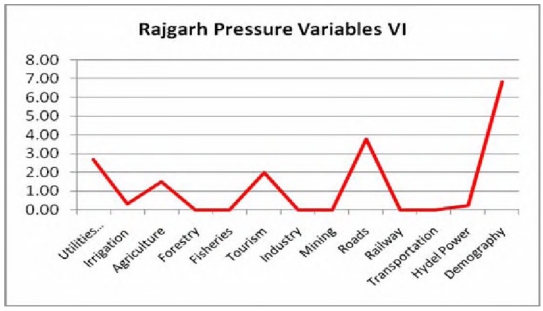




RAJGARH - Overall Vulnerability Index = 1.91



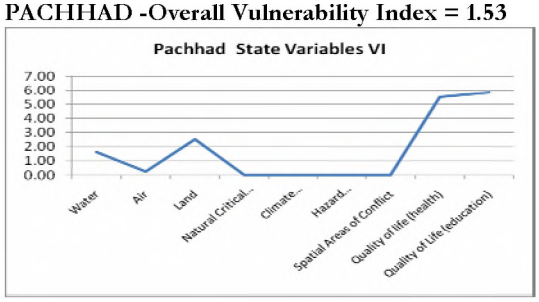
The analysis of data indicates gaps in infrastructure and services in health and education sector which has crossed critical segment thereby making the sector the most vulnerable in the Tehsil. A programme for improving infrastructure and services for health and education sector can be taken up to reduce the VI. Rest of the sectors are in the low vulnerability segment and are not of cause of immediate concern/priority.



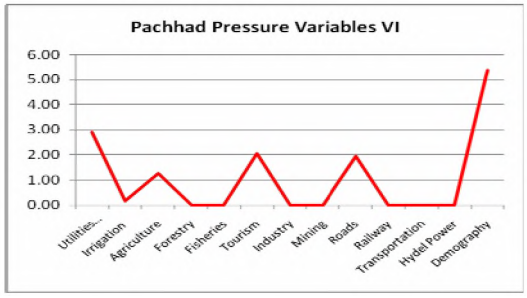
The analysis of data indicates development of Road Network and demographic pressure. With 42% growth rate and demographic pressure in the Tehsil due to proximity to Solan, vulnerability has crossed the critical segment.

A programme for improving infrastructure and services for health and education sector can be taken up on priority to reduce the VI. The Development Plan for Rajgarh Town and surrounding sub region can also be prepared.

PACHHAD -Overall Vulnerability Index = 1.53

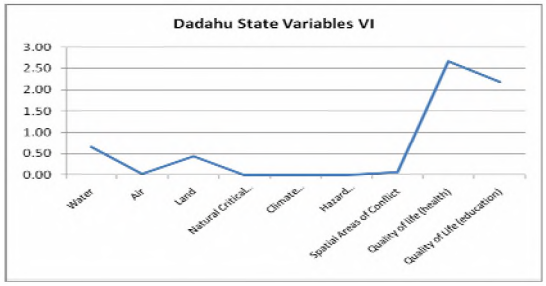


The analysis of data indicates gaps in infrastructure and services in health sector making them vulnerable. Rest of the sectors is within controllable range.



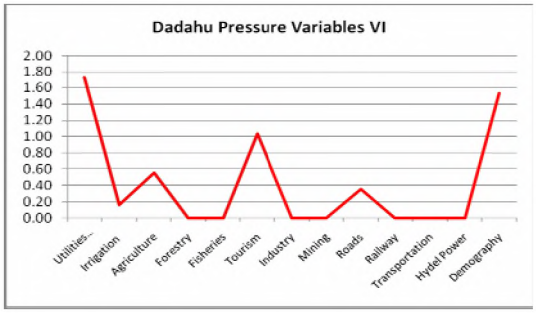
This Tehsil presents a very interesting fact in the demography. It had an urban area in 1991 Census. However, no urban area was recorded in 2001 Census. The growth rate of rural population is also higher than the general growth rate. It is expected that the land may come under pressure in future with the accessibility improved by the development of road network. Further, analysis of data indicates demographic pressure in this border Tehsil which has reached the critical segment making it most vulnerable. Rest of the variables is in controllable segments. A programme for improving infrastructure and services for health and education sector can be taken up on priority to reduce the VI.

DADAHU- Overall Vulnerability Index = 0.60



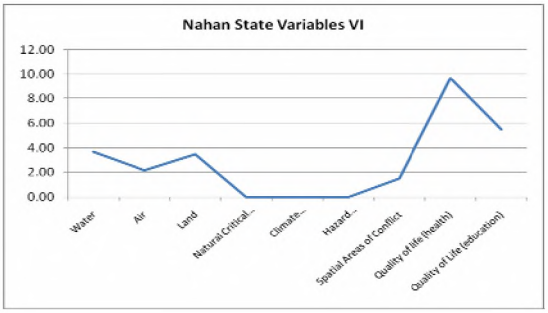
The analysis of data indicates gaps in health infrastructure and services sector. though both are in the low or very low vulnerability segment.

A programme for improving infrastructure and services for health and education sector can be taken up on priority to reduce the VI.



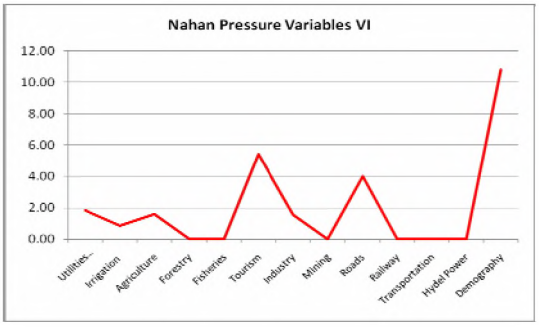
The analysis of data indicates that all sectors are within the controllable range of VI.

NAHAN – Overall Vulnerability Index 2.65



The analysis of data indicates gaps in infrastructure and services in health sector which are critically vulnerable. Rest of the sectors are in controllable range of VI.

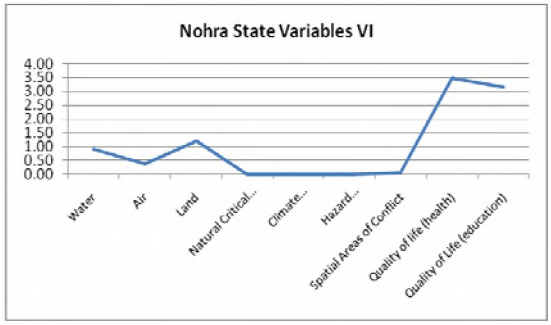
A programme for improving infrastructure and services for health and education sector can be taken up on priority to reduce the VI.



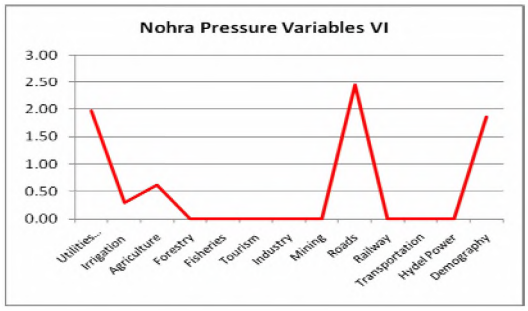
The analysis of data indicates demographic pressure which makes this border Tehsil (also the District Headquarters) most vulnerable. The growth rate of rural population is higher than average. The sole urban centre of Nahan has also got an average growth rate. The existence of the NH is opening up new areas and triggering in-migration.

A corridor development plan along the National Highway can be prepared. A programme for improving infrastructure and services of health sector can be taken up on priority to reduce the VI. Industrial corridor can be considered in light of the Comprehensive Environmental Pollution Index (CEPI) and after EIA/EMP of the proposed Industrial corridor.

NOHRA – Overall Vulnerability Index = 0.87



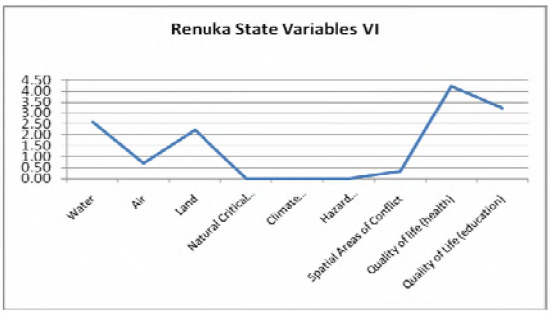
The analysis of data indicates gaps in health infrastructure and services sector which are crossing the low vulnerability segments. A programme for improving infrastructure and services for health and education sector can be taken up on priority to reduce the VI.



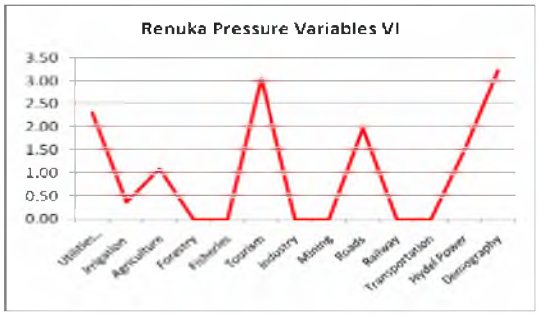
The analysis of data indicates that no sector is touching the critical stage. All the sectors are under controllable limits of Vulnerability.

However, a programme for improving infrastructure and services for health and education sector can be taken up.

RENUKA – Overall Vulnerability Index-1.82

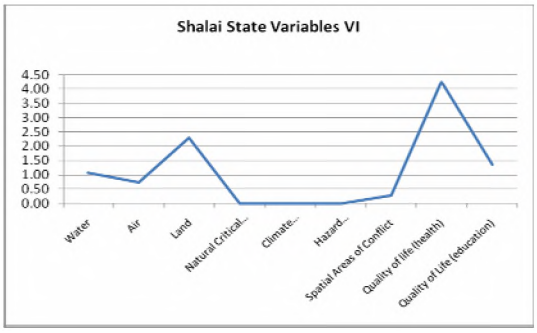


The analysis of data indicates gaps in infrastructure and services of health sector. Health sector is into moderately low segment while Education sector is in the low segment. A programme for improving infrastructure and services for health and education sector can be taken up.

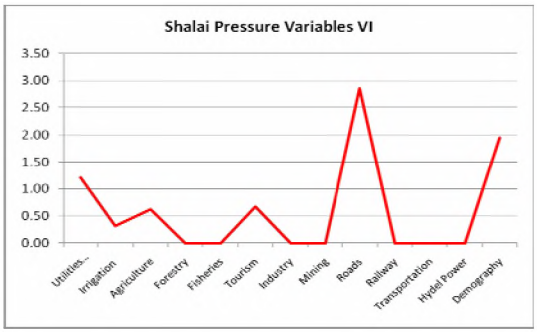


The analysis of data indicates demographic pressure and Tourism development which creates gaps in Utilities & Infrastructure. All of them are in the low vulnerability segment or just above it in the moderately low vulnerability segment. The Tourism pressure is on account of pilgrims. A programme for improving infrastructure and services for health and education sector can be taken up. A Conservation Plan for Renuka Lake can be prepared. A Tourism Infrastructure Plan for Renuka Lake can be prepared as per the Tourism Master Plan.

SHALAI – Overall Vulnerability Index- 1.20

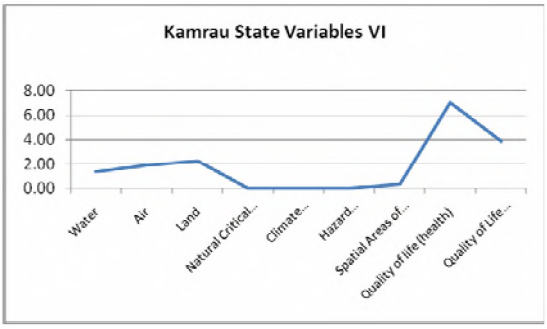


The analysis of data indicates gaps in infrastructure and services in health and education sector. All other variables sectors are in controllable situation. A programme for improving infrastructure and services for health and education sector can be taken up to reduce vulnerability.

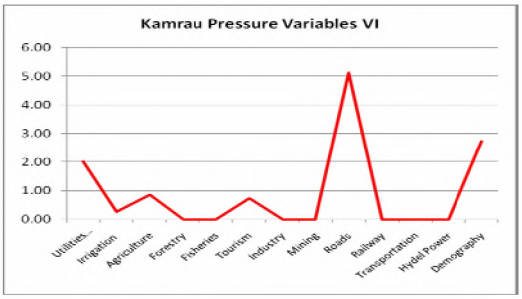


The analysis of data indicates that no sector in under any state of criticality. However, a programme for improving infrastructure and services for health sector can be taken up.

KAMRAU – Overall Vulnerability Index- 1.71

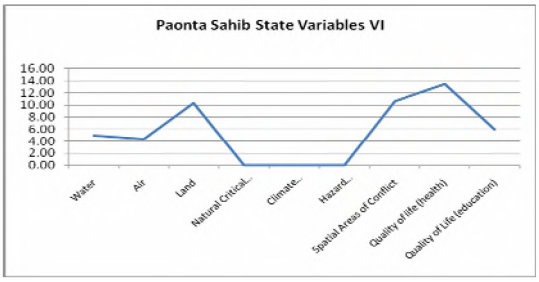


The analysis of data indicates gaps in infrastructure and services in health and education sector making it vulnerable. Health sector is critically vulnerable, while Education is in the high vulnerability segment. A programme for improving infrastructure and services for health and education sector can be taken up to reduce vulnerability.

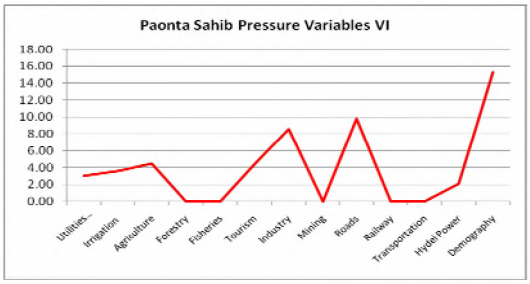


The analysis of data indicates development of Road network which has opened up new areas. All the other sectors are within controllable range of vulnerability. A programme for improving infrastructure and services for health and education sector can be taken up to reduce vulnerability.

PAONTA SAHIB- Overall Vulnerability- 4.46



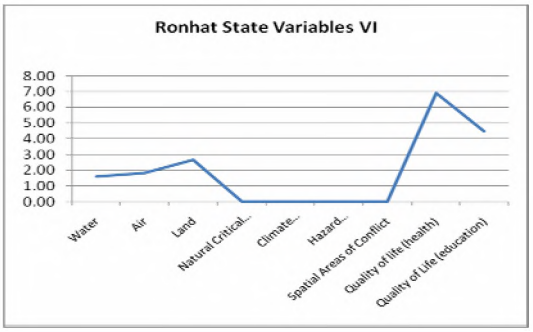
The analysis of data indicates gaps in infrastructure and services in health and education sector making it very critical vulnerable for Health sector and critically vulnerable for Education sector. Further, analysis indicates very critical vulnerability for Spatial Areas of Conflict and Land.



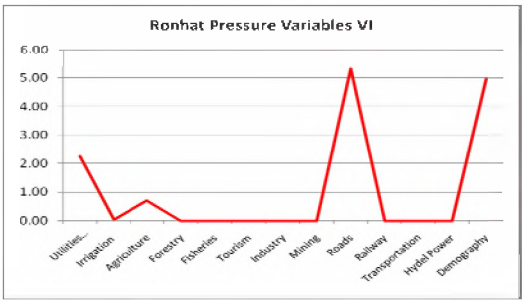
The analysis of data indicates demographic pressure resulting in extremely critical vulnerability because of a high rural and urban population growth rate. The analysis indicates that migratory population from the neighboring States has settled to service the Industrial Growth which also shows a critically high vulnerability along with land.

A programme for improving infrastructure and services for health and education sector can be taken up to reduce vulnerability. Diversion of Land for non agricultural purposes from agriculture can be as per development plan/land use plan/ state agriculture plan/ district agriculture plan. Future development of Industrial corridor can be considered in light of the Comprehensive Environmental Pollution Index (CEPI) and after EIA/EMP of the proposed Industrial corridor.

RONHAT – Overall Vulnerability Index – 1.87



The analysis of data indicates gaps in infrastructure and services in health and education sector making it very critical vulnerable for Health sector. Education sector is highly vulnerable and reaching criticality. Rest of the variables is under controllable range of vulnerability.



Further, Road network development and Demographic pressure makes these sectors highly vulnerable. The Rural Population growth rate is very much higher than the average and which could be because of in-migration from neighboring State. A programme for improving infrastructure and services for health and education sector can be taken up to reduce vulnerability.

Vulnerability Levels in Regional Context:

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

Having assessed the VI for Sirmaur District, it would be interesting to juxtaposition these VI values with values for adjoining Tehsils of other Districts. The matrix below displays the relationship-

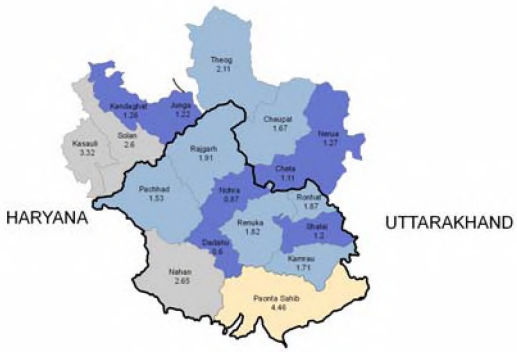
Sirmaur

S. No.	Tehsil	VI	Adjoining Tehsil in Sirmaur District	VI	Adjoining Tehsil in Other District	District	VI
1	Rajgarh	1.91	Nohra	0.87	Solan	Solan	2.60
			Pachhad	1.53	Kandaghat	Solan	1.26
					Junga	Shimla	1.22
					Shimla Rural	Shimla	4.12
					Theog	Shimla	2.11
2	Nohra	0.87	Renuka	1.82	Chaupal	Shimla	1.67
			Rajgarh	1.91	Cheta	Shimla	1.11
			Pachhad	1.53			

S. No.	Tehsil	VI	Adjoining Tehsil in Sirmaur District	VI	Adjoining Tehsil in Other District	District	VI
			Dadahu	0.60			
3	Pachhad	1.53	Rajgarh	1.91	Kasauli	Solan	3.32
			Nohra	0.87	Solan	Solan	2.60
			Dadahu	0.60			
			Nahan	2.65			
4	Renuka	1.82	Nohra	0.87	Cheta	Shimla	1.11
			Ronhat	1.87			
			Shalai	1.20			
			Kamrau	1.71			
			Paonta Sahib	4.46			
			Dadahu	0.60			
5	Dadahu	0.60	Pachhad	1.53			
			Nohra	0.87			
			Renuka	1.82			
			Paonta Sahib	4.46			
			Nahan	2.65			
6	Nahan	2.65	Pachhad	1.53			
			Dadahu	0.60			
			Paonta Sahib	4.46			
7	Paonta Sahib	4.46	Nahan	2.65			
			Dadahu	0.60			
			Renuka	1.82			
			Kamrau	1.71			
8	Kamrau	1.71	Shalai	1.20			
			Paonta Sahib	4.46			
			Renuka	1.82			
9	Shalai	1.20	Kamrau	1.71			
			Renuka	1.82			
			Ronhat	1.87			
10	Ronhat	1.87	Shalai	1.20	Cheta	Shimla	1.11
			Renuka	1.82	Nerua	Shimla	1.27

Color Code

Vulnerability Categorization	Color
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	



District Sirmaur is surrounded by various Tehsils of District Shimla and Solan. The vulnerability levels of all surrounding areas are higher than that of what is prevailing in various Tehsil/ Sub tehsils except for Renuka and Ronhat. The transitional impact of vulnerability possibly will give rise to vulnerability levels in when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.

Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis

required to be addressed as a response in terms of policy, plans, programmes and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the programme as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and rationalization of distribution of water resources for various usages is required to be undertaken. There is a need felt to recharge the ground water by developing the small check dams on the non perennial *khuds* and tributaries to improvise the irrigation scenario in the district.

(ii) As is observed from the analysis, the quality of life in terms of health and education required to be addressed on a priority. To reiterate the basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.

(iii) The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Villages which do not have these facilities within the specified distance are deficient. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils(in descending order)-. Paonta sahib, Nahan, Rajgarh, Pachhad, Kamrau, Ronhat, Renuka

Similarly, for the quality of life parameters for education, the district has an excellent network up-to the college level but intensive efforts are needed in establishment of Vocational training Institutions, so that villages within 25 kms. radius have accessibility. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

Priority Tehsils (in descending order)-)-. Paonta sahib, Rajgarh, Pachhad, Ronhat, Kamrau, Renuka

The benchmarking of the norms has been done with a view of the terrain in the State. A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

Two of the Tehsils in the district, Paonta Sahib and Nahan, reveals probable Spatial Areas of Conflict. Most of these are primarily related to conflict with water due to the setting up of Industries near water-ways, some relate to conflict with air, which are a result of industries and Plants operating in the area. A couple of Spatial Areas of conflict are identified with land with green cover, as the proposed Industrial Corridor is proposed to be established over this area. It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural &

utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) Tourism as a parameter is the next highest scorer in the district pressure parameters. A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed District Level Plans for Tourism is required to be prepared.

(iii) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has decreased by approximately 22% on an average in the entire district. In future, the current agriculture land use can change to non agriculture land use, for instance, Industrial development and Urbanization. Rationalization of land requirement for Industrial and habitation can be done and policy for Industrial Growth and Urbanization may include this through norms developed on the basis of type of Industry and Urban Activities and its planned output including employment potential.

(iv) Utilities and Infrastructure is the second highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks.

(v) It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(vi) The proposal to expand existing Industrial area may be considered after taking prior environment clearance. The proposal to establish Industrial Corridor should be carefully analyzed to prevent any adverse environmental impact and an Environmental Impact Assessment Study can be made mandatory in the State context.

(vii) The catchment area treatment is required to be implemented as per plans submitted by Hydel Power projects proponents. There is a need to implement and achieve an ecological flow in the downstream of dams on river. A comprehensive water utilization plan is required to be prepared through scientific studies.

(viii) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Variable	Policy	Plan	Programme	Project	Remarks
STATE					
Water		√	√		Water Utilization Plan
Quality of life (Health)			√		Programme to improve access
Quality of life			√		Programme to improve access

Variable	Policy	Plan	Programme	Project	Remarks
(Education)					
PRESSURE					
Roads	√				Policy to take care of State variables
Tourism		√			Tourism Plan at State, District, and Destination Level
Utilities & Infrastructure		√		√	Tehsil level plan Cluster level projects
Agriculture	√				Policy regarding Diversion of land for non-agricultural use
Industrial Corridor		√			Detailed EIA and EMP

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

	Rajgarh	Pachhad	Dadahu	Nahan	Nohra	Renuka	Shalai	Kamrau	Paonta Sahib	Ronhat
VI	4692.66	3749.55	1461.25	6483.08	2128.18	4449.22	2930.45	4195.91	10937.76	4580.97
Denominator = 57x43						**2451**				
Normalized VI	**1.91**	**1.53**	**0.60**	**2.65**	**0.87**	**1.82**	**1.20**	**1.71**	**4.46**	**1.87**

Population Projections

	Pop 2001	Projected Pop 2011	Projected Pop 2021	Projected Pop 2031	Projected Pop 2041
Rajgarh	20125	24600	29807	35710	42268
Pachhad	66,315	79174	94515	112087	131646
Dadahu	41,730	50,424	60,640	72,235	85,068
Nahan	48,310	67794	89974	115012	143066
Nohra	1,39,072	169891	206747	248982	295985
Renuka'	33750	40,192	47,675	56,112	65,416
Shalai	14514	15,529	16,678	17,957	19,359
Kamrau	22732	26203	30337	35075	40357
Paonta Sahib	54791	75815.09	98889.28	124122.5	151601.1
Ronhat	32676	40330	48839	58151	68209

Calculation of per capita share of VI

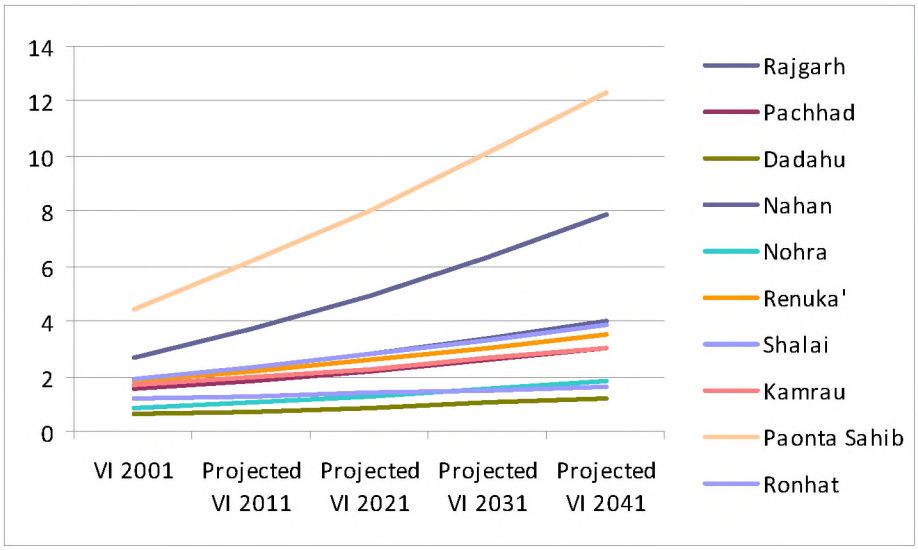
	Pop 2001	VI 2001	per capita share
Rajgarh	20125	1.91	9.49
Pachhad	66,315	1.53	2.31
Dadahu	41,730	0.6	1.44
Nahan	48,310	2.65	5.49
Nohra	1,39,072	0.87	6.26
Renuka	33,750	1.82	5.39
Shalai	14,514	1.2	8.27
Kamrau	22,732	1.71	7.52
Paonta Sahib	54,791	4.46	8.14
Ronhat	32676	1.87	5.72

Calculation of Projected VI

	Pop 2001	VI 2001	per capita share	Proj Pop 2011	Proj. VI 2011	Proj Pop 2021	Proj VI 2021	Projected Pop 2031	Proj VI 2031	Proj Pop 2041	Proj VI 2041
Rajgarh	20125	1.91	9.49	24600	2.33	29807	2.83	35710	3.39	42268	4.01
Pachhad	66,315	1.53	2.31	79174	1.83	94515	2.18	112087	2.59	131646	3.04
Dadahu	41,730	0.6	1.44	50,424	0.73	60,640	0.87	72,235	1.04	85,068	1.22
Nahan	48,310	2.65	5.49	67794	3.72	89974	4.94	115012	6.31	143066	7.85
Nohra	1,39,072	0.87	6.26	169891	1.06	206747	1.29	248982	1.56	295985	1.85
Renuka	33,750	1.82	5.39	40192	2.17	47675	2.57	56112	3.03	65416	3.53
Shalai	14,514	1.2	8.27	15529	1.28	16678	1.38	17957	1.48	19359	1.60
Kamrau	22,732	1.71	7.52	26203	1.97	30337	2.28	35075	2.64	40357	3.04
Paonta Sahib	54,791	4.46	8.14	75815	6.17	98889	8.05	124123	10.10	151601	12.34
Ronhat	32676	1.87	5.72	40330	2.31	48839	2.79	58151	3.33	68209	3.90

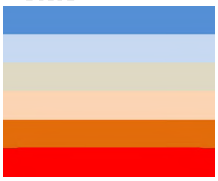
Projected Vulnerability Index

	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Rajgarh	1.91	2.33	2.83	3.39	4.012
Pachhad	1.53	1.83	2.18	2.59	3.037
Dadahu	0.6	0.73	0.87	1.04	1.223
Nahan	2.65	3.72	4.94	6.31	7.848
Nohra	0.87	1.06	1.29	1.56	1.852
Renuka'	1.82	2.17	2.57	3.03	3.528
Shalai	1.2	1.28	1.38	1.48	1.601
Kamrau	1.71	1.97	2.28	2.64	3.036
Paonta Sahib	4.46	6.17	8.05	10.10	12.340
Ronhat	1.87	2.31	2.79	3.33	3.90



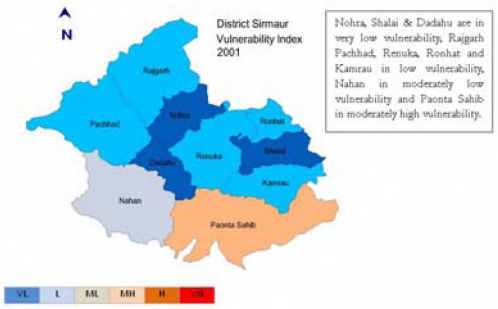
Vulnerability Categorization
Very low vulnerability
Low vulnerability
Moderate low vulnerability
Moderate high vulnerability
High vulnerability
Very High Vulnerability

Color



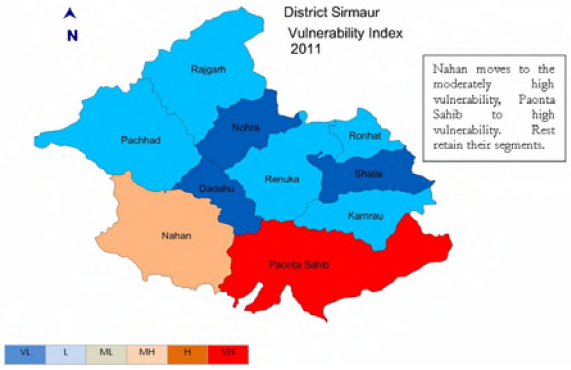
Projected VI- Mapping the future Scenarios Color code

2001



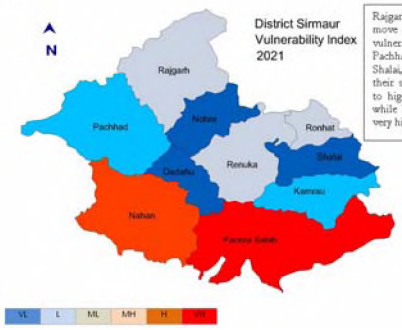
Nohra, Shalai & Dadahu are in very low vulnerability, Rajgarh Pachhad, Renuka, Ronhat and Kamrau in low vulnerability, Nahan in moderately low vulnerability and Paonta Sahib in moderately high vulnerability.

2011



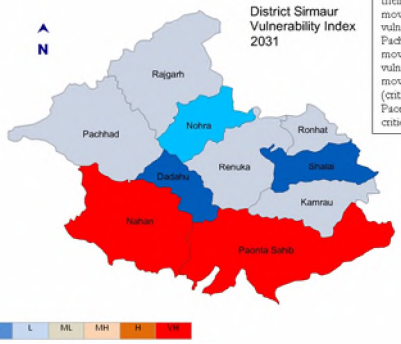
Nahan moves to the moderately high vulnerability, Paonta Sahib to high vulnerability. Rest retain their segments.

2021



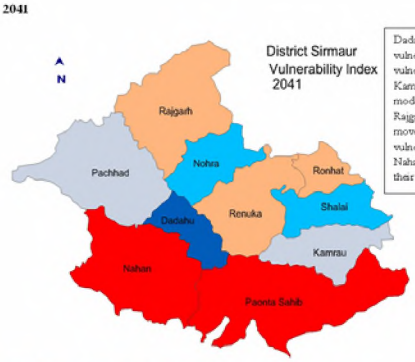
Rajgarh, Renuka and Ronhat move to the moderately high vulnerability segment, Pachhad, Dadahu, Nohra, Shalai, and Kamrau retain their segments. Nahan moves to high vulnerability segment while Paonta Sahib moves to very high (critical) segment.

2031



Dadahu, Shalai, Rajgarh, Renuka and Ronhat retain their segments. Nohra moves to low vulnerability while Pachhad and Kamrau move to moderately low vulnerability. Nahan moves to very high (critical) vulnerability and Paonta Sahib retains its criticality.

2041

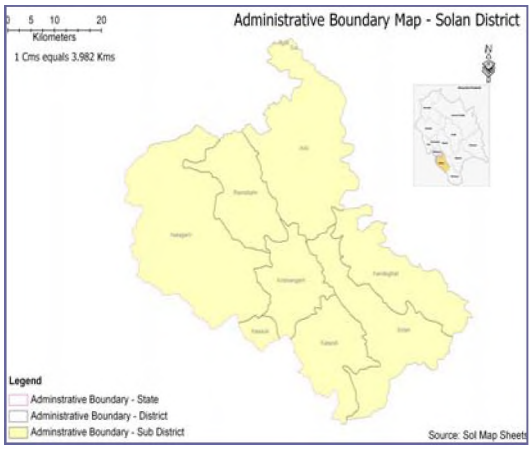


Dadahu remains very low vulnerable. Nohra is joined in low vulnerability segment by Shalai. Kamrau and Pachhad retain moderately low vulnerability. Rajgarh, Renuka and Ronhat move to moderately high vulnerability segment. Nahan & Paonta Sahib retain their criticality.

SOLAN

General Background

Solan lies between 30^0 45' 11" and 31' 21' 10" north latitudes and 76036'0" and 77^0 15' 20" east longitudes. The elevation of the district ranges from 300 to 3000m above sea level. The district is bounded by Shimla in North, by Ropar district in Punjab & Ambala district of Haryana in South, Sirmaur in East and by Bilaspur district in west. Mandi district touches boundary of Solan district in North-East. The shape of district is rectangular with slight bulge on northern side intruding towards Mandi district. The total area of the district is 1936 sq. kms. forming 3.5% of the total area of the State.



The district is divided into 7 administrative units as Tehsil / Sub-Tehsil (area in descending order as follows):

Sr. No.	Tehsil	Area in sq. kms.
1.	Nalagarh	522.90
2.	Arki	394
3.	Solan	210.50
4.	Kandaghat	207.20
5.	Ramshahr	183.20
6.	Krishangarh	152.50
7.	Kasauli	138.80

Physiography

The terrain of the district on the whole is mountainous except three valleys of Kunihar in Arki, Saproon in Solan and Doon in Nalagarh Tehsil. Doon valley is the most fertile and is bigger in size, whereas Kunihar and Saproon valleys are smaller. The elevation of Solan district ranges from 284 metres to 2069 metres above the mean sea level. The district is having certain areas of very low altitude, which are mostly located in western and southern parts and areas of high altitude in central region extending upto north -eastern corner of the district. This district is divided into four sub-micro regions of *Satluj* Basin. Solan Lesser Himalaya, Nalagarh Shiwalik and Solan Forests.

The Satluj Basin



This region extends over the extreme north - eastern part of the district covering northern and eastern part of Arki Tehsil consisting of 274 villages. It makes its boundaries with Mandi district in the north, Bilaspur district in the west, Solan lesser Himalaya in the south and Shimla district in the east. This region is characterized by the rugged and mountainous features with elevation ranging from 951 meters to 1985 metres above the mean sea level. One of the highest hill ranges is *Devi Dhar* which runs parallel to *Sutlej* river with steep slopes on the northern side and gentle slopes on the southern side.

Solan Lesser Himalaya



This spreads over the central part of the district occupying southern and western parts of Arki Tehsil, eastern half of Ramshahr sub-Tehsil, northern extreme of Krishangarh sub-Tehsil, Solan and Kandaghat Tehsil covering 623 villages and one Arki Nagar Panchayat. It is surrounded by *Satluj* Basin from north, by Shimla district from east, by Solan forest region from south and by Bilaspur district and Nalagarh Shiwalik from west. The Solan lesser Himalaya spreads over the central part of the district and is criss- crossed by hill ranges of which *Bari Dhar* is a prominent range. It runs almost in the centre of this region from south to north direction. The elevation of this region ranges between 539 metres and 2069 metres above the mean sea level. Kunihar valley is flat and fertile and is small in size. The general terrestrial slope of this region is from south-east to north-west direction.

Nalagarh Shivalik

This portion covers the western portion of the district which includes Nalagarh Tehsil, western half of Ramshahr sub-Tehsil and small area of Kasauli Tehsil. It covers 553 villages, 2 towns namely Nalagarh Nagar Parishad and Baddi Nagar Panchayat. It is bounded by Bilaspur district in the north, State of Punjab in the west State of Haryana in the south and Solan lesser Himalaya and Solan Forests in the east. The Nalagarh Shivalik region has lower hill ranges varying from 284 metres to 1391 metres high. The elevation in this region rises gradually towards east and north -east direction.

Solan forest



This region extends over the southern and south eastern parts of the district and includes major parts of Kandaghat, Solan Tehsil and Krishangarh sub-Tehsil except their northern parts and Kasauli Tehsil almost as a whole. It covers 1051 villages and five towns. It is surrounded by Shimla district in the north east, Sirmaur district in the south-east, Haryana State in the south west, Nalagarh Shivalik in the North West and Solan lesser Himalaya in the north. Solan Forests is characterized by many hill ranges and forests and the hill ranges generally stretch from north-west to south-east direction. The altitude varies from 630 metres in Kasauli tehsil to 1,999 metres in this region at a hill top of Karol reserved forest at Karol forest, south of Kandaghat. There is narrow tract of valley in Saproon area along the river banks while the other area are surrounded/covered by hill and thick reserved forest.

Culture and Social Brief

Fairs & Festivals

In the district a number of fairs are held throughout the year. These are: *Sharad Purnima* Fair, *Dev Bara* Fair, *Bani* Fair, *Sayari* Fair, *Koti* Fair and *Solan* Fair.

Places of religious, historical, archaeological importance and Tourist interest

Solan district has many places of religious and historical interest. A few of these are as follows:



Chail This tourist resort is located at a distance of 45 kms. from Solan and 43 kms. from Shimla. Chail is connected with pucca all weather motorable road. With a lush green setting this was the former summer capital of the Patiala State. At 2250 metres above mean sea level it has the world's highest cricket pitch and polo ground. The Himachal Pradesh Tourist Development Corporation is running a hotel which used to be palace of Maharaja Patiala.

Kandaghat: It is situated on Kalka Shimla National Highway at a distance of 15 kms. from Solan and 30 kms. from Shimla. The place was famous during the time of erstwhile rulers of Patiala. The climate of this place is semi-temperate and off-season vegetables and fruits are the specialty of the place. The place is also known for the Indira Gandhi's Holiday Home.



Kasauli: Kasauli is a beautiful small town situated at a distance of 32 kms. from Solan and 77 kms. from Shimla. This place is at a height of 1927 metres from the mean sea level. This tourist resort is suitable for the summer vacation. The Central Research Institute engaged in the research and manufacture of various vaccines is located in the town.



Solan: Solan is located on Kalka-Shimla National Highway at a distance of about 50 kms. from Kalka and 48 kms. from Shimla. The altitude of this place is 1453 metres from the mean sea level. Solan is also coming up on industrial map of the State.

Dagshai: This place is situated at a distance of 15 kms. from Solan, on Shimla-Kalka motorable road, with motorable link of one Km. from Kumarhatti. The altitude of this place is 1,922 metres from the mean sea level. The place is a health resort as well as a place of natural beauty.



Parwanoo: It is situated on the National Highway only 3 kms. away from Kalka. The town is opening way to the Himachal Pradesh for the people of Punjab and Haryana. The town is rapidly developing as

an Industrial Estate in Himachal Pradesh. Many medium large scale industries have come-up in Parwanoo.

Subathu: It is connected by a motorable road from Solan as well as from Dharampur. It is located at a distance of about 24 kms. from Solan. This place got its importance after the establishment of Gorkha Training Centre. In the olden days Subathu was known as a famous business centre and a trading centre for agriculture produce. This place is also considered to be a health resort.

Nalagarh: This place is 82 kms. from Solan and is connected by all weather roads. The town is located at the foothills of Shiwalik hills and directly connected with the plains. It also has a fort on the top of the town. Small hills facing the town provide a unique view for the visitors. Nalagarh town has grown-up as industrial area.

Arki: This small town is at a distance of 55 kms. from Solan and connected with motorable road. This place has a historical significance because of the capital of the erstwhile ruler. It has a big fort on the top of the town. A cave is also adjacent to this town. This cave has a religious importance and is known as a cave of Lord Shiva.



Assessment of District Vulnerability

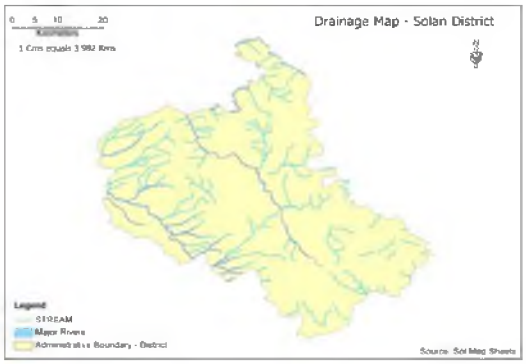
As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of Solan district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System

Solan district is the catchment area of three important rivers, namely *Sutlej, Yamuna* and *Ghagghar.*



The main tributary of *Yamuna* is *Ashni*, of *Sutlej* river are *Kiar Ka Nala*, *Ghandhar* river, *Dadar Khad* and *Kuthar Nadi* etc. and of *Ghagghar* river is *Kaushalya. Sirsa Nadi* is the mainstream in Nalagarh which has its source in the hills above Kalka and runs north -west along the base of the Shiwalik eventually joining *Satluj* river at Avankot in Ropar district of Punjab. *Sutlej* is the main river of

this region which flows from north -east to north -west direction along the northern boundary and separates the region as well as Solan district from Mandi district. The region has been drained by several small streams and rivulets, which originates in *Devi Dhar* range. *Ghambar* is the main river of Solan Lesser Himalaya region which flows almost in the centre of the region from south -east to north -west direction. It drains the whole water of this region with the tributaries like *Dabar, Kuthar, Kohaj, Rao, Kuni* and *Badhal khads*. The first three *khads* join the *Ghambar* river on the right bank and the remaining three *khads* on the left bank. Ghambar river is a rain fed river. Ghamrala khad flows from south east to north -west direction. *Sirsa Nadi* is the important river of Nalagarh Shiwalik region and flows from south -east to north -west direction. *Balad Nadi, Ralla Nadi, Phula Nala* and *Chikni Khad* are the tributaries of *Sirsa Nadi*. There are several non perennial minor streams/rivulets which originate in western Shiwalik range and join it on the left bank. There is an important Doon valley stretching parallel to the *Sirsa Nadi*. *Gambhar* and *Ashni* are the main rivers of Solan forest region. *Gambhar* flows in north westerly direction while *Ashni* flows in south easterly direction and entire water of this region is drained by these two rivers with their tributaries. *Patta Khad, Baja ki Khad* and *Surajpur Cho* are the main streams. *Giri* river forms the southern boundary of Kandaghat Tehsil and *Ghagghar* forms southern boundary of Solan and Kasauli Tehsil.

Climate

The climate of the district is mostly sub-tropical in the lower areas and moist temperate in upper reaches. The climate of *Sutlej* Basin is cold in winter and hot in summer while it is relatively hot, during summer in lower areas and cool during winter in the upper areas in Solan Lesser Himalayas. The climatic conditions of Nalagarh Shivalik region are the same as these found in the adjoining areas of Punjab and Haryana. The Solan forests region has moist temperature climatic conditions. Winter, summer, rainy and the autumn seasons are well marked. Due to significant variations in altitudes in the district the temperature also varies considerably. Minimum temperature goes down below 0^0 c in higher reaches during the winter season and the maximum temperature exceeds even 4^0 c in lower areas during the summer months.

Precipitation/Rainfall

Rainfall is received both in rainy and winter seasons. The snow fall is received during the months of January and February on the higher reaches. *Bari Dhar* range receives mild snow fall during winter. Generally, the rainy season commences from the first week of July and continues up to the last week of August, but sometimes it may advance by a fortnight and extends even up to the end of September Winter rains generally commence from the last week of December and continue up to the end of February. The months of October, November and May are relatively dry months. Snow is received during January and February mainly around Chail, Kasauli, and Karil.

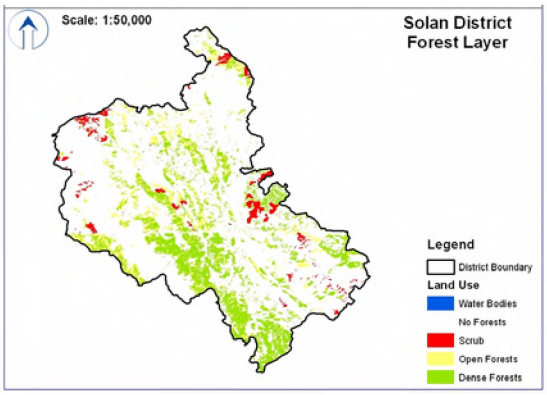
Particulars	Maximum	Minimum
Rainfall	213.61mm	6.08 mm
Temperature	40.18° C	6.23° C

Forests

The description and the main fauna and flora found in three forest divisions of the district is as follows:

Kunihar Forest Division: The vegetation within this division shows a great variation due to wide variations in the altitude. Soil depth and available moisture, chil, khair, bamboos and other broad leaved species like chhal, simbal, jhingan etc. are the most important species found within the area. The tropical euphorbia scrub forests, Shivalik chil, pine and little ban, oak are found in this tract. The vegetation changes, depending on the availability of water and

slopes. The undergrowth consists of phul lakri, karounda, ghandela and top storey consists of kashmal, katni, kainth, tirmira, khair, bel, banarasi, kangu, malkora, dub, daula and lobb are the various types of grasses found in the division.



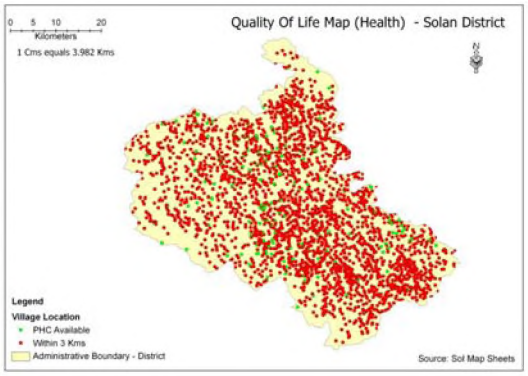
Nalagarh Forest Division: The vegetation within this tract shows variation. Mixed deciduous shrubs, bamboo and chil pine type of forests occur in this division. Natural regeneration of all species is generally deficit because of biotic interferences. The main species under mixed deciduous forests found in the division are Chhal, Jhingon. Simal, Khair, Toon, Kachnar, Amaltas etc. Undergrowth consists of karaunda, harsingar dhavi, ghandhela, mehadu, Basuti etc. Important grasses are bhabhar, dub etc. Mixed deciduous forests occur up to 1,000 metres elevation on well drained and loose textured Shiwalik formation. It closely resembles the foregoing type, the only difference being that in this case bamboo is met with in the top canopy. Chil pine forests are most important forest of the tract occurring between 800 to 1800 metres elevations. Its associates are kainth, ban, oak, kamal, amla, khair and dheru etc.

Solan Forest Division: Chil, khair, bamboos and other broad leaved species like chihal, simbal, jhingon etc. are the most important species met within this area. Undergrowth consists of phul lakri, karaunda, ghandelo and top story consists of kashmal, katni, kainth, tirmula, khair, bel, kangu and dub are the various types of grasses found in the division.

There are four wildlife sanctuaries. These are Chail in Solan Forest Division (area 109 sq.km.); Darlaghat in Kunihar Forest Division (area 6 sq.km.); Majathal in Kunihar forest division (area 40 sq.km.); Shilli in Solan Forest Division (area 2 sq.km.).

Quality of Life (Health)

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector. Of the total 2388 inhabited villages 2386 villages doesn't have hospital facility and 2366 villages doesn't have primary health centres. In case of primary health centres 796 villages have it at less than 5 kms., 706 have it between 5-10 kms. while inhabitants of 864 villages have to cover distance of 10 or more kms. With regards to hospital 186 villages have it at less than 5 kms., 338 have this at 5-10 kms. while inhabitants of 1862 villages have to cover distance of more than 10 kms.



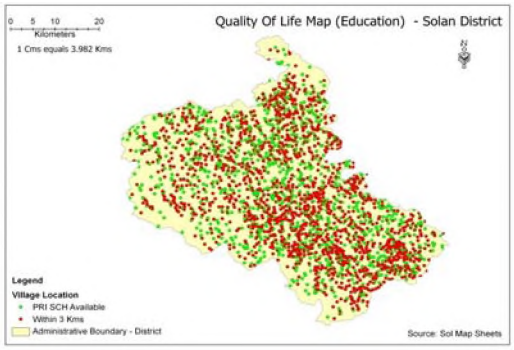
In fact, to summarize, according to 2001 Census, on an average 74.17% of villages in the district do not have access to a Primary Health Centre within a distance of 3 kms., 80.19 % of the villages do not have access to Community Health Centre within a distance of 6 kms., and, 92.84% of the villages do not have access to a Hospital within a distance of 10 kms. This clearly means that the Health Services are not accessible to people with ease.

Quality of Life (Education)

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km. in order to make the Primary School viable.

Similar is the case of access to Educational Facilities, another essential indicator of quality of life. With regards to educational facility of the total 2388 villages 1589 villages doesn't have any primary school, 2161 doesn't have middle school while 2387 villages doesn't have degree college. Of these children of 1570 villages have to travel less than 5 kms. while those of 18 villages have to travel distance between 5-10 kms. and only those of one village have to travel distance of more than 10 kms. With regards to middle school inhabitants of 1919 villages have to travel less than 5 kms; those of 232 villages have to cover distance between 5-10 kms. while those of 10 villages have to cover distance of more than 10 kms. In case of degree colleges inhabitants of 108 villages have to travel distance of less than 5 kms., of 298 villages cover 5-10 kms. while an overwhelming number of 1981 villages have to cover distance of more than 10 kms.

To summarize, according to 2001 Census, on an average just 6.28% of villages in the district do not have access to a Primary School within a distance of 2 kms., 8.08 % of the villages do not have access to a Secondary School within a distance of 6 kms., 7.69% of the villages do not have access to a College within a distance of 10 kms., and, 96.98% of the villages do not have access to a Vocational Institute within a distance of 25 kms.



This goes on to show that the district is adequately networked as far as education up-to college level is concerned, but a lot of ground has to be covered as for Institutes for vocational training is concerned.

Description of Pressure Theme Variables:

Pressure variable which are relevant in context of District Solan such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Solan district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to 2001 Census, the total population of Solan district is 500,557 persons comprising 270,291 males and 230,266 females. This population of the district forms 8.2 % of the State population and ranks at 4th place among the districts. Out of the total population of the district 81.8 % lives in rural areas while 18.2 % lives in urban areas. Rural population of the district is distributed among 7 Tehsil, sub-Tehsil and the urban population is spread over in 8 towns. The urban population in the district is 91,195 persons comprising 56,141 males and 35,054 females. The total rural population comes to 409,362 persons comprising 214,150 males and 195,212 females as recorded in 2001 Census. The rural population is distributed in 2,388

inhabited villages. Out of total 2,536 villages in the district, 2,388 are inhabited villages while 148 villages are uninhabited.

Population Growth

According to 1991 Census the total population of the district was 382,268 persons which rose to 500,557 persons in 2001 Census. There has been net addition of 118,289 persons during 1991-2001. The decadal growth rate of district comes to 30.9%. The growth rate for rural and urban areas of the district is 22.2 and 92.9% respectively. The growth rate in urban population is high in the district due to creation of a new town of Baddi N.P. and growth in urban areas of the district.

Density

The density of population in Solan district is to 259 persons per sq.kms. against State average of 109 persons. At Tehsil/sub-Tehsil level. Kasauli Tehsil ranks 1st accounting 513 persons per sq.km.

DECADAL CHANGE IN POPULATION OF TEHSILS/SUB-TEHSILS BY RESIDENCE, 1991-2001

Tehsil/ Sub-Tehsil	Population 1991			Population 2001			Percentage decadal variation 1991-2001			Percentage urban population	
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
Arki	68,069	66,093	1,976	83,230	80,353	2,877	+22.3	+21.6	+45.6	2.9	3.5
Ramshahr	25,796	25,796	-	29,718	29,718	-	+15.2	+15.2	-	0.0	0.0
Nalagarh	109,300	101,852	7,448	155,619	123,575	32,044	+42.4	+21.3	+330.2	6.8	20.6
Krishangarh	22,760	22,760	-	25,836	25,836	-	+13.5	+13.5	-	0.0	0.0
Kasauli	52,904	42,663	10,241	71,225	57,626	13,599	+34.6	+35.1	+32.8	19.4	19.1
Solan	73,865	46,251	27,614	99,793	57,118	42,675	+35.1	+23.5	+54.5	37.4	42.8
Kandaghat	29,574	29,574	-	35,136	35,136	-	+18.8	+18.8	-	0.0	0.0
District Total :	**382,268**	**334,989**	**47,279**	**500,557**	**409,362**	**91,195**	**+30.9**	**+22.2**	**+92.9**	**12.4**	**18.2**

Ramshahr sub-Tehsil ranks 7th having the lowest density of 162 persons per sq.km. among the Tehsil/sub-Tehsil in the district. The density of population varies between 513 persons to 162 persons per sq.km. In rural areas, the density of population works out to 215 persons per sq.km. while in urban areas it comes to 2,739 persons per sq.km.

Sex Ratio

There are 852 females for every thousand males in Solan district. The sex ratio in rural and urban areas in Solan district comes to 912 and 624 females per 1,000 males respectively. It is observed the proportion of females in rural areas is higher than that of urban areas. In rural and urban areas the sex ratio is 905 and 876 females per 1,000 males respectively.

Workers Participation Rate

The work participation rate is defined as percentage of total workers to total population. In the same way it is defined for main-workers and marginal-workers. According to 2001 Census, the total workers including main and marginal workers constitute 52.6% of the total population of the district as a whole of the total workers, the share of the main workers is 34.4% and the marginal worker comes to 18.2%. The remaining 47.4% of the population belongs to the category of non-workers.

According to 2001 Census among the main workers, male participation rate in the district stands at 50.8% and of females is 15.2%. The percentage of males and females marginal workers is 10.4 and 27.4% respectively. The proportion of female marginal workers is higher than that of males as the females are generally engaged themselves in one or more economic activities in addition to their daily household duties to improve the family income. It is

observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than female main workers.

Literacy

A person who can read and write in any language with understanding is taken as literate in Census. All the children of age-group 0-6 years has been treated as illiterate. As per 2001 Census, Solan has 332,410 literates persons constituting 76.6% of the total population excluding age-group 0-6 years. The proportion of males and females literates in the district is 84.8 and 66.9% respectively. The literacy rate of males is higher than that of females and gap in gender literacy is 17.9%.

The total literacy rates of rural and urban areas are 73.9 and 88.0% respectively. The proportion of males and females literate in rural is 83.1 and 64.0% respectively, while in urban areas proportion of males and females is 90.8 and 83.2%. Females in urban areas are better educated than their counterparts in rural areas of the district.

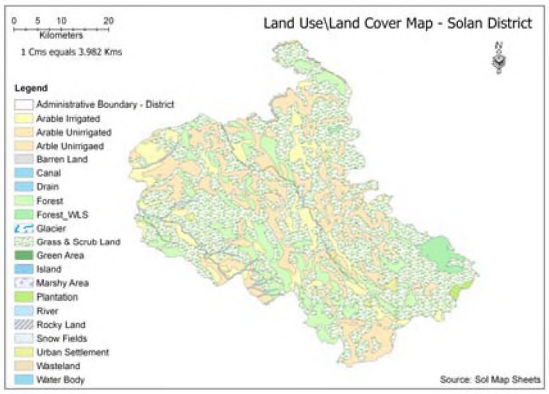
Urban Population

The statement given below shows the position and number of urban units in size class for 2001 Census.

Size class of Town	Name and Civic status of Town.	Population
VI	Arki N.P.	2,877
III	Baddi N.P.	22,601
VI	Dagshai C.B.	2,750
VI	Kasauli C.B.	4,990
V	Nalagarh M.Cl.	9,443
V	Parwanoo M.Cl.	8,609
V	Sabathu, C.B.	5,719
III	Solan, M.Cl.	34,206

The development of Industrial areas at Baddi, Barotiwala and Nalagarh has given a 330% growth impetus to the urban population of Nalagarh Tehsil. This area is expected to further grow on the population front as the urban population stabilizes.

Land Use



Land use Classification of Area	Land utilization (Sq.Km)
Total Geographical Area	1936
Forest	1253.11
Cultivable	451.26
Barren and uncultivable Land	104.41
Cultivable Wasteland	127.22

The district is spread over the valleys and higher elevations. The cultivation is possible only in small terraces in the hills or along the streams/*khads* in most parts of the district. However, in the valleys the cultivation is spread over a vast area. Except the valley area, most of the land is either under scrub forests or grassy land with chil trees up to the height of 1500 metres from the mean sea level and kail and deodar on the high altitudes. It is only in the Doon, Saproon and Kunihar valleys that the land is mostly flat and fertile.

Agriculture

Agriculture being the largest and main occupation of the people in the district. It provides direct employment to the major chunk of the working population. Maize, wheat, rice and pulses etc. are the main crops of the district. Cash crops such as sugarcane in Nalagarh Tehsil and potato in Kandaghat Tehsil are grown. Besides, vegetable cultivation has also been taken up. Despite hilly topography of the district, additional area has been brought under cultivation. Rainfall is indispensible for the cultivation in the hilly areas. This is because irrigation facilities could not be created here to the extent possible in plains. Due to unfavourable climatic conditions, only

higher elevation area with a facility of irrigation provided a good scope for vegetable cultivation in the district. The district is suitable for growing off season vegetables like tomato, capsicum, peas etc. The cauliflower seed is also grown in the district and exported to plains. The major crops grown in the district are Wheat, Maize, Paddy, Gram, Pulses, and off season Vegetables.

Tehsil-Wise Area under Principal Crops*

Crops	Arki	Kandaghat	Kasauli	Krishangarh	Nalagarh	Ramshahr	Solan	Total
Paddy	9.92	0.40	1.66	1.88	20.36	4.64	0.51	39.37
Maize	59.94	13.48	19.63	17.16	87.43	17.70	20.63	237.97
Wheat	40.93	7.56	29.46	16.98	107.74	21.75	19.89	236.31
Barley	7.52	4.37	1.40	2.56	0.09	0.99	3.72	20.63
Total Cereals	126.31	25.81	43.15	38.58	217.29	45.06	37.75	534.48
Gram	-	-	1.49	0.01	5.96	0.13	0.04	7.68
Peas	0.05	3.31	0.66	0.38	-	0.14	6.52	10.91
Arhar	-	-	0.23	-	2.59	-	-	2.82
Mash	-	0.87	1.61	-	8.75	0.23	1.92	16.62
Kulath	3.24	0.79	0.16	0.38	0.23	0.14	0.38	5.59
Masoor	-	-	-	-	-	-	0.03	3.54
Other Pulses	0.47	-	-	0.74	0.09	-	-	1.24
Total pulses	7.27	4.97	4.15	1.53	12.62	0.64	8.89	45.07
Sugarcane	-	-	0.27	-	2.17	-	0.07	3.05
Potato	0.27	0.42	0.08	0.03	0.53	0.02	0.04	1.38
Tomato	1.46	4.08	2.15	1.04	0.20	1.69	7.65	18.77
Onion	0.09	0.01	0.14	0.01	0.10	0.01	-	0.36
Cabbage	0.26	0.15	0.02	0.04	0.02	0.01	0.14	0.64
Other Vegetables	0.64	1.89	0.43	0.27	0.82	0.21	1.76	5.84
Total vegetables	2.72	6.55	2.81	1.99	1.67	1.84	9.59	27.17

Solan is named as Mushroom city. A large number of cultivators in the district are growing mushroom on commercial scale, as the climatic conditions in the district are most conducive for growing mushroom.

Irrigation

The total geographical area of Solan is 1936 Sq. kms. Of this a high percentage of area is under forest and area comprising steep barren slopes. Due to these natural factors extensive irrigation is difficult in the district. However, cultivated area exists in patches in villages along the hill slopes which are basically suited for minor irrigation. Improved method of cultivation, irrigation and better seeds can boost the production of food grains. The district has a number of perennial streams with immense scope for exploitation of surface water potential. Further the Nalagarh valley has been found ground water worthy as per survey conducted by the Central Ground Water Board and the region has been found suitable for sinking of shallow and deep tube wells.

Tehsil-Wise Position of Irrigated Area (Sq.Km)

Tehsil/Sub-Tehsil	Canal/Kuhl	Pond	Well/ tap	Other sources	Tot. Irr. Area
Arki	21.17	-	-	1.43	22.60
Kandaghat	7.32	0.05	-	0.32	7.69
Kasauli	13.54	-	3.20	-	16.74
Krishangarh	6.40	-	-	0.05	6.45
Nalagarh	22.02	-	17.26	1.84	41.22
Ramshahr	8.65	-	0.04	0.05	8.74
Solan	12.81	-	-	0.02	12.83
District Total	**91.91**	**0.05**	**20.50**	**3.71**	**116.27**

Livestock

The livestock plays an important role in State's economy which is primarily agrarian. Agriculture economy is supplemented by Animal Husbandry. Agriculture production depends very much on the livestock available. Agriculture is viable if adequate animal stock is there to feed it by way of manure etc. The Department of Animal Husbandry is playing a key role in improving the cattle wealth of the district in a big way. The total live stock was 3, 33,440 as compared to 3,26,098 in 1982 livestock Census. Total cows were 1,43,491 both in cross and indigenous breeds, 74,349 buffaloes, 19,713 sheep, 82,541 goats, 1,128 pigs, 1,047 ponies and the number of other type animals are meager. The total number of poultry birds was 46,167 in the district. Bullocks are mainly used for farm operations and threshing etc. The mules and ponies are mostly used for transportation as small land holding and the terrain are not convenient for use of tractor in the field.

Horticulture

Apple is the dominant fruit crop in the State. Other fruit crops like citrus, mango, stone fruits etc. are also steadily coming up in the potential areas. Entire Solan district holds excellent promise for rising of horticultural crops like stone fruits, citrus fruits, mushroom, kiwi, bee keeping, and floriculture in poly greenhouses etc. in view of highly conducive agro-climatic conditions. The stone fruits orchards in the district are located mainly in Solan, Kandaghat and some parts of Kasauli Tehsil. In the lower parts of Nalagarh and Arki Tehsil, the citrus plantation is quite popular. Apart from stone and citrus fruits, apples are also being grown in higher reaches of the district and its cultivation is mainly in Chail area of Kandaghat block.

Area under horticulture and production of various fruits

Fruit	Area (sq.km.)	Production (MT)
Apple	1.60	121
Other Temperate Fruits	37.41	2235
Sub Tropical Fruits	21.25	1024
Nuts & Dry Fruits	3.32	253
Citrus Fruits	6.15	1552
Total	69.73	5225

Fisheries

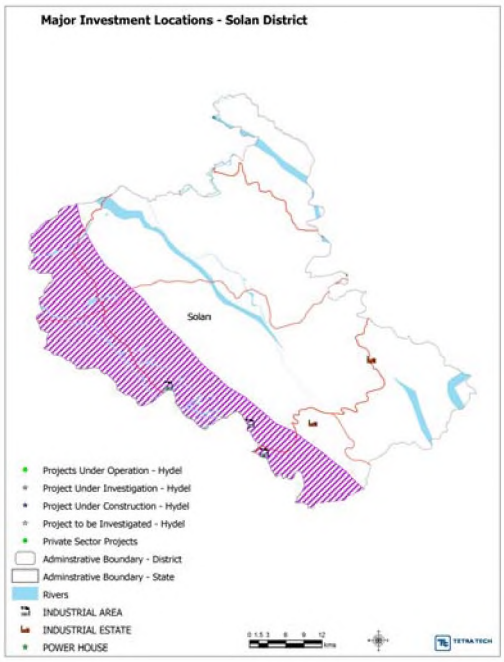
The existing fishery resources of the Solan district are in the shape of village ponds, hilly streams, khuds, marshes and reservoirs. There is no major river, pond or lake in the district, hence very little scope for natural fish. There is hatchery and fish breeding farm at Jagat Khana near Nalagarh. Scientific studies indicate that there are approximately 98 species of endemic and exotic species thriving in the waters of the district. These species include Indian major and minor carps, cat fishes, lesser brills, cobitidae and mahseer.

Industries

In view of the limited availability of agricultural land and growing unemployment, the industries have been accorded a prominent place in the development of the district. The district is quite rich in mineral resources.

Out of the main minerals viz. building stones, brick clay, limestone, sand and boulders, the latter is being used as raw material for crushers. Large deposits of limestone have been found in Arki Tehsil which are being used by large capacity cement plant in Darlaghat. Solan is the most industrially advanced district in the State. There are about 126 medium and large scale industries located in the district. The main manufacturing items being produced by medium and large scale sectors are cement, telecom equipment, fruits, watches dial, telephone parts, textiles, cotton/synthetic yarn, forging, Ayurvedic medicines, IMFL,

PCP, medicines, flour, steel ingots, magnetic head, computer software/hardware etc.



Except Mohan Meakins Breweries Ltd. all these units have come up very recently. A large number of ancillary units are also functioning in the district. Most of these units are located in the foothills due to locational advantage and proximity to market in neighboring States. There are about 2,644 registered small scale industries units functioning in the district generating employment to about 17,191 persons. 70 % of these units are located in rural area.

The important items manufactured include parts of tractors, automobile bearings, fittings, wrist watches, watch cases, watch jewels, tape recorders, video and audio cassettes, clinical and industrial thermometers, activated carbon, medicines, fruits and mushroom canning, PVC footwear, ACSR conductors, ACC pipes, high density polythene films etc. A large number of families in rural areas are also engaged in traditional jobs like black smithy carpentry etc. Kunihar block has the largest number of such artisans followed by Nalagarh, Dharampur, Solan and Kandaghat blocks. State Directorate of Industries has already identified growth centres viz. Solan, Nalagarh, Parwanoo and Barotiwala. Besides, Dhaampur, Jabli, Kunihar, Kandaghat, Kasauli and Baddi have also been identified as growth centres.

The south western part of the district, i.e. area encompassing the industrial growth centres of Nalagarh, Baddi,Barotiwala and Parwanoo, and bordering neighbouring States has been proposed as an Industrial Corridor.

Minerals & Mining

Though the district is rich in mineral wealth, most of the area of the district has not so far been fully surveyed for the exploitation of minerals and mining. However, minerals like limestone, dolomite, limestone, gypsum have been found in the district. Minerals like limestone etc. are being excavated on a large scale for commercial purposes. The Oil and Natural Gas Commission has started exploration of oil and Natural Gas/Minerals in the district. Detailed mapping and sampling for limestone deposit along the ridge north -west of Arki is in progress where a huge quantity of special type of limestone is found which is used to clean the iron ore. The extent of limestone has been assessed in Kashlog area to explore the possibility of setting-up a big cement plant. Detailed mapping and sampling along limestone deposit of Bagga area is in progress to assess the quantity and quality of limestone available in the area.

Roads & Transport

Economic and social development depends mostly on efficient system of communications. Road transport is the life line of the economy of the district. There is a network of 2264 kms. length of roads. Besides road there is a railway line in the district. Total length of railway line is 72 kms. National Highway No. 22 and railway line passes through the district. There are three transport depots viz. Solan, Parwanoo and Nalagarh which are functioning in the

district. In the district out of a total road length of 2264 Kms., 171 kms. is double lane motorable road. 1621 kms. is single lane motorable road, 50 kms. is jeepable road and 422 kms. is non jeepable road. All the Tehsil headquarters are connected with the district headquarters by motorable roads. Most of the villages also connected with the Tehsil/sub-Tehsil headquarters by a vast network of motorable roads.



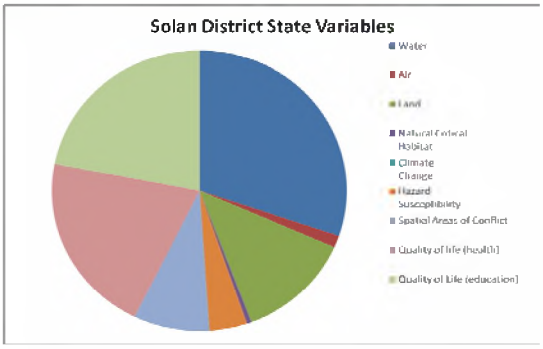
Electricity and Power

The district is fully electrified with all the villages having electricity connectivity. Due to the abundance of this resource, impetus has been provided for industrial growth in the district.

Summary of State Variables at District Level

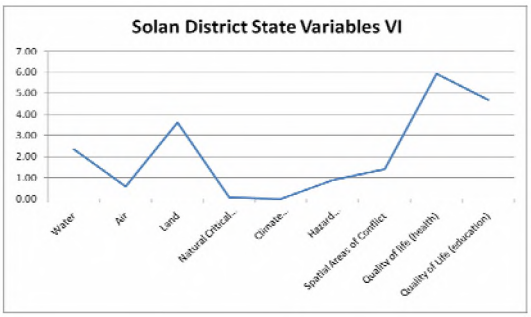
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Solan. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{State Sector}}$) as a total for that particular system.

Solan	
Variable Sector	**Vulnerability of State Sector $V_{\text{State Sector}}$**
Water	10276.57
Air	463.97
Land	4334.25
Natural Critical Habitat	168.72
Climate Change	0.00
Hazard Susceptibility	3649.33
Spatial Areas of Conflict	2832.16
Quality of life (health)	7079.04
Quality of Life (education)	7460.95



Analysis of data shows that District has adequate water resources. A substantial portion of the District is vulnerable to Hazards. The analysis indicates gaps in infrastructure and services Health and Education sector. Though the accessibility to educational facilities at the school levels is adequate, there is gap in infrastructure at the higher level, i.e. colleges and Vocational Training Centres.

Analysis of data indicates gaps in infrastructure and services in Health sector which makes it critically vulnerable. Gaps in infrastructure of Education sector is in the moderately high vulnerability segment. Land is also under pressure. Other State variables are in the low or very low vulnerability segment. A programme to improve infrastructure and services in Health and Education sector would reduce vulnerability.

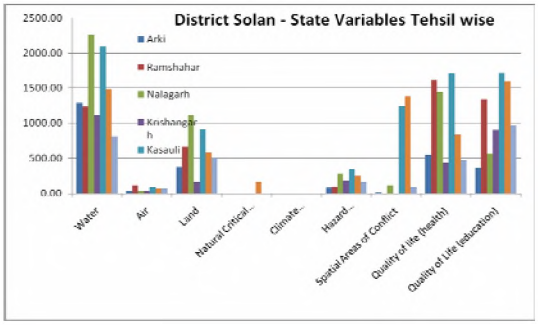


State Variables at Tehsil Level

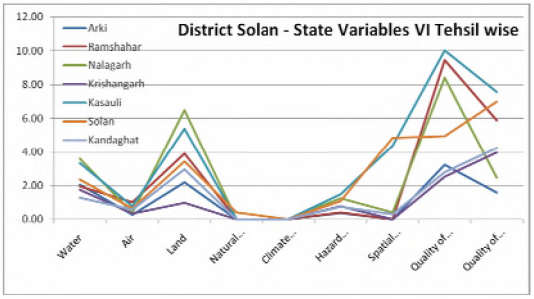
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level:

State Variables	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	1288.85	1237.87	2257.67	1103.67	2094.33	1480.52	813.66	10276.57
Air	33.90	115.56	42.31	40.79	89.63	75.59	66.19	463.97
Land	377.11	665.73	1108.45	165.80	919.87	588.39	507.10	4332.45
Natural Critical Habitat	0.00	0.00	0.00	0.00	0.00	168.72	0.00	168.72
Climate Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	87.50	97.50	282.80	180.40	343.40	248.00	168.73	0
Spatial Areas of Conflict	2.00	0.00	116.69	0.00	1243.33	1378.07	92.07	0
Quality of life (health)	552.03	1617.29	1435.33	435.48	1716.36	845.70	476.85	1408.33
Quality of Life (education)	366.22	1342.16	558.35	905.31	1726.64	1595.38	966.89	0



State Variables Vulnerability at Tehsil Level in District Solan



Analysis of data indicates substantial Land and Water resources in Nalagarh Tehsil. However, tehsil is susceptible to hazards and Spatial areas of Conflict are evident. Proposed Industrial Corridor is further likely to impact and create conflict with various resources. The analysis indicates gaps in infrastructure and services in Health sector.

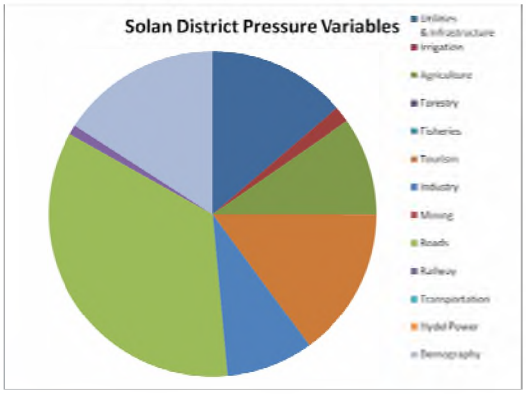
Summary of Pressure Variables at District Level

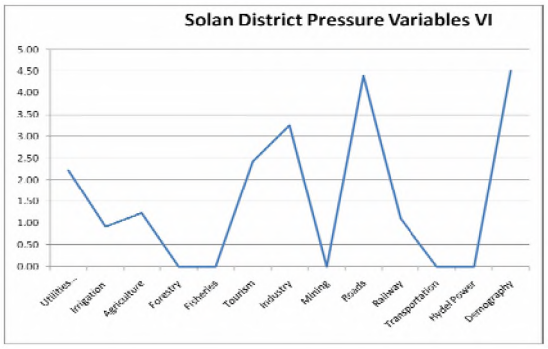
Similarly, based on the database for pressure variable, computation of pressure variables have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Solan. For deriving the vulnerability level,

first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($\mathbf{V}_{\text{pressure Sector}}$) as a total for that particular system.

Solan Variable Sector	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities & Infrastructure	4685.78
Irrigation	552.44
Agriculture	3343.23
Forestry	0.00
Fisheries	0.00
Tourism	5122.39
Industry	2939.40
Mining	0.00
Roads	11049.47
Railway	333.78
Transportation	0.00
Hydel Power	0.00
Demography	5423.08

Analysis of data indicates that pressure of Road network is highest followed by Tourism, Demography, Utilities and Infrastructure, Industry and Agriculture. Tourism and Road network create cumulative pressure. Increasing demographic pressures has created gaps in Utilities and Infrastructure. Industries being one of the growth engines in the District create pressure on almost all the other resources. With the development of rail network in the District, the pressures are projected to increase.





Analysis of data indicates that Demographic pressure is moderately high in the district because of rise in urban population to the Industrial growth in Baddi, Nalagarh Tehsil. The population increase, on an average, is approximately 330% in Nalagarh alone. The Industrial pressure, on a whole is seen to be moderately low as the figures are for the entire district. The analysis also indicates strong growth of business tourism because of Industrial growth.

Pressure Variables at Tehsil Level

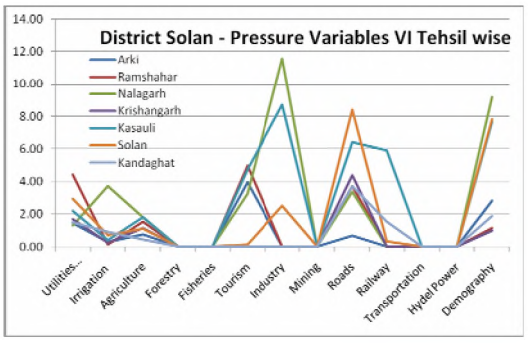
Similarly, the pressure variables computed at Tehsil level for comparison is given below.

Comparison of Pressure variables at Tehsil level:

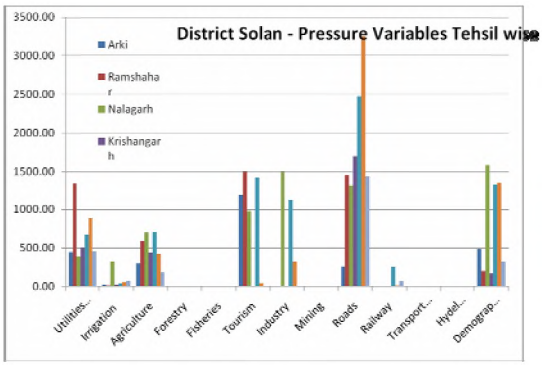
Pressure Variables	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat	Vulnerability of Pressure Sector $V_{\text{Pressure Sector}}$
Utilities & Infrastructure	443.49	1333.87	394.80	505.22	668.30	888.85	451.25	**4685.78**

Pressure Variables	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat	Vulnerability of Pressure Sector $V_{Pressure\ Sector}$
Irrigation	24.65	12.21	319.10	20.68	35.79	61.15	78.86	**552.44**
Agriculture	299.13	592.64	697.68	439.01	708.71	425.43	180.63	**3895.67**
Forestry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**3343.23**
Fisheries	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0**
Tourism	1187.78	1492.64	975.43	0.00	1421.16	45.38	0.00	**5122.39**
Industry	0.00	0.00	1492.64	0.00	1124.73	322.03	0.00	**8061.79**
Mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2939.4**
Roads	264.38	1447.86	1309.97	1698.70	2477.16	3247.40	1434.59	**11880.06**
Railway	0.00	0.00	0.00	0.00	253.30	14.50	65.98	**12213.84**
Transportation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**333.78**
Hydel Power	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0**
Demography	488.24	196.31	1580.33	167.84	1318.47	1348.47	323.42	**5423.08**

Analysis of data indicates pressure on Utilities & Infrastructure in Ramshehr, Solan and Kasauli to some extent. Agriculture is a significant land-use in Nalagarh. Tourism shows a strong pressure in Kasauli (tourist destination) and Nalagarh (business tourism), along with Ramshehr and Arki, which are destinations for Fairs and domestic tourism. The tehsils of Nalagarh and Kasauli show high pressure for Industry. Road network development has created pressure in almost all the Tehsils except Arki and is projected to further increase the pressure. Arki, Nalagarh, Kasauli and Solan display a high demographic pressure.



Pressure Variables vulnerability at Tehsil level in District Solan



Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Solan. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

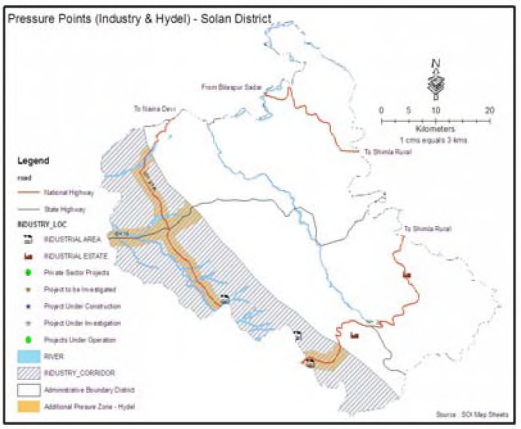
$$\frac{\sum V_{Pressure\ Sectors} : V_{State\ Sectors}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

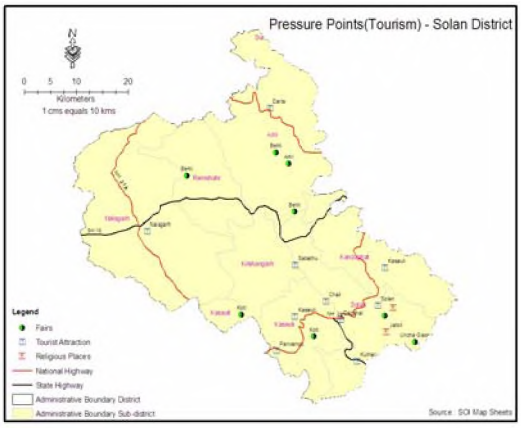
Vulnerability Index

	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat
VI	2707.67	5076.13	6852.80	2831.44	8133.61	6379.66	3091.55
Denominator = 57x43	2451						
Normalized VI	1.10	2.07	2.80	1.16	3.32	2.60	1.26

Analysis of data indicates that Tehsils which border the highly industrialized and urbanized states of Punjab and Haryana have a higher value of vulnerability index, followed by Solan Tehsil, which is the District Headquarter and Ramshehr, which borders Bilaspur Sadar. Arki, Kandaghat and Kishangarh tehsils have a very low vulnerability index rating due to their interior locations. Broader analysis indicates that the Vulnerability index for Nalagarh and Kasauli Tehsils is in the moderately low vulnerability segment, though the Industrial Centres of Nalagarh, Baddi and Barotiwala are situated in these Tehsils. The VI of Nalagarh which is undergoing multiple development activities is lower than Kasauli. The detailed analysis considers the entire District as a whole for its State and Pressure variables on a cumulative basis for evolving the vulnerability for each of the variables.



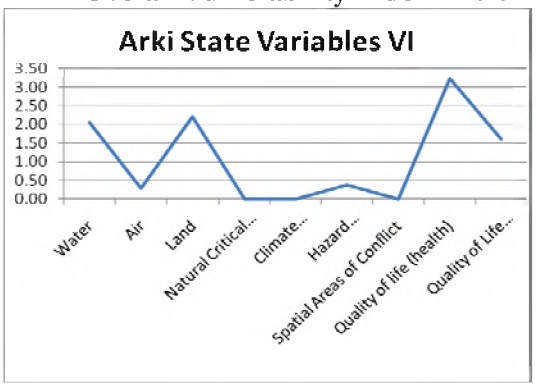




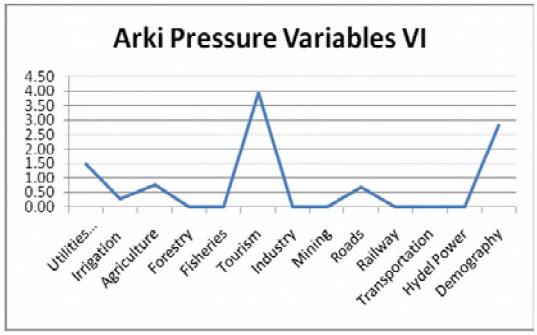
Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables have been presented here at Tehsil level so as to analyze the position on sectoral basis and to understand how the programmes at tehsil may be attempted to reduce the vulnerability through the sectoral intervention.

Arki - Overall Vulnerability Index = 1.10

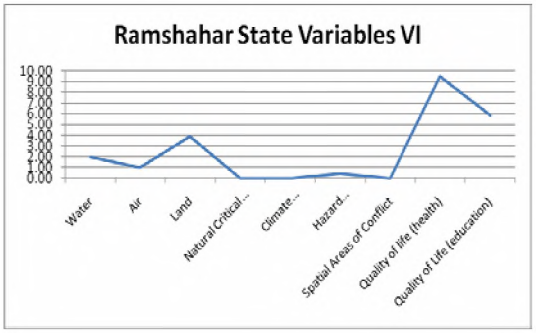


Analysis of data indicates gaps in infrastructure and services in Health sector. Improving infrastructure and services in Health sector can reduce the vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.

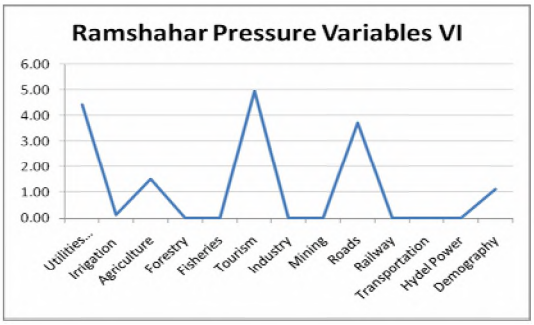


Analysis of data indicates demographic and tourism pressure, the latter pressure is on account of the domestic participation in Fairs and Melas. Since these events occur at specific days annually, it is not a matter of priority concern. However, the high vulnerability of Demography, predominantly in the rural areas needs attention.

Ramshehr - Overall Vulnerability Index = 2.07

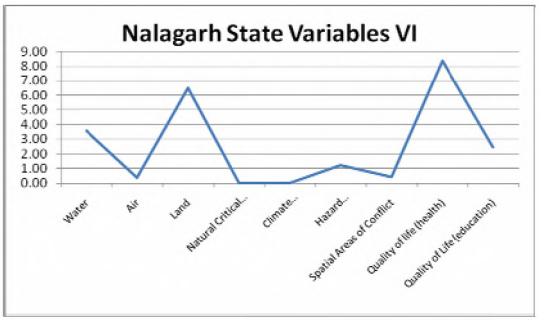


Analysis of data indicates gaps in infrastructure and services in Health and Education sector making them vulnerable. While Health is in the Very high critical segment, Education is in the high vulnerability segment. Development of programme for improving infrastructure and services in Health and Education sector can help in reducing the vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.

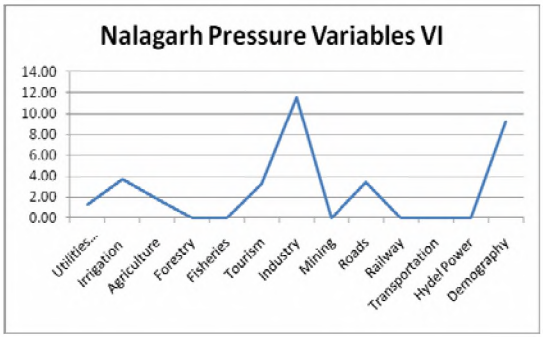


Analysis of data indicates high tourism pressure predominantly due to Fairs and Melas. Since these events occur at specific days annually, it is not a matter of priority concern. However, addressing gaps in Utility and Infrastructure is a matter of priority concern.

Nalagarh - Overall Vulnerability Index = 2.80

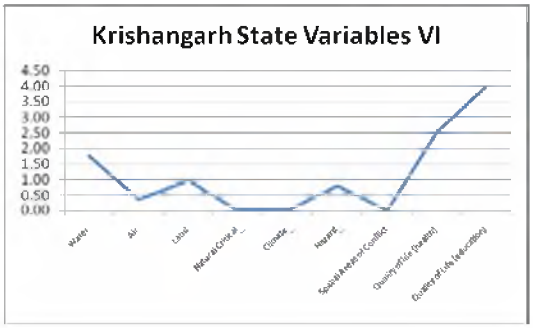


Analysis of data indicates gaps in Health infrastructure and services making it very highly critical. Programme for improving infrastructure and services in health sector can help in reducing the vulnerability of the Tehsil. Analysis indicates that availability of land in the Tehsil has triggered diversion of land from agricultural to non agricultural purposes which has also prompted land use change. A part of the Tehsil is also Hazard prone.

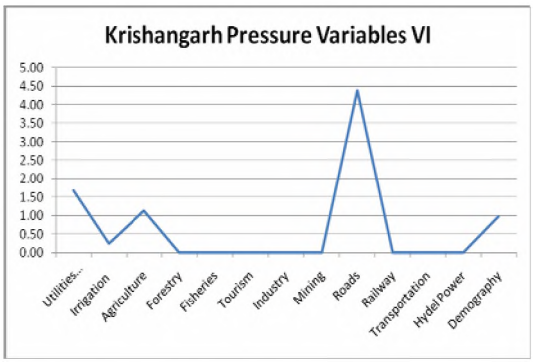


Analysis of data indicates pressure from Industries, mainly due to development of the Industrial Centres at Baddi and Nalagarh making it vulnerable. Industrial development has prompted business tourism which together with increase in demographic creates pressure. Adequate irrigation facilities can sustain and increase agriculture growth .

Kishangarh – Overall Vulnerability Index 1.16

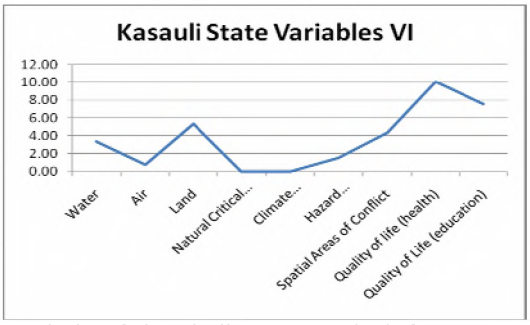


Analysis of data indicates gaps in infrastructure and services in health and education sector making these sectors vulnerable. Programme for improvement of infrastructure and services in health and education sector can help in reducing vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.

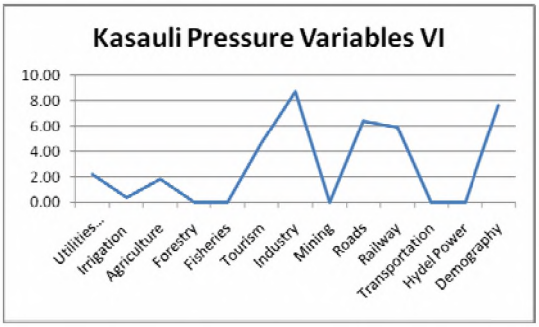


Analysis of data indicates that development of Road network has been done. Current and road network development can be in accordance with development needs and as per sectoral guidelines of Road and Transport sector.

Kasauli – Overall Vulnerability Index = 3.32

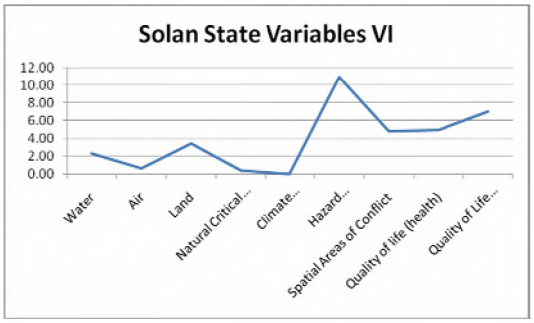


Analysis of data indicates gaps in infrastructure and services in health and education sector making these sectors vulnerable. While Health is in the very high critical segment, Education is in the high vulnerability segment. Programme for improvement of infrastructure and services in health and education sector can help in reducing vulnerability of the Tehsil. Further, Hazard Susceptibility and Spatial areas of conflict are also in the high vulnerability and moderately high vulnerability segments respectively.

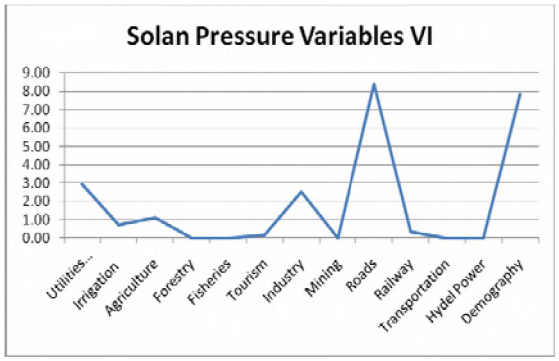


Analysis of data indicates pressure due to the Industrial Centres at Barotiwala and Parwanoo. Industrial development has prompted business tourism which together with increase in demographic creates pressure. Development of road & rail network has opened up new areas improving access which has added to pressure.

Solan Overall Vulnerability Index = 2.60

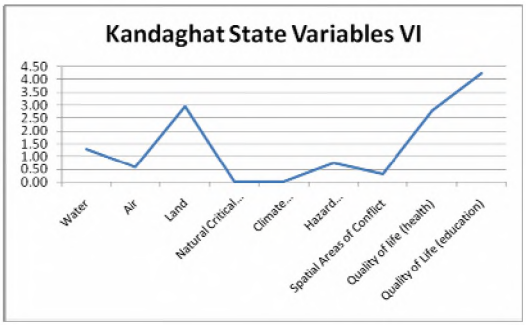


Analysis of data indicates gaps in infrastructure and services in health and education sector making these sectors vulnerable. While Health is in the high vulnerability segment, Education is in the very high and critical vulnerability segment. Programme for improvement of infrastructure and services in health and education sector can help in reducing vulnerability of the Tehsil. Hazard Susceptibility and Spatial areas of conflict also make the tehsil vulnerable.



Analysis of data indicates pressure due to the Industrial development. The Industry is in the moderately high vulnerability segment. Road network development has opened up new areas and that is being reflected on the Demography. Tehsil being the District Headquarters also faces additional demographic pressure.

Kandaghat – Overall Vulnerability Index 1.26



Analysis of data indicates in infrastructure and services in health and education sector making these sectors vulnerable. Programme for improvement of infrastructure and services in health and education sector can help in reducing vulnerability of the Tehsil. Rest all variables are either in the low vulnerability or very low vulnerability segments.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

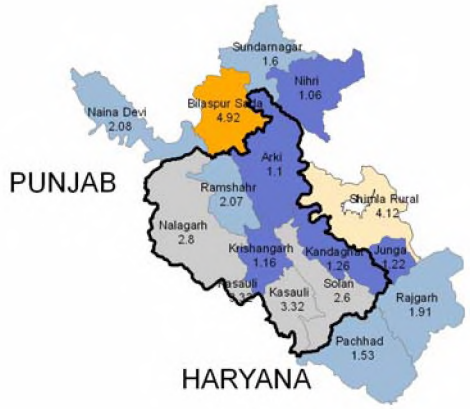
Solan

Sr. No.	Tehsil	VI	Adjoining Tehsil in Solan District	VI	Adjoining Tehsil in Other District	District	VI
1	Arki	1.10	Ramshahr	2.07	Seoni	Shimla	1.69
			Krishangarh	1.16	Shimla (Rural)	Shimla	4.12
			Kandaghat	1.26	Nihri	Mandi	1.06
			Solan	2.60	Bilaspur Sadar	Bilaspur	4.92
2	Ramshahr	2.07	Nalagarh	2.80	Bilaspur Sadar	Bilaspur	4.92
			Krishangarh	1.16			
			Arki	1.10			
3	Nalagarh	2.80	Kasauli	3.32	Naina Devi	Bilaspur	2.08

Sr. No.	Tehsil	VI	Adjoining Tehsil in Solan District	VI	Adjoining Tehsil in Other District	District	VI
			Krishangarh	1.16			
			Ramshahr	2.07			
4	Krishangarh	1.16	Arki	1.10			
			Solan	2.60			
			Kasauli	3.32			
			Nalagarh	2.80			
			Ramshahr	2.07			
5	Kasauli	3.32	Nalagarh	2.80	Pachhad	Sirmaur	1.53
			Krishangarh	1.16			
			Solan	2.60			
6	Solan	2.60	Kandaghat	1.26	Pachhad	Sirmaur	1.53
			Kasauli	3.32	Rajgarh	Sirmaur	1.91
			Krishangarh	1.16			
			Arki	1.10			
7	Kandaghat	1.26	Arki	1.10	Junga	Shimla	1.22
					Shimla Rural	Shimla	4.12
			Solan	2.60	Rajgarh	Sirmaur	1.91

Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	



District Solan is surrounded by various Tehsils of District Shimla, Bilaspur, Mandi and Sirmaur. The vulnerability levels of all surrounding areas are higher than that of what is prevailing in various Tehsil/ Sub tehsils of District Solan except for Nalagarh, Kasauli, Solan and Kandaghat. The transitional impact of vulnerability possibly will give rise to vulnerability levels in these tehsils when analyzed in regional context, though this impact will directly be linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.

Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameters

(i) As is observed from the analysis of the data available, the quality of life parameters in terms of health and education need to be addressed on a priority. To reiterate our basic premises that the environment is vulnerable on account of the survival and betterment of the quality of life of the human beings, these parameters become parameters of prime interest.
The quality of life parameters for health include accessibility to a Primary Health Centre within a distance of 3 Kilometres, Community Health Centre within a distance of 6 Kilometres and a Hospital within a distance of 10 Kilometres. Areas which do not have these facilities within the specified distance are actually lacking in meeting the standards/ norms and hence require intervention.

Priority Tehsils (in descending order) Kasauli, Nalagarh, Ramshehr, Solan, Kandaghat

Similarly, for the quality of life parameters for education, the district has a excellent network up-to the college level but intensive efforts are needed in establishment of Vocational training Institutions, so that villages within 25 kms. radius have accessibility.

Priority Tehsils (in descending order)- Solan, Kasauli, Kandaghat, Ramshehar, Krishangarh and *Nalagarh*

The benchmarking of the norms has been done with a view of the terrain in the State. A programme in collaboration with the Health and Education Departments of the State Government shall reduce this gap. The developmental organizations such as Public Works Department can also be taken in the consultation so that access to these basic facilities becomes easier and comfortable. Interventions in these sub sectors will help in reducing the vulnerability.

(i) Prioritization and Rationalization of distribution of water resources for various usages has to be undertaken. The groundwater may be recharged through the creation of small check dams on the non perennial khuds, which could also improve the irrigation scenario.

(ii) It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface run off due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater.

Pressure Parameters

(i) From the data analysis, it has been observed that the development of roads have on one hand reduced the vulnerability from infrastructural & utilities point of view but on other hand has raised the vulnerability of the sensitive areas such as forests, green areas, wildlife and bio-diversity etc. it is recommended that the state must intervene with policy instruments to protect these areas from such interference.

(ii) Utilities and Infrastructure is the third highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific, such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted. A Utilities and Infrastructure Plan can be prepared for each Tehsil and implemented through comprehensive projects for the clusters.

(iii) Tourism as a parameter is the third highest scorer in the district pressure parameters. However, tourism is one of the mainstays of economy in the State and thus has to develop further. The growth in the sector is welcome, as it boosts the economy, but the rate at which it is growing demands a definite and specific plan for the district in terms of growth of tourism.

(iii) Agriculture emerges as a major pressure variable in the district. This is on account of the fact that the area under agriculture has decreased by approximately 22% on an average in the entire district. It can be inferred that land which was earlier under agriculture has been diverted to non agricultural purposes for particularly for Industrial development and housing facilities for industrial workers.

(iv) The proposal to establish Industrial Corridor can be carefully analyzed in the context of current and future development needs and in conformity of development plan/land use plans. Further, with the aim of identifying polluted industrial clusters and prioritizing planning needs for intervention to improve the quality of environment in these industrial clusters, Comprehensive Environment Pollution Index (CEPI) has been developed by CPCB. The CPCB's report has concluded that the industrial clusters/areas having aggregated CEPI scores of 70 and above should be considered as critically polluted; the clusters/areas having CEPI scores between 60-70 should be considered as severely polluted areas. In Himachal Pradesh, Baddi, and Parwanoo, Solan district fall under this category of severely polluted areas and shall be kept under surveillance and pollution control measures should be efficiently implemented; and the critically polluted industrial clusters/areas need further detailed investigations in terms of the extent of damage and formulation of appropriate remedial action. Future development of Industries can be in accordance with Zoning Atlas for Siting of industries, State Environmental Atlas of Himachal Pradesh, CEPI for industries in Solan district.

(v) It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyse and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
State						
1	Water		*	*		Water Utilization Plan
2	Natural Critical Habitat		*			Plans for Buffer zones
3	Quality of life (Health)			*		Programme to improve access
4	Quality of life (Education)			*		Programme to improve access to Vocational Institutes
Pressure						
1	Roads	*				Policy to take care of State variables
2	Tourism		*			Tourism Plan at State, District, and Destination Level

Sr. No.	Variable	Policy	Plan	Programme	Project	Remarks
3	Utilities & Infrastructure		*		*	Tehsil level plan Cluster level projects
4	Agriculture	*				Policy regarding Diversion of land for non-agricultural use
5	Industrial Corridor		*			Detailed EIA and EMP

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Arki	Ramshahar	Nalagarh	Krishangarh	Kasauli	Solan	Kandaghat
VI	2707.67	5076.13	6852.80	2831.44	8133.61	6379.66	3091.55
Denominator = 57x43				**2451**			
Normalized VI	**1.10**	**2.07**	**2.80**	**1.16**	**3.32**	**2.60**	**1.26**

Population Projections

	Pop 2001	Projected Pop 2011	Projected Pop 2021	Projected Pop 2031	Projected Pop 2041
Arki	83230	1,00,037	1,20,238	1,44,519	1,73,702
Ramshahr	29718	35,676	42,827	51,413	61,720
Nalagarh	155619	1,88,831	2,29,131	2,78,032	3,37,369
Krishangarh	25836	31,096	37,426	45,045	54,216
Kasauli	71226	86,151	1,04,205	1,26,041	1,52,455
Solan	99793	1,20,254	1,44,911	1,74,622	2,10,426
Kandaghat	35136	42,278	50,871	61,211	73,653

Calculation of per capita share of VI

	Pop 2001	VI 2001	per capita contribution	
Arki	83230	1.105	1.32	
Ramshahr	29718	2.07	6.96	
Nalagarh	155619	2.8	1.79	
Krishangarh	25836	1.18	4.56	
Kasauli	71226	3.32	4.66	
Solan	99793	2.6	2.60	
Kandaghat	35136	1.26	3.58	

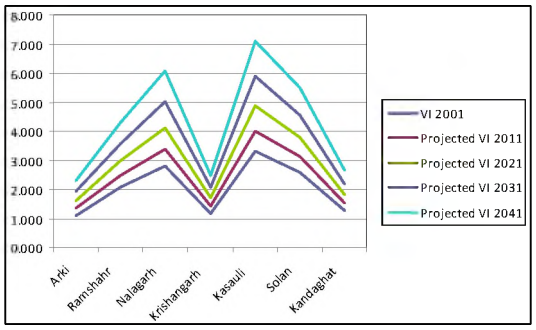
Calculation of Projected VI

	Pop 2001	VI 2001	per capita share	Projected Pop 2011	Proj. VI 2011	Projected Pop 2021	Proj VI 2021	Projected Pop 2031	Proj VI 2031	Projected Pop 2041	Proj VI 2041
Arki	83230	1.105	1.32	1,00,037	1.33	1,20,238	1.60	1,44,519	1.92	1,73,702	2.31
Ramshahr	29718	2.07	6.96	35,676	2.48	42,827	2.98	51,413	3.58	61,720	4.30
Nalagarh	155619	2.8	1.79	1,88,831	3.40	2,29,131	4.12	2,78,032	5.00	3,37,369	6.07
Krishangarh	25836	1.18	4.56	31,096	1.42	37,426	1.71	45,045	2.06	54,216	2.48
Kasauli	71226	3.32	4.66	86,151	4.02	1,04,205	4.86	1,26,041	5.88	1,52,455	7.11
Solan	99793	2.6	2.60	1,20,254	3.13	1,44,911	3.78	1,74,622	4.55	2,10,426	5.48
Kandaghat	35136	1.26	3.58	42,278	1.52	50,871	1.82	61,211	2.20	73,653	2.64

Projected Vulnerability Index

	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Arki	1.105	1.328	1.596	1.919	2.306
Ramshahr	2.070	2.485	2.983	3.581	4.299
Nalagarh	2.800	3.398	4.123	5.003	6.070
Krishangarh	1.180	1.420	1.709	2.057	2.476
Kasauli	3.320	4.016	4.857	5.875	7.106
Solan	2.600	3.133	3.775	4.550	5.482
Kandaghat	1.260	1.516	1.824	2.195	2.641

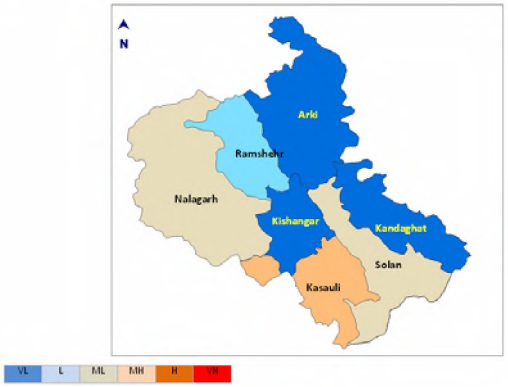
Vulnerability Index Scenarios – District Solan at Tehsil Level



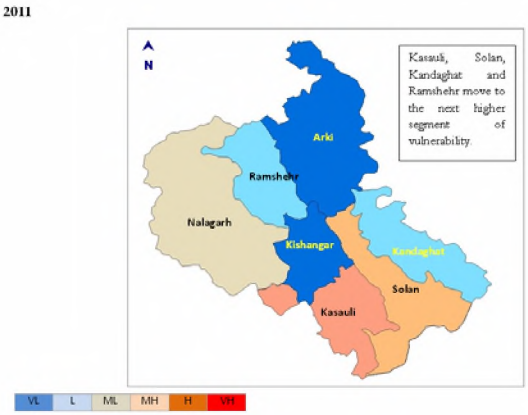
Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

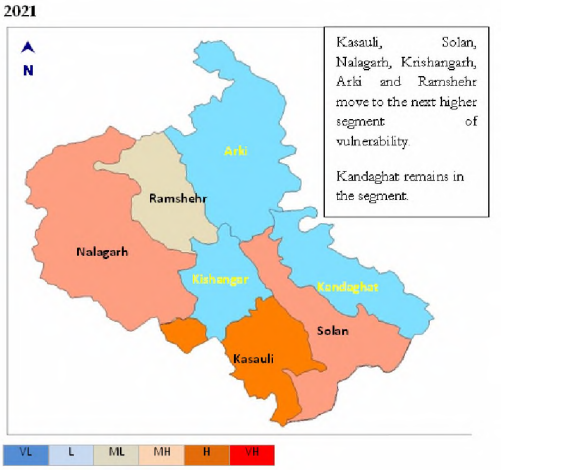
2001



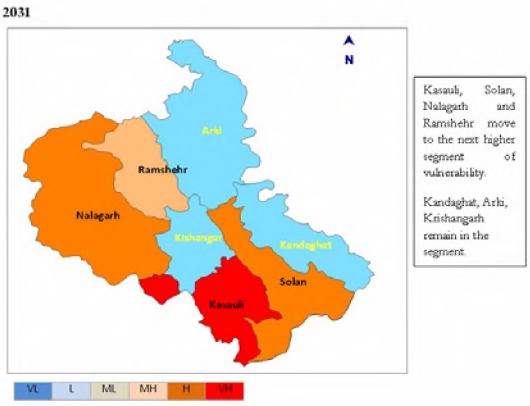
2011



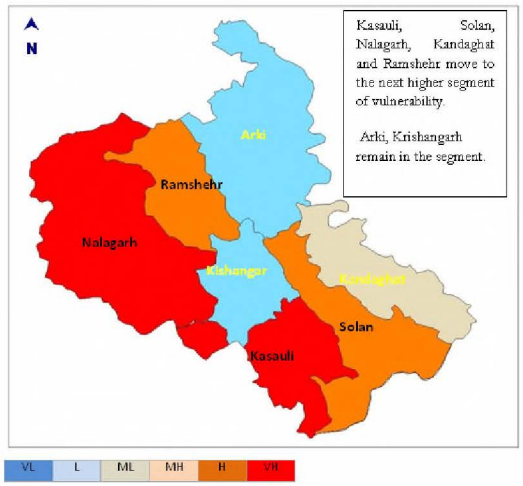
2021



2031



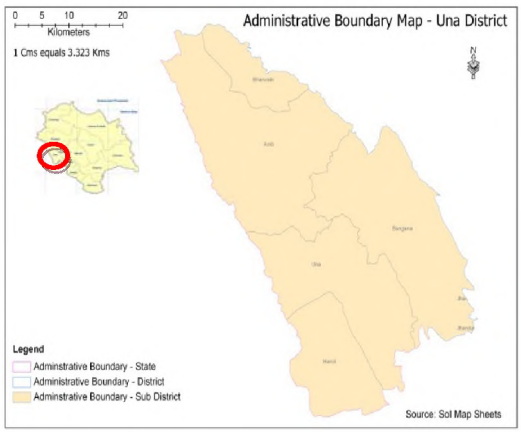
2041


N
Kasauli, Solan, Nalagarh, Kandaghat and Ramshehr move to the next higher segment of vulnerability.
Arki, Krishangarh remain in the segment.
Arki
Ramshehr
Nalagarh
Krishangar
Kandaghat
Solan
Kasauli
VL
L
ML
MH
H
VH

UNA

General Background

Una district lies in the western south-western part of Himachal Pradesh. It is bounded by Kangra district in the north and north-east, Hamirpur district in the east, Bilaspur in the south-east and Punjab State in west and south. The district is located between $31^0$17'52"-$31^0$5'20" North latitudes and $75^0$58'21"-$76^0$28'25" East longitudes. The district has a total area of 1,550 sq. kms. and ranks 10th in the State in order of area.



During the British regime, present Una district excluding Bangana was part of Hoshiarpur district of Punjab. In the re-organization of Punjab state, present Una district was merged within Himachal Pradesh with district headquarters at Dharamsala and the remaining area of present Anandpur Sahib tehsil remained in Punjab. Thus, Una was bifurcated in two states i.e. Himachal and Punjab on the re-organization of states. On 1.9.1972, Himachal Pradesh Government divided the Kangra district into three districts namely Una, Hamirpur and Kangra. New Una district was formed by transferring entire Una tehsil, Amb sub-tehsil and villages of Barsar sub-tehsil from the Kangra district.

The district is divided in five administrative sub divisions namely Una (which houses the District Headquarters), Amb, Bangana, Bharwain and Haroli. Area wise, Amb is the largest entity covering an area of 496.3 sq. kms. followed by Bangana spread over an area of 412.5 sq. kms., Una 333.9 sq. kms., Haroli 198.8 sq.kms, and Bharwain spread over an area of 100.6 sq.kms.

Bharwain shares its boundaries with Kotla Khas (Jaswan) and Dera Gopipur Tehsils of Kangra District, Amb shares boundaries with Kotla Khas, Dera Gopipur and Rakkar Tehsils of Kangra District and Bangana shares its boundaries with Rakkar Tehsil of Kangra District, Nadaun and Barasar Tehsils of Hamirpur District and Jhanduta and Naina Devi Tehsils of Bilaspur District. Bangana, Una, Haroli and Amb Tehsils share boundaries with Punjab.

Physiography

The district falls in the Himalayan foot- hill zone popularly known as Shiwalik foot hills. On the basis of physiography, climate and soils, natural vegetation and geology, this district is divided into 3 sub-micro regions which are detailed below:

Una Siwalik



This region is formed by the area surrounding Swan valley in the district, occupying the western Haroli sub-tehsil and north western part of the Una tehsil, western, northern and eastern parts of Amb tehsil and Bangana tehsil excepting areas which are in Soan valley and Satluj Basin. It is the biggest sub-micro region of the district

and is surrounded by Kangra and Hamirpur districts from north-east and east, respectively, by Satluj Basin and Soan valley from south and by Punjab state from west. This region has many low lying hills popularly known as *Dhars* viz, *Sola Singhi Dhar, Chaumukhi Dhar, Dhionsar Dhar, Ramgarh Ki Dhar* and they are all falling on the eastern part of the region. Eastern part is relatively higher in elevation than western part. The elevation of this region varies between 433 metres and 1,162 metres above the mean sea level. *Sola Singhi Dhar* is the longest hill range of this region and is also known as *Chintpurni Dhar* and *Jaswan Dhar*. It rises from near Talwara and enters the district in north where its culminating ridge forms the boundary between Una and Kangra districts. As this range passes southwards, it increases steadily in width as well as in elevation and attains maximum height of 1,162 metres. This *Dhar* terminates on the bank of the *Satluj* river beyond this district. *Chaumukhi Dhar* enters the district in the east from Kangra side and runs south-easterly direction. It also forms boundary between Una and Hamirpur districts. *Dhionsar Dhar* and *Ramgarh Ki Dhar*, on the western parts of the Bangana tehsil, extend from north-west to south-east direction and both the *Dhars* terminate on the bank of *Satluj* river. In western part of this region, the hill ranges are low. The elevation of these small hills decreases towards Soan valley as well as Punjab plains. The numerous non-perennial streams as tributaries of *Swan* river rise from these hills/*dhars* and join it outside the region. *Lunkhar Khad* and *Swan* river itself take their origin in the eastern Shiwalik hills. The Shiwalik hills receive considerable amount of rainfall during the monsoon season.

The geological structure of this region pertains to Siwalik formations occurring as conglomerates, friable micaceous sand stone, silt stone and clay stone. The seasonal and non-seasonal streams have caused heavy denudation in these hills. The soils are shallow black, brown, sandy and alluvial soils of northern region and are of recent origin. Eastern Shiwalik hills/*Dhars* are covered with thick reserved and protected forests of Chir, Bamboo and Khair etc. However, in western Shiwalik hills, vegetation is scattered and is of scrub type.

Swan Valley


View of Swan river

This valley spreads on the both sides of *Swan* river in the Una district and covers the eastern part of Haroli sub-tehsil, whole of Una tehsil except north-west and south-east corner, central and southern parts of Amb tehsil and small part of Bangana tehsil. It is enclosed by Una Siwalik from three sides and by Punjab state and *Satluj* Basin from south. ***Swan* river is an important seasonal river of the district which flows in the centre of *Swan* valley**.



It starts near Daulatpur in north-west and flows towards south-easterly direction. *Swan* river is a tributary of *Satluj* river which joins ultimately outside the district. The valley is formed by *Swan* river and by its tributaries which meet it from left and right sides. Important amongst them are *Hum Khad, Badowali Khad, Kalohwali Khad, Borewali Khad, Barera Khad, Garni Khad, Panjoa Khad, Ambwali*

Khad and *Chaler Khad* etc. This valley is narrow in the north and becomes wider in the central and southern portions of the district. The entire valley is most fertile and flat. The elevation varies between 332 metres and 554 metres above the mean sea level. From the banks of *Swan* river, slope starts rising gradually towards east and west. The valley receives considerable amount of rainfall most of which is received during monsoon season. Summers are comparatively hot and winters are cool. The geology of this valley predominantly pertains to alluvium of recent formations. However, in peripheral areas of this valley, geology pertains to Shiwalik formation. The soils of this valley soils are shallow black, brown, alluvial and sandy soils of recent origin. Due to heavy population pressure on land, broad leaved scattered vegetations are found in this valley.

Satluj **Basin**

This basin comprises mostly the eastern Una district which includes central and southern parts of Bangana tehsil and south- eastern fringe of Una tehsil. It is the smallest sub-micro region of the district.

The main *khad*/stream of this basin is *Lunkhar Khad* which rises in the northern Bangana tehsil and flows in the centre of this basin from north-west to south-east direction. It is a tributary of *Satluj* river (Govind Sagar Reservoir). *Lunkhar Khad* forms its own valley which is narrow in extent. Major tract of this basin lies between *Chaumukhi* and *Sola Singhi Dhars* in the east and *Dhionsar* and *Ramgarh Ki Dhar* in the west. *Bangar Ki Dhar*, a low lying hill, lies in the south-western part and runs in the southerly direction. Altitude of this basin varies between 462 metres and 867 metres above the mean sea level.

The geological structure of this region is predominantly composed of Shiwalik formation. However, in south-western part it is alluvium of recent formation. The eastern and western slopes of this basin are covered with thick mixed vegetation mainly of Bamboos while in the lower part there is a thin vegetation cover due to dense concentration of population.

Culture and Social Brief

Fairs & Festivals

There are quite a few fairs and festivals celebrated in the various parts of the district. Some of the important fairs are*: Chintpurni, Pir Nigaha, Panjgatra, Baisakhi* and *Holi, Sidh Badhmana, Jatoli-Harol, and Bhadra Kali.*

Places of religious, historical, archaeological importance and places of Tourist interest

Una district does not have many places of historical or archaeological interest. However, it has a number of places having religious importance. Among these are:

Una: The Una town is the district headquarters which is situated on the bank of *Swan* river, a tributary of the *Satluj* river. During the period of Guru Govind Singh, a follower of Guru Nanak Dev known as Baba Kala Dhari had come and settled here. Kala Dhari family was given a Jagir of 177 villages by Maharaja Ranjit Singh. Kala Dhari family had laid the foundation of Una town. Even today, in the fort of Una the family of Baba Kala Dhari lives. Every year in the month of February/March, fairs held here in the memory of Baba Kala Dhari.

Chintpurni: This place is situated on the northern end of the district on Bharwain-Talwara road. This place is famous for temple of goddess Bhagwati. It is well connected by roads to Punjab and other various religious places of Kangra district. Durga Ashtami is one of the famous festivals of this place. Thousands of pilgrims visit every month from all over the northern India.



Dera Baba Barbhag Singh: It is believed that some 300 years ago, Saint Barbhag Singh had come from Kartarpur and performed the penance. The place is located near Amb-Nadaun road. After the death of Baba Barbhag Singh his followers have constructed two Gurudwaras, one at the place of penance and the other at the place where he preached the people. Some 2 kms. away from this place flows the *Banganga* river. The pilgrims take a bath in this river.



Dera Baba Rudroo: This holy place is located at a height of 669 metres from mean sea level on the road from Una to Amb near Basal village. There is a Samadhi of Baba Rudra Nand at this place. Baba had performed the penance. The famous festivals celebrated at this place are Ganesh Chaturthi, Krishna Janmashtami etc. Slightly near by this place, there is another holy place known as 'Jogi Panga'. It is surrounded by deep forests. It is believed that Baba Rudra Nand had sat in penance at this place also. His followers are still looking after this place.

Shiv Bari-Gagret: On Hoshiarpur-Dharamsala road near Gagret, the Shiva temple is located on the bank of river 'Som Bhadra'. It is believed that temple had been constructed by Saint Dronacharya. During July / August, thousands of people visit here to offer bouquets to Shiva Linga.

Bhadra Kali Temple: It is located at 4 kms. from Daulatpur. The temple of Bhadra Kali Mata is considered to be very ancient. The Baisakhi festival is celebrated at this place with great gaiety.

Mahadeva Temple: This is a very ancient temple situated in Talmera village of Bangana tehsil. On the occasion of Shivratri, a fair is held and butter and milk is offered. The Place is known for its beautiful surroundings. Famous Govind Sagar Lake and *Sola Singhi Dhar* near it forms a natural boundary between Hamirpur and Una districts.

Assessment of District Vulnerability

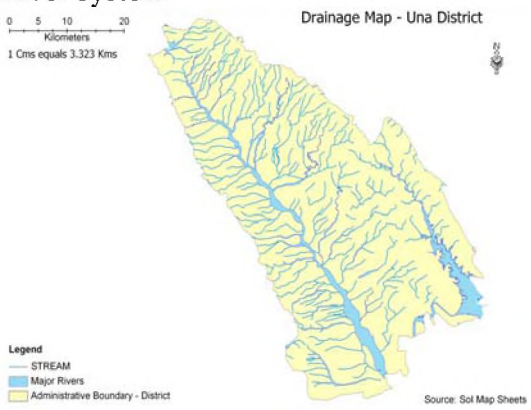
As explained above the '*Pressure*' and '*State*' variables together when analyzed gives a level of understanding as '*how*' and '*where*' a particular system is exposed and hence vulnerable at different degrees. Accordingly, in the first step the description of state and pressure themes has been made. All indicators, under different components have been detailed up, quantified qualitatively for the district at tehsil and sub tehsil level. The level of pressure and sensitivity of the natural system are then defined with gap analysis and resource availability viz-a-viz utilization, which in turn when further analyzed indicates the level of vulnerability of a particular system. The vulnerability has also been derived at tehsil level and sectoral level. The pressure points have also been indicated through this exercise besides giving scenario projections up till 2041.

Description of State Theme Variables

The status of natural systems such as river system, climate, forests, quality of life (education and health) relevant in context of

Una district is described below which sets the baseline for vulnerability assessment for the district at tehsil level.

River System



This district comprises of a portion of Govind Sagar Reservoir formed by *Satluj* and the district contributes to it through *Lunkhar Khad* which emerges from the northern ridge of Bangana Tehsil.

Sohan river, a seasonal river starts just north of Daulatpur town which is almost on a ridge and flows northwards. The major seasonal river for the district is *Swan* river which originates from Daulatpur chowk of Amb tehsil and crosses over to Punjab state at village Santokhgarh of Una tehsil of this district.

An extremely large number of non perennial *khuds* dominate the physiography and the drainage pattern of the district. These non perennial sources being seasonal serve no purpose of irrigation etc. and the entire district has to depend on ground water as a resource.

These non perennial sources erode the hill sides, and deposit silt in the valley while washing away fertile land during the rainy season. A project for flood protection and channelization of the *Swan* river has been prepared by the concerned department of the Himachal Pradesh Government and have completed the phase I implementation of the channelization project from Jhulera Bridge towards Santokhgarh. There are 130 seasonal and perennial ponds measuring about 65 hectares area in the district.

Climate

This district is situated at the foot of Shiwalik Hills. Throughout the summer climate remains very hot. During winter, the days are cold. The maximum temperature goes up to 41.0^{0}c during the month of June and lowest temperature recorded during December/January in south-western part of the district is above 25^{0}c while in the north-eastern portion, it varies between 20^{0}c to 25^{0}c.

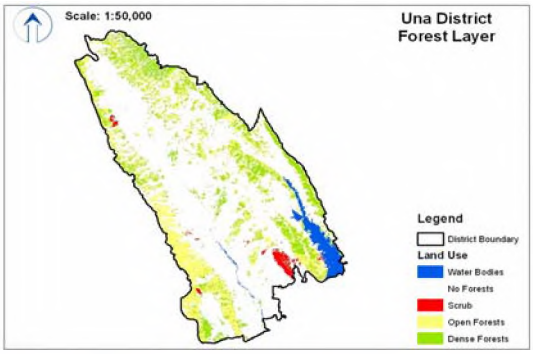
District receives average annual rainfall of about 1,009 mm. In rainy season when rain occurs in the upper hills and water flows down to the plain the *Swan* river which is a seasonal river, plays havoc with the area.

Precipitation/ Rainfall

Particulars	Maximum	Minimum
Rainfall	62 mm	1.5 mm
Temperature	41° C	20° C

Forests

The Forests play a vital role in shaping the characteristic conditions of an area. Besides, they also influence the economic and social life of the people considerably. The forests provide valuable timber, medicinal herbs and raw materials for industries and also provide employment and play a vital role in conserving the soil erosion and ensure timely rains. The following statement shows broadly the area under different types of forest covers.



Type of Forests	Area in hectares
Reserved forest	4,391
Protected forests	4,796
Unclassified forests	15,500
Other forests	26,860
Total forests	**51,547**

Una has two Reserve Forests. The Panjal Reserve Forest is situated on the *Gular Dhar Chintpurni* Ridge and is spread over parts of Amb and Bharwain Tehsils. The Gharui Reserve Forest is in patches and not contiguous and is situated in the eastern part of Amb Tehsil. The *Sola Singhi Dhar* accommodates a number of Demarcated Protected Forests.

In the district, plantation of Chil, Khair and Eucalyptus have been raised successfully.

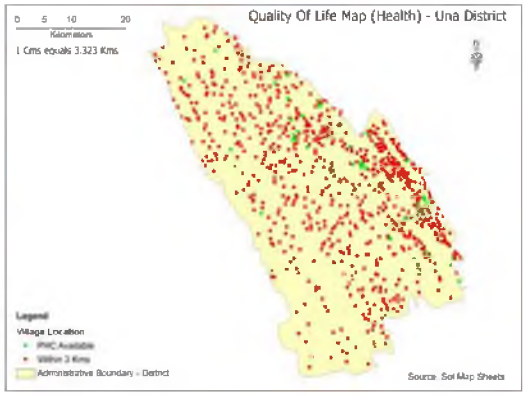
Quality of Life (Health)

In view of the hilly terrain, one health worker at present is needed to walk two to seven hours to travel the distance between two villages in some remote hilly districts. Due to hilly terrain and scattered population, it is difficult for a health worker to visit even 5 km distance in a day and cover the scattered population

Availability of Health facilities are one of the major indicators for quality of life. If a person has to move to another village to have access to health facilities, it demonstrates the lack of quality of life in this critical sector.

Of the total 758 inhabited villages in district, 753 villages do not have a Hospital located in them. Similarly 746 villages in the district do not have Primary Health Centres.

In fact, it is interesting to note that, according to 2001 census, all the villages have access to a Primary Health Centre within 3 km distance, Community Health Centres within 6 km distance & a Hospital within a distance of 10 kms. This implies that Una rates better in terms of quality of life- health indicators. The map below substantiates the statistics.

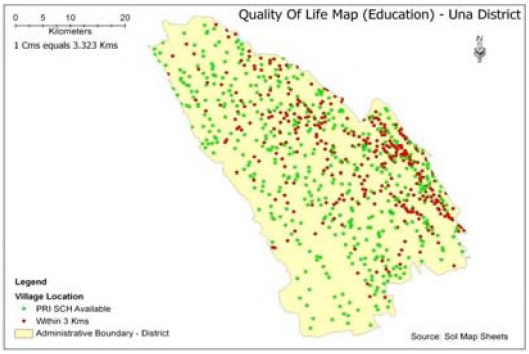


Quality of Life (Education)

The District Primary Education Programme had a norm of having a Primary School within a distance of 1 km so that the child does not have to walk more than a km to school. Since the populations in villages in the State are small, the norm has been benchmarked at 2 km in order to make the Primary School viable.

Similar is the case of access to Educational Facilities, another essential indicator of quality of life.

Of the total 758 inhabited villages in district there are 343 villages do not have primary school and out of these children of 340 villages have to travel distance of less than four kms for schooling. 565 are deprived of middle school and 754 of Degree College. Of these, 528 avail the facility of middle school at a distance of less than 5 kms. and 37 at a distance of 5-10 kms. In respect of Degree College, 81 avail this facility at a distance of less than 5 kms., while 673 villages have this within 10 kms.



To summarize, according to Census of India 2001, on an average across the district, 40% villages do not have access to Primary School within a distance of 2 kms. (a distance which could be walked by the child), all the villages have Secondary School within a distance of 6 kms. Also all the villages have colleges within a distance of 15 kms. and a 92.88% of the villages on an average, do not have access to a Vocational Institute within a distance of 25 kms.

Description of Pressure Theme Variables

Pressure variable which are relevant in context of District Una such as Population and density, growth pattern, labour force, literacy rate, distribution of rural and urban population, land use and agriculture horticulture practices that have impact on the State of natural system in Una district and its on Tehsils are described below.

Demographic Profile

Population & its distribution

According to the 2001 Census, the total population of Una district is 448,273 comprising 224,524 males and 223,749 females **(the Census of India, 2011 gives a provisional population figure of 521057 with a density of 338 per sq.km. Data at tehsil level is not available).** This population of the district forms 7.4 percent of the State population and ranks at 7th place among the districts. The District had a population of 317,422 persons in 1981 census and that of 378,289 persons in 1991 census. The decadal growth rate of population in the 1981-91 was approximately 19% while that in the 1991-2001 was a marginally lower of 18.5%.

Out of the total population of the district 91.2 percent lives in rural areas while 8.8 percent lives in urban areas. Rural population of the district is distributed among 5 tehsils, sub-tehsils and urban population is spread over in 5 towns. The total urban population in the district is 39,424 persons comprising 20,800 males and 18,624 females. The total rural population in this district comes to 408,849 persons and is composed of 203,724 males and 205,125 females as per 2001 Census. This rural population is distributed in 758 villages. Out of the total 814 villages in the district 758 are inhabited villages while 56 villages are uninhabited. *Swan* valley has dense concentration of villages which are bigger in size. The main concentration of villages is mainly in this valley as it is flat and most fertile area of the district.

The decadal change in population of various Tehsils is demonstrated in the following table.

Decadal Change in Population of Tehsils/Sub-Tehsils by Residence, 1991-2001

Tehsil/Sub-Tehsil	Population						Percentage decadal variation			Percentage urban population	
	1991			2001			1991-2001				
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	1991	2001
Bharwain (ST)	15,625	15,625	-	16,323	16,323	-	+4.5	+4.5	-	-	-
Amb (T)	120,427	113,421	7,006	143,645	137,110	6,535	+19.3	+20.9	-6.7	5.8	4.5
Bangana (T)	55,605	55,605	-	64,347	64,347	-	+15.7	+15.7	-	-	-
Una (T)	135,175	109,909	25,266	164,779	131,890	32,889	+21.9	+20.0	+30.2	18.7	20
Haroli (ST)	51,437	51,437	-	59,179	59,179	-	+15.1	+15.1	-	-	-
District Total	**378,269**	**345,997**	**32,272**	**448,273**	**408,849**	**39,424**	**+18.5**	**+18.2**	**+22.2**	**8.5**	**8.8**

Density

The density of population in Una district is 291 persons per sq. km. against the state average of 109 persons. At tehsil / sub-tehsil level, the density of population varies between 493 persons in Una tehsil and 156 persons in Bangana tehsil. In rural areas, the density of population works out 269 persons per km^2 while in urban areas it comes to 1923 persons.

Sex Ratio

There are 997 females for every thousand males in Una district. The sex-ratio figures for rural and urban areas of the district are 1,007 and 895 respectively. It is also observed that, the proportion of females in rural areas is higher than that of urban areas. Among the tehsils / sub-tehsils, the highest sex ratio of 1,028 females has been recorded in Bangana tehsil and the lowest is recorded in Una tehsil (958). The urban areas of Mehatpur Basdehra have lowest sex ratio of 866 females. Sex-ratio in age-group 0-6 comes 837 females per 1,000 males in the district, as a whole. In rural areas, this proportion is 839 females while in urban areas the sex-ratio of child population works out 820 females per 1,000 males.

Work Participation Rate

The work participation rate is defined as percentage of total workers to total population. In the same way it is defined for main workers and marginal workers. According to 2001 Census, the total workers including main and marginal workers constitute 45.0 percent of the total population of the district. Of the total workers, the share of the main workers is 26.6 percent and the marginal worker is 18.4 percent. The remaining more than half of population belongs to the category of non-workers.

As per 2001 Census among the main workers, male participation rate in the district is 41.1 percent and corresponding proportion of females is 12.0 percent. Male and female marginal workers account for 11.8 and 25.0 percent respectively. The proportion of female marginal workers is substantially higher than males, as the females are attending to one or more economic activities in addition to their house duties to improve the family income.

It is observed that in rural as well as in the urban areas of the district, the proportion of male main workers is higher than that of the female main workers.

Urban Population

There are five urban centres in the district which are given in the following table.

Name and Civic Status of Town	Urban Population of Town
Daulatpur (Nagar Panchayat)	3,354
Gagret (Nagar Panchayat)	3,181
Mehatpur Basdehra (Nagar Panchayat)	8,681
Santokhgarh (Nagar Panchayat)	8,308
Una (Municipal Council)	15,900
Total 5 towns	39,424

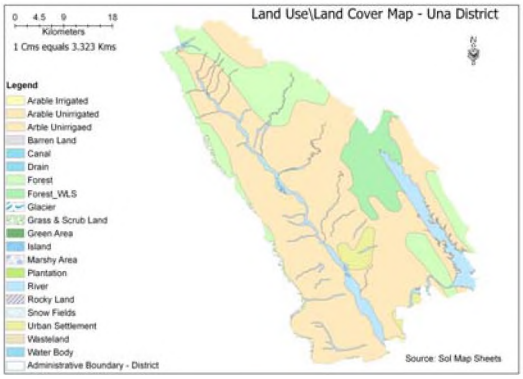
Literacy

A person who can read and write in any language with understanding is taken as literate in census. All children of age below 7 years are treated as illiterates.

As per 2001 census Una district reported 312,278 persons as literates constituting 80.4 percent of the total population, excluding 0-6 age-group population. The proportion of male and female literates in the district is 87.7 and 73.2 percent respectively. The literacy rate of males is much higher than that of females. The difference of male and female literacy rate is 14.5 points in the district.

The total literacy rates of rural and urban areas are 80.2 and 82.1 percent respectively. The proportion of male and female literates in rural areas is 87.8 and 72.8 percent

respectively. In urban areas this proportion is 86.6 and 77.2 percent respectively. The difference between male and female literacy rates in urban areas is about 9.4 points as against 15.0 points in rural areas. It is thus clear that females are better educated in urban areas than their counterparts in rural areas.



Land Use

Classification of Area	Tehsil wise land utilization (in hectares)					
	Una	Amb	Bangana	Bharwain	Haroli	Total
Total Geographical Area	33,477	49,657	41,850	10,055	19,883	154,992
Forest	1,158	4,062	8,731	4,570	-	18,521
Barren and unculturable land	11,148	17,084	13,001	2,520	8,322	52,075
Land put to non-agricultural uses	8,109	12,316	12,416	1,474	4,614	38,929
Culturable waste	1,205	311	1,680	226	1,396	4,818
Total cropped area	**21,747**	**25,281**	**11,249**	**2,550**	**10,673**	**71,500**

Agriculture

Agriculture is the main occupation of the people in the district. The agro-climatic conditions prevailing in the district are favorable for growing crops. The land holdings of the farmers in the district are small. The farmers grow more than two crops in a year so as to get maximum production from the land.

Soil in the district varies from sandy loam to clay. Agricultural activities in the district are carried out in two spells i.e. spring and autumn. The spring crops are called "Rabi" and the autumn crops are known as "Kharif". The main "Rabi" crops are namely Wheat, Barley, Gram and Oilseeds. The "Kharif" crops are namely Maize, Paddy, Oilseeds Pulses and Potatoes. The crop rotations followed in the district are 1.Paddy-Wheat, 2. Maize-Wheat, 3. Maize-Potato 4.Maize-Wheat and Baisakhi Moong etc.

Maize tops the list of agricultural produce, followed by wheat, rice, oilseeds, pulses, potatoes and sugarcane. In addition, efforts are also being made to encourage the farmers for growing vegetables like Cauliflower, Tomato, Kalitori, Tinda, Potato, Lady's Finger etc. Almost about 43% of the cultivated area is under double crops.

Tehsil-Wise Area Under Main Crops (in Hectares)

Name of Crop	Tehsil-wise Area					
	Una	Amb	Bangana	Haroli	Bharwain	Total
Cereals	19,016	23,255	10,296	9,338	2,386	64,291
Pulses	178	356	137	157	35	863
Others	1,125	948	661	643	43	3,420

With the use of high yielding varieties of seeds, advanced agricultural machinery, fertilizers, pesticides, the agriculture production per hectare has increased in the district.

Horticulture

District Una falls in Himalayan foothill-zone of the state. As such apple, the main fruit crop of Himachal Pradesh, is not grown in the district. However, a variety of other fruits are being grown in the district.

Main fruit crops which are grown in the district are citrus, mango, guava and pear. Daulatpur in Amb Tehsil is a major market for Mangoes.

The main river of district is *Swan* which does not provide the perennial source of water. However, the groundwater level in plain area and adjoining to *Swan* river is high and is used for irrigation by digging tube wells. Besides this, water of *Satluj* river is lifted at village Bhabour Sahib of Punjab to provide the irrigation facility to the some villages of Una tehsil. The major proportion of crops in the district is un-irrigated.

Irrigation

Farmers have had a major tradition of building canals aligned roughly with contours to draw water from hill streams or springs. These canals are known as kuhls, which vary from 1 to 15 kms. Generally, a kuhl would have a trapezoidal cross section, 0.1 to 0.2 square metres in area, and usually conveys a discharge of around 15 to 100 litres per second. A single kuhl can irrigate an area of 80 to 400 ha through distributaries or by flooding. The system is common at altitudes from 350 to 3000 m in the outer and middle Himalaya where there is a significant drop in elevation in the path of a kuhl; the fall is utilized to drive simple machinery, like flour mills.

Tehsil-Wise Position of Irrigated Area (Sq.Km)

Tehsil	Net Irrigated Area	Lift		Wells		Tanks		Ponds/ Kuhls		Tubewells		Others	
		N	A	N	A	N	A	N	A	N	A	N	A
Una	4729	8	1264	468	707	1041	1776	148	-	18	952	-	30
Amb	2281	19	337	22	21	190	1630	-	-	25	293	-	-
Bangana	57	2	19	5	-	9	-	-	-	5	38	-	-
Haroli	1458	-	-	98	-	402	1455	-	3	-	-	-	-
Bharwain	31	-	-	-	-	1	-	-	-	56	31	-	-
Total District	8556	29	1620	593	728	1643	4861	148	3	104	1314	-	30

Livestock

Livestock is the main wealth of rural population next only to agriculture. Almost every household in rural areas invariably keeps a few cows, buffaloes, sheep and goats and keep poultry birds. Animals are kept for milk, meat and providing manure to the fields. The district has a large number of livestock. As per the livestock Census of 1992, the number of livestock in the district is given in the following statement.

Live Stock and Poultry (According To 1992 Livestock Census)

Particulars of Live stock and Poultry	Total
Cattle	67,492
Buffaloes	91,736
Sheep	5,983
Goats	46,974
Pigs	66
Others	768
Total	**213,019**
Poultry birds	21,847

The district is surplus in milk and Gujjars living in this district are mainly engaged in the rearing of milch animals. There are 8 routes in the district through which milk is collected from the rural areas and supplied to the milk chilling plants. Cattle fairs are regularly organized in each block and animals of good quality are being supplied. Two poultry farms at Ajouli and Jalgran exist and supply poultry birds.

Fisheries

Una is a foothills district and is not drained by the perennial rivers/*khuds*. The natural fishing grounds inside the district are almost absent. The natural fisheries resources of this district comprises of a portion of Govind Sagar reservoir falling in the district. Fish production to the tune of approximately 300 tonnes is achieved from *Lunkar Khad* which is spread from Dumkhar to Bhakra.

Minerals and Mining

There is no useful mineral in the district. However, the rivers and khuds of the district provide stones, "Bajri" and sand used in the construction of the buildings and roads. A number of brick kilns exist in the *Swan* valley.

Industries

There are no large scale Industrial units in the district. There are 6 medium and 1229 small scale industries existing in the district.

The medium scale industries are engaged in the manufacturing L.P. gas cylinders, coated cotton fabrics, P.V.C. films, P.V.C. sheeting, HDPE woven fabric socks, decorative & laminated sheets, Malta spirits, country liquor and craft paper etc. The small scale industries are manufacturing steel furniture, gate, grills, building material, wooden furniture, plastic pipes and water tanks etc.

Industry department of the State has developed industrial areas in the district where all facilities to set up the industrial units are easily available. The most of industries in the district are located in Mehatpur, Tahliwal, Amb and Gagret. The detail of these industrial centres is given below:

Industrial Areas in the District

Name of the area	Total land in acres	Total plots	Sheds	Units in production
(i) Mehatpur	109	131	26	94
(ii) Tahliwal	72	154	10	45
(iii) Industrial Area, Amb Phase-I	50	42	-	1
(iv) Industrial Area, Gagret	32.5	21	-	-

LARGE AND MEDIUM INDUSTRIAL UNITS

Name of large & medium industrial units	Year of establish-ment	Name of product produced
M/s Rangar Breweries, Industrial Area, Mehatpur ,	1997	IMFL Country liquor malt spirits & ENA
M/s Nipso Poly coats Fabrics Pvt. Ltd., I. Area, Mehatpur	1986	HDPE/PP Wavest Fabrics
M/s Him Cylinder Ltd., Industrial Area, Amb, Distt. Una	1986	LPG Cylinder
M/s Shivambu International, Mahesh Nagar Oel, Tehsil Amb,	1994	Fruits & Veg. processing
M/s Kapson Polycoats India Pvt. Ltd., I. Area, Mehatpur,	2001	PVC film sheeting
M/s Extrol Chemicals Pvt. Ltd., I. Area Mehatpur, Distt. Una	1998	Blowing Agent

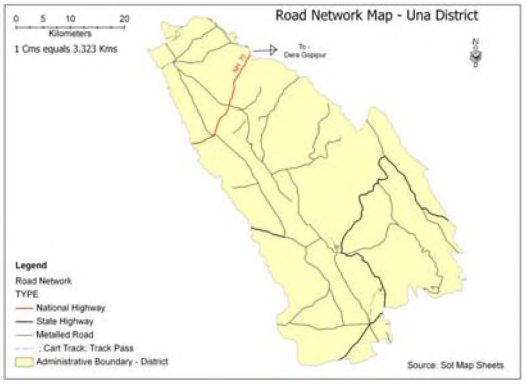
An Industrial corridor as depicted in the map is proposed by the Industries Department. The corridor encompasses almost 40% of the Amb Tehsil, almost 60% of Una Tehsil and the entire Haroli Tehsil. It covers the entire lower foothills situated in the South west and west of the district as well as the plains of the *Swan* and *Sohan* valleys. Since this region borders the fertile and industrial region of Punjab, the lower foothills will be impacted by the Industrial development which is likely to be initiated along the National Highway and the roads leading to Una and Tahliwal- Santokhgarh.

These foothills have ravenous formations with gullies and small shrubbery consolidating the soil.

Roads & Transport

Road transportation is the life of the economy of the district. The district is well connected by roads and rail. The district has a good number of roads and it is connected by the roads from Chandigarh, Delhi and maximum places of Punjab and Himachal Pradesh. The district headquarters is also connected by broad gauge railway line which is extended in the Amb Tehsil also.

NH 70 from Hoshiarpur passes through Gagret and Amb in Amb Tehsil while SH 32 links Una with the State Headquarters through Barsar. The goods transport is almost in the hands of private truck operators while in case of passenger transport the buses of various regions are mainly plied by H.R.T.C. A fleet of 94 buses is plied by H.R.T.C. Una on different routes. Punjab Roadways also plies buses on various routes in the district.



The total length of metalled and unmetalled roads is 1,515 kms. including National and State Highways. Of these length, 90 kms. is double-lane while remaining length of road is single- lane.

Electricity and Power

For the development of agriculture and industries, the availability of power is essential. The use of electricity for domestic purpose has become a necessity in modern times. The rural electrification plays a significant role in socio-economic development. In the field of rural electrification, the State has made remarkable achievements. All the inhabited villages of the State were electrified by the end of June 1988, though it was a very difficult task due to mountainous terrain. The district does not have any hydro-electric generating station because there are no perennial rivers that flow through the district.

For the distribution of electricity for industrial and domestic consumption, the district has 33 KV and 11 KV electric lines.

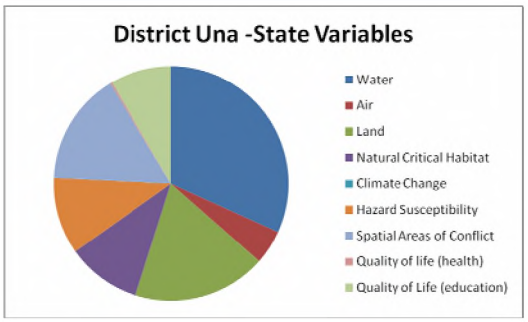
Summary of State Variables at District Level

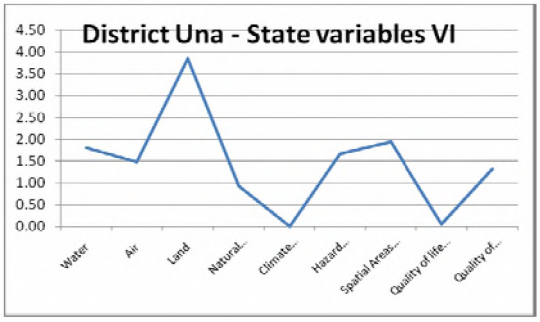
Based on the database for State variable, computation of State variables have been done at the district level. Based on computation, state variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under State component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Una. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'state'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Water, Air, Land etc., as grids on x-axis, which actually represent the value of vulnerability ($V_{State\ Sector}$) as a total for that particular system.

Una	
Variable Sector	**Vulnerability of State Sector $V_{State\ Sector}$**
Water	7959.25
Air	1180.20
Land	4608.57
Natural Critical Habitat	2581.47
Climate Change	0.00
Hazard Susceptibility	2652.18

Una Variable Sector	Vulnerability of State Sector $V_{\text{State Sector}}$
Spatial Areas of Conflict	3887.12
Quality of life (health)	62.81
Quality of Life (education)	2113.32

The analysis of data indicates that water resources show a remarkable presence followed by land and Spatial areas of conflict. Being a border district, some tehsils induce pressures. Further, the analysis shows that Land is under pressure indicating the vulnerability of land.



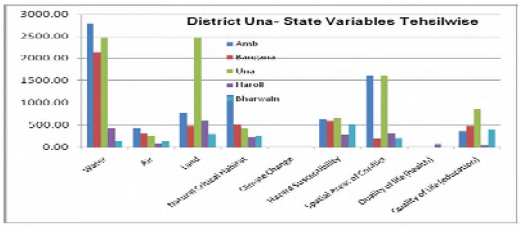


State Variables at Tehsil Level

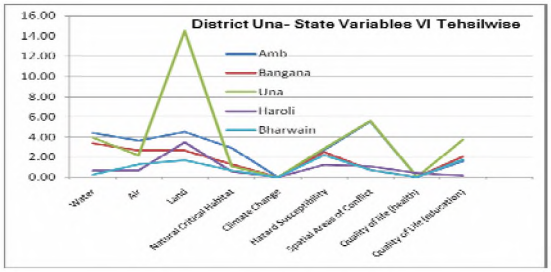
Similarly the state variables quantified at Tehsil level are given below:

Comparison of State variables at Tehsil level

State Variables	Amb	Bangana	Una	Haroli	Bharwain	Vulnerability of State Sector $V_{\text{State Sector}}$
Water	2791.60	2140.06	2478.13	414.99	134.47	7959.25
Air	414.70	304.60	245.30	73.20	142.40	1180.2
Land	772.59	461.45	2480.77	603.43	290.33	4608.57
Natural Critical Habitat	1163.75	513.87	427.49	226.26	250.10	2581.47
Climate Change	0.00	0.00	0.00	0.00	0.00	0
Hazard Susceptibility	624.43	579.49	658.48	283.47	506.31	2652.18
Spatial Areas of Conflict	1595.40	194.40	1601.66	298.06	197.60	3887.12
Quality of life (health)	0.00	0.00	0.00	62.81	0.00	62.81
Quality of Life (education)	356.81	465.50	854.85	35.16	401.00	2113.32



State Variables vulnerability at Tehsil level in District Una



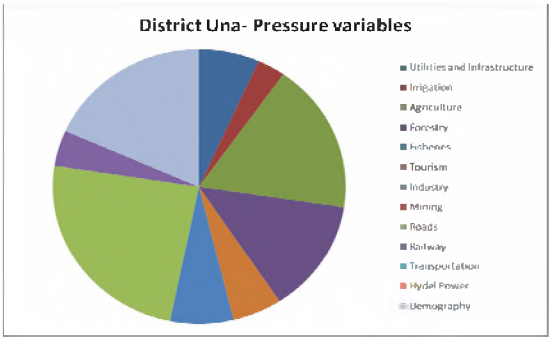
Summary of Pressure Variables at District Level

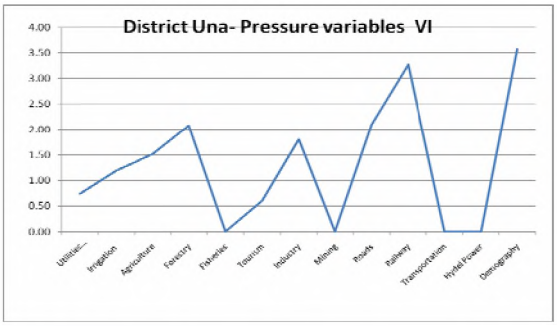
Similarly, based on the database for pressure variable, computation of pressure variables

have been done at the district level. Based on computation, pressure variables have been assessed w.r.t vulnerability which is described below. On the basis of quantification of variables under Pressure component, the vulnerability index has been derived for all tehsil/ sub-tehsils for district Una. For deriving the vulnerability level, first the quantified values were normalized and applied through naturalization factor ($N_{F\ 'pressure'}$). These values were placed in an inter relationship matrix to draw the component values along grid in matrix, these values determine the 'grid sum' for all the indicator sectors i.e. Utilities & infrastructure, Irrigation, Agriculture, Forest, Tourism etc., as grids on y-axis, which actually represent the value of vulnerability ($V_{pressure\ Sector}$) as a total for that particular system.

Una Variable Sector	Vulnerability of Pressure Sector $V_{Pressure\ Sector}$
Utilities and Infrastructure	1564.53
Irrigation	722.03
Agriculture	4125.58
Forestry	3129.36
Fisheries	0.00
Tourism	1277.09
Industry	1630.99
Mining	0.00
Roads	5684.98
Railway	983.20
Transportation	0.00
Hydel Power	0.00
Demography	4298.92

The analysis of data indicates development of Road network. Further, being a border District, demographic pressures are evident in five urban centres. Agriculture is a dominant land use particularly in Una, Haroli and Amb Tehsils and terrain of these tehsils makes the agriculture sector vulnerable. Forest is another significant land use category. The Industrial Centres in the towns has made a significant presence. Railway network has also grown in the district.





The analysis of data indicates that Demographic pressures and development of Railway network results in higher vulnerability than other sectors. Roads, Industry, forestry and agriculture sector form the next higher segment of vulnerability but they are within manageable limits.

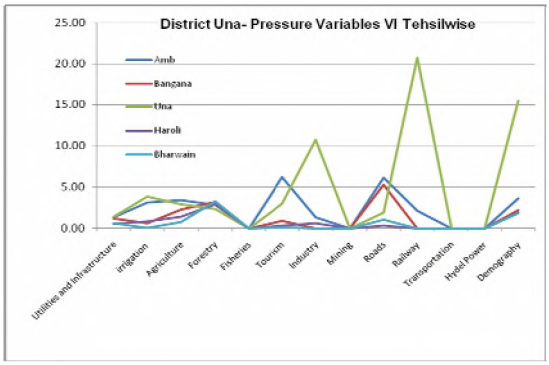
Pressure Variables at Tehsil Level

Similarly, the pressure variables computed at Tehsil level for comparison is given below.

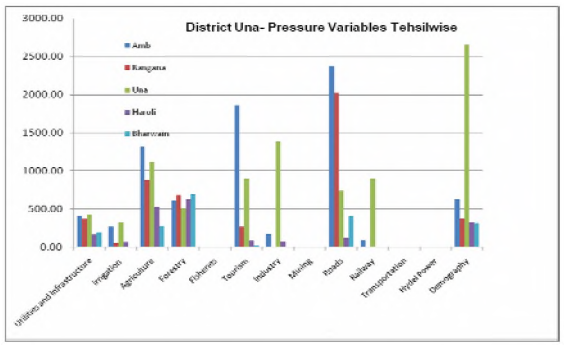
Comparison of Pressure variables at Tehsil level:

Pressure Variables	Amb	[illegible]	Una	Haroli	Bharwain
Utilities and Infrastructure	408.00	366.35	431.00	165.90	193.28
irrigation	267.13	54.10	329.50	68.30	3.00
Agriculture	1320.11	873.81	1116.87	534.62	280.17
Forestry	612.38	688.51	504.38	627.99	696.10
Fisheries	0.00	0.00	0.00	0.00	0.00
Tourism	1861.00	268.25	897.10	86.94	24.80

Pressure Variables	Amb	Bangana	Una	Haroli	Bharwain
Industry	170.98	0.00	1380.60	79.41	0.00
Mining	0.00	0.00	0.00	0.00	0.00
Roads	2381.61	2030.52	738.17	121.90	412.78
Railway	90.20	0.00	893.00	0.00	0.00
Transportation	0.00	0.00	0.00	0.00	0.00
Hydel Power	0.00	0.00	0.00	0.00	0.00
Demography	627.88	377.84	2656.00	325.02	312.18



Pressure Variables vulnerability at Tehsil level in District Una



The analysis of data indicates that Una is under high pressure because of pressure of Demography, Industry and Agriculture sector. Further, Amb is under high pressure because of Road network, Tourism (which comprises predominantly of domestic pilgrimage tourism to various temples e.g. Chintpurni and various Gurudwaras) and agriculture. The other three tehsils are not under demographic pressure. This analysis indicate that urban tehsils is attracting migration.

Based on the quantification of Pressure and State variables, the vulnerability index has been derived for all Tehsil/ Sub-tehsils for district Una. For deriving this vulnerability index, first the quantified values were normalized and applied through naturalization factor (N_F 'state' or 'pressure' as the case may be). These values were placed in an inter relationship matrix to draw the component values, these values determine the 'common sum' of both the variables i.e. State & Pressure, as grids on x-axis and y-axis respectively which actually represent the value of Vulnerability (V) as a total for that particular system and these values have further been normalized by using following equation that represents the normalized Vulnerability Index (VI) values for that particular system as given below:

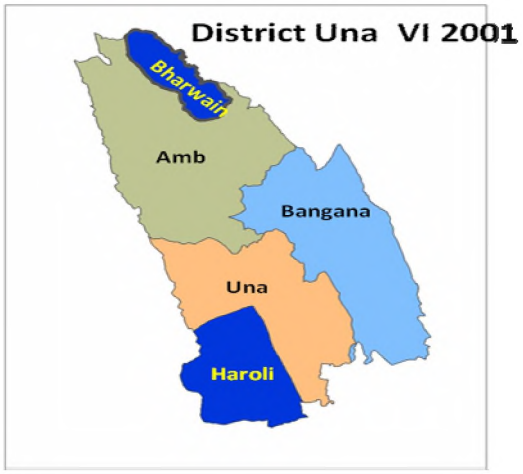
$$\frac{\sum V_{\text{Pressure Sectors}} : V_{\text{State Sectors}}}{\text{Total no. of State variables x total no. of Pressure variables}}$$

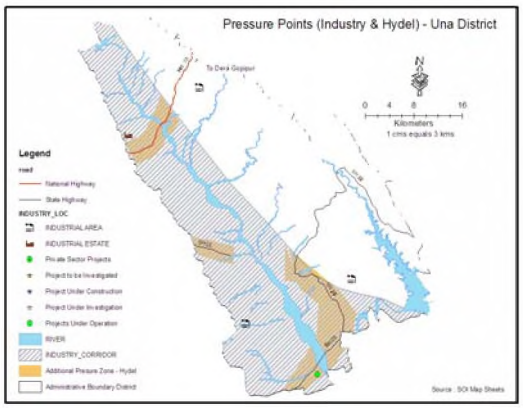
Vulnerability Index

	Amb	Bangana	Una	Haroli	Bharwain
$\sum V_{\text{State and Pressure}}$	7739.29	4659.38	8946.29	2010.08	1922.30
denominator = 57x43			2451		
Normalized VI	**3.16**	**1.90**	**3.65**	**0.82**	**0.78**

The analysis of data indicates that Tehsils bordering the neighboring state of Punjab have a higher VI. Amb and Una tehsils have accessibility from Punjab and thus the pressures are higher. Though Haroli also borders Punjab, yet, the Tehsil is not highly vulnerable due to the fact that the accessibility is not very good. It is interesting

to note that the rail connectivity to Una and Amb has developed in manner which is reflection of continuum of development of Naya Nangal Industrial core in Punjab. Bangana tehsil, though traversed by the National Highway, is not under major developmental pressures because of its typical land form and segregation by the Govind Sagar Lake. Bharwain on the other hand is an insulated Tehsil and thus is not under pressures. The analysis of data indicates that development of increased access to Haroli in due course can put pressure thereon and increase the VI of Haroli.



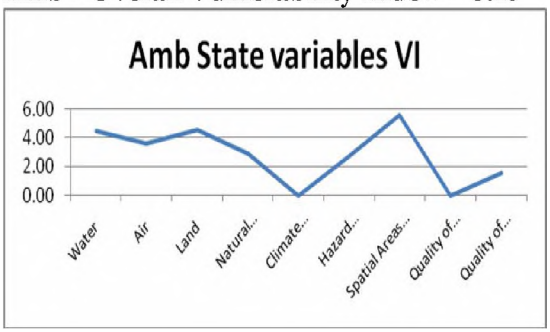




Description of Sectoral Vulnerability at Tehsil Level

State & Pressure variables, have been presented here at Tehsil level as to analyze the position on sectoral basis and to understand how the programmes at tehsil be attempted to reduce the vulnerability through the sectoral intervention.

Amb - Overall Vulnerability Index = 3.16

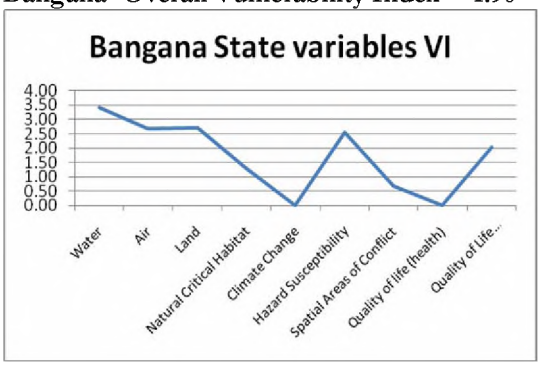


The analysis of data indicates that the Spatial Areas of Conflict variables are the most vulnerable in the Tehsil. Through the National Highway, Amb tehsil is the entry point in Himachal from Punjab and the foothills areas along the NH. This area is prone to urbanization which has resulted in loss of the green cover. Similarly, Industries located along the river / tributary poses threat of water pollution. These attributes has had an impact on water, air and land making them vulnerable. The analysis of data indicates that there is no gap in Health infrastructure and services. However, gaps in Education infrastructure need to addressed

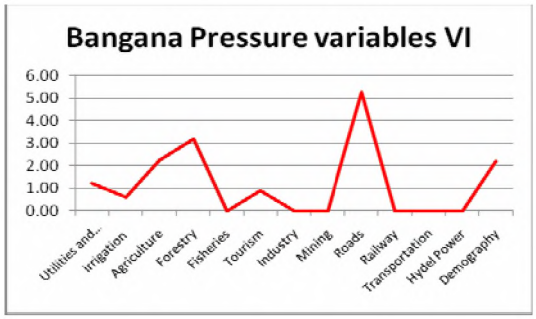
though a programme for improving Education infrastructure.

The analysis of data indicates that Tourism, Road network and Demographic exert pressure making Tehsil vulnerable. The tourism pressure is due to the participation of local communities in Fairs and Melas. Since these events occur at specific days annually, it is not a matter of immediate concern. The high vulnerability of Road sector, predominantly in the rural segment is alarming as it is opening up new areas for development.

Bangana -Overall Vulnerability Index = 1.90

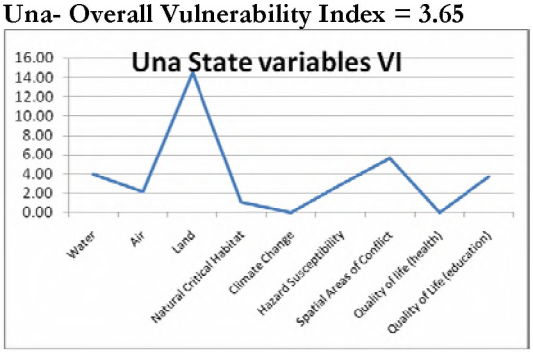


The analysis of data indicates that water resources are under pressure making it vulnerable. Though Govind Sagar Lake exists in the Tehsil, the entire water drawl for usage is from groundwater sources. In view of the terrain, land is also pressure and vulnerable. Analysis of data shows susceptibility of Teshil to Hazards. Gaps in Education infrastructure can be addressed by a developing a programme for improvement of Education infrastructure.

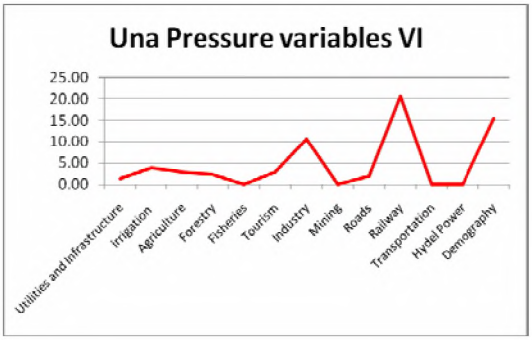


The analysis of data indicates high VI for Roads which indicates development of Road Network. A tunnel is also proposed for the NH in this Tehsil. Environmental assessment can be done for such projects more so because Vulnerability for Hazards is also high. Forests are under pressure which indicates heavy reliance on forest for fuelwood.

Una- Overall Vulnerability Index = 3.65



The analysis of data indicates pressure on Land because of diversion from agricultural to non agricultural uses making it vulnerable. Being the entry point to the State, the Spatial Areas of Conflict show a high vulnerability.

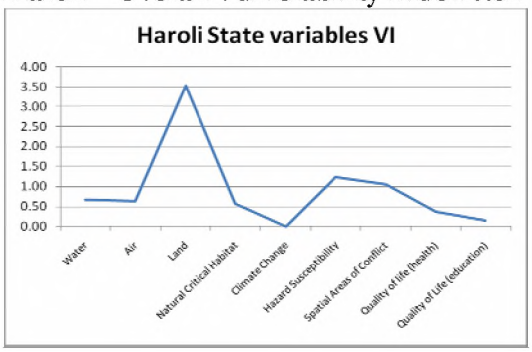


The analysis of data indicates extremely high VI values for Industries, mainly due to the establishment of Industrial centres at Una, Mehatpur and Santokhgarh. The analysis of data also indicates increase in demographic pressures because of establishment of Industries.

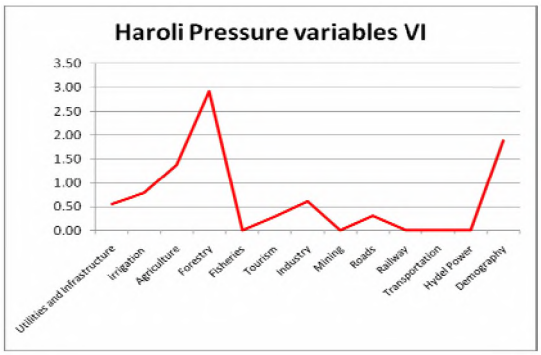
Further Industrial growth need to be carefully analyzed in the context of current and future development needs and in conformity of development plan/land use plans. Further, with the aim of identifying polluted industrial clusters and prioritising planning needs for intervention to improve the quality of environment in these industrial

clusters, Comprehensive Environment Pollution Index (CEPI) has been developed by CPCB. The CPCB's report has concluded that the industrial clusters/areas having aggregated CEPI scores of 70 and above should be considered as critically polluted; the clusters/areas having CEPI scores between 60-70 should be considered as severely polluted areas. In Himachal Pradesh, Baddi, Kala Amb and Parwanoo fall under this category of severely polluted areas and shall be kept under surveillance and pollution control measures should be efficiently implemented; and the critically polluted industrial clusters/areas need further detailed investigations in terms of the extent of damage and formulation of appropriate remedial action. Future development of Industries can be in accordance with Zoning Atlas for Siting of industries, State Environmental Atlas of Himachal Pradesh, CEPI for industries in Una district. Similarly, the need of Industrial corridor can be considered. The non-working /sick Industrial units can also be appraised and considered accordingly.

Haroli – Overall Vulnerability Index 0.82

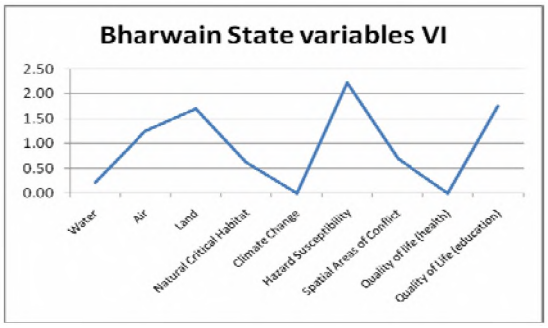


The analysis of data indicate that Land is under pressure being a border district (but lesser in magnitude than Una and Amb) making it vulnerable. No other variable is cause of immediate concern.

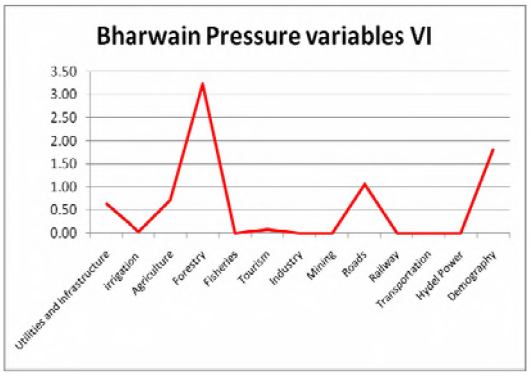


The analysis of data indicates that Forest resources are under pressure, especially in terms of use of timber and as fuelwood for domestic purposes. Establishment of Industrial estates has further increased Demographic pressures. A programme for providing alternate fuels for domestic purposes can be developed to reduce pressure on forest resources.

Bharwain – Overall Vulnerability Index = 0.78



The analysis of data indicates Hazard Susceptibility of Tehsil making it vulnerable. Land is also under pressure. The analysis also shows gaps in Education infrastructure. A programme for improvement in Education infrastructure can help in addressing the gaps and reduce the vulnerability of the Tehsil.



The analysis of data indicates that apart from pressure on Forest resources and Demographic pressure, rest of the variables is under control.

Vulnerability Levels in Regional Context

An attempt has also been made to understand the vulnerability in regional context. Vulnerability in regional context gives and understanding as how the levels of vulnerability of adjoining areas/ tehsil/ sub tehsil within the district or other districts are impacting the levels of vulnerability of current areas/ tehsil/ sub tehsil. This understanding is helpful in consideration of the intervention prioritization.

Una

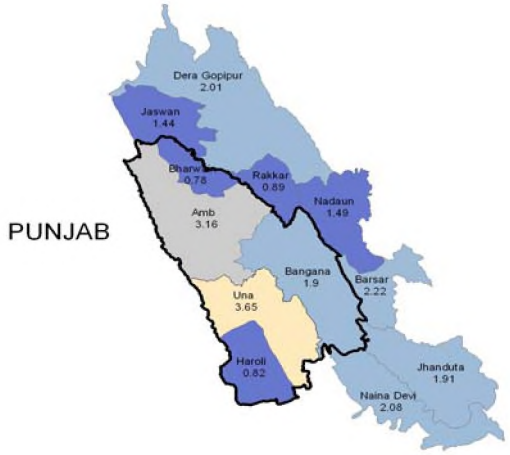
S. No.	Tehsil	VI	Adjoining Tehsil in Una District	VI	Adjoining Tehsil in Other District	District	VI
1	Bharwain	0.78	Amb	3.16	Jaswan	Kangra	1.44
					Dera Gopipur	Kangra	2.01
2	Amb	3.16	Bharwain	0.78	Rakkar	Kangra	0.89
			Bangana	1.90			
			Una	3.65			
3	Bangana	1.90	Una	3.65	Rakkar	Kangra	0.89
			Amb	3.16	Nadaun	Hamirpur	1.49
					Barsar	Hamirpur	2.22
					Naina Devi	Bilaspur	2.08
					Jhanduta	Bilaspur	1.91
4	Una	3.65	Amb	3.16			
			Bangana	1.90			
			Haroli	0.82			
5	Haroli	0.82	Una	3.65			

Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

District Una is surrounded by various Tehsils of District Kangra, Hamirpur and Bilaspur, the vulnerability levels of all surrounding areas are lower than that of what is prevailing in various Tehsil/ Sub tehsils of District Una except for Bharwain tehsil. The transitional impact of vulnerability possibly will give rise to vulnerability levels when analyzed in regional context, though this impact will directly be

linked to the 'State' & 'Pressure' variables vulnerabilities of interacting Tehsil/ Sub-tehsils.



Analysis & Recommendations

The current analysis reveals that though the district as a whole is not so highly vulnerable, yet there are indicators on basis of which one can infer that the scenario may change in times to come in case the present position of gaps prevails. The observations and concern emerging from this analysis required to be addressed as a response in terms of policy, plans, programs and projects interventions. The temporal scale for each of these interventions would be the policy and the plan as a long term response, the program as the medium term response and the projects as a short term response.

State Parameters

(i) Prioritization and Rationalization of distribution of water resources for various usages can be undertaken so as to sustain the vulnerable groundwater resource. A programme for regular monitoring of the groundwater reserves and replenishing the resource with effective Rain Water Harvesting can be undertaken. It is also inferred that in entire district ponds on the ridges in forest areas be created to hold and store the surface runoff due to rains etc. which will help the ecosystem of that area to maintain moisture content in critical areas besides recharging of the groundwater. Further, the groundwater may be recharged through the creation of small check dams on the non perennial *khuds*, which could also improve the irrigation scenario.
Priority Tehsils- Una, Haroli, Bharwain and Amb.

(ii) The district has a number of Natural Critical Habitats and creation of buffer zones around the Natural Critical Habitats, i.e. Reserve forests can be done. This is important as a number of religious places, which attract a large congregation of people, are in the vicinity of Reserve Forests.

The plantation of native species instead of *Eucalyptus* can be taken up so as to manage and sustain the valuable ground water reserves.

Priority Tehsils- Amb, Bharwain,

(iii) The Quality of Life variables in terms of Health and Education seem to be adequately addressed. However, gaps if any, in health and education infrastructure services can be addressed by developing health and education infrastructure.

Pressure Parameters

(i) Tourism creates pressure on the Utilities and Infrastructure and other resources. A definite and specific plan for the district in terms of growth of tourism is required. For a sustainable coexistence of tourism and environment, detailed State Level and District Level Plans for Tourism is required to be prepared. Moreover since, a majority of tourists are domestic pilgrims, specific plans for their destination can be made.

Priority Tehsils- Amb, Bharwain, Haroli, Una,

(ii) Utilities and Infrastructure is the second highest pressure in the district. This kind of pressure is appearing due to the fact that there is a distinct gap between the demand and the supply, based on the National Benchmarks. It is felt that a State specific,

such benchmarks can be re-fixed in the State context. Since the settlement pattern is very distinct, it is felt that a cluster approach may be adopted so that each utility becomes sustainable and financially viable. Interventions such as Low Cost Sanitation, in situ management of solid waste etc. can be adopted.

(iii) The proposal to expand existing Industrial area may be considered after taking prior environment clearance. The proposal to establish Industrial Corridor should be carefully analyzed to prevent any adverse environmental impact and an Environmental Impact Assessment Study can be made mandatory in the State context.

(iv) Priority Tehsils- Amb, Una, Haroli

It has been observed that availability of data base at the Tehsil level is lacking and there is no proper accounting of environmental data base. A system is to be evolved whereby the data could be generated at the Tehsil level and integrated in the VI calculations to update annually and to analyze and assess the variation in VI at annual level.

Response Matrix

Based on above inferences and data analysis a response matrix has been prepared which maps the state & pressure variables with the suggested intervention which are required to be made to reduce the vulnerability. The suggested intervention shall partly act as response mechanism of the State Government.

Variable	Policy	Plan	Programme	Project	Remarks
State					
Water			*		Charging through non perennial khuds Groundwater recharge programme
Natural Critical Habitat		*	*		Plans for Buffer zones Programme for maintenance of moisture content and groundwater recharging
Quality of life (Health)			*		Programme to improve access
Quality of life (Education)			*		Programme to improve access
Pressure					
Tourism		*			Tourism Plan at State, District, and Destination Level
Utilities & Infrastructure		*	*		Tehsil level plan Cluster level projects
Industry					Environment Impact Assessment for Industrial corridor

Vulnerability – Scenario Projection

While analyzing the future scenarios except demographic variables no other variable is scientifically projectable in present context. In view of such limitations the population projections at tehsils level for years 2011, 2021, 2031 and 2041 have been made based on the established scientific arithmetic increase, incremental increase and geometric increase methods. The vulnerability index and the population have been interlinked by evolving a per capita share of vulnerability index.

VI- 2001

	Amb	Bangana	Una	Haroli	Bharwain
VI	7739.29	4659.38	8946.29	2010.08	1922.30
Denominator = 57x43			**2451**		

Normalized VI	**3.16**	**1.90**	**3.65**	**0.82**	**0.78**

Population Projections

	Pop 2001	Projected Pop 2011	Projected Pop 2021	Projected Pop 2031	Projected Pop 2041
Amb	143645	163431	186039	211878	241403
Bangana	64,347	74527	86774	100891	116676
Una	2,07,992	2,37,958	2,72,813	3,12,769	3,58,079
Haroli	59,179	69298	81253	94881	110015
Bharwain	16,323	19577	23002	26594	30347

Calculation of per capita share of VI

	Pop 2001	VI 2001	per capita share
Amb	143645	3.16	2.2
Bangana	64,347	1.9	2.95
Una	2,07,992	3.65	1.75
Haroli	59,179	0.82	1.39
Bharwain	16,323	0.78	4.78

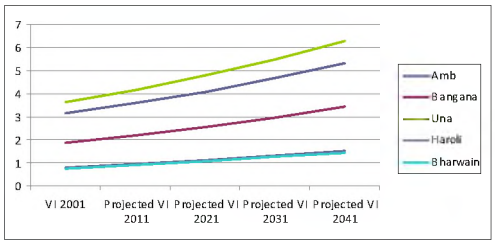
Calculation of Projected VI

	Pop 2001	VI 2001	per capita share	Proj Pop 2011	Proj. VI 2011	Proj Pop 2021	Proj VI 2021	Proj Pop 2031	Proj VI 2031	Proj Pop 2041	Proj VI 2041
Amb	143645	3.16	2.2E-05	163431	3.60	186039	4.09	211878	4.66	241403	5.31
Bangana	64,347	1.9	2.95E-05	74527	2.20	86774	2.56	100891	2.98	116676	3.45
Una	2,07,992	3.65	1.75E-05	2,37,958	4.18	2,72,813	4.79	3,12,769	5.49	3,58,079	6.28
Haroli	59,179	0.82	1.39E-05	69298	0.96	81253	1.13	94881	1.31	110015	1.52
Bharwain	16,323	0.78	4.78E-05	19577	0.94	23002	1.10	26594	1.27	30347	1.45

Projected Vulnerability Index

	VI 2001	Projected VI 2011	Projected VI 2021	Projected VI 2031	Projected VI 2041
Amb	3.16	3.60	4.09	4.66	5.311
Bangana	1.90	2.20	2.56	2.98	3.445
Una	3.65	4.18	4.79	5.49	6.284
Haroli	0.82	0.96	1.13	1.31	1.524
Bharwain	0.78	0.94	1.10	1.27	1.450

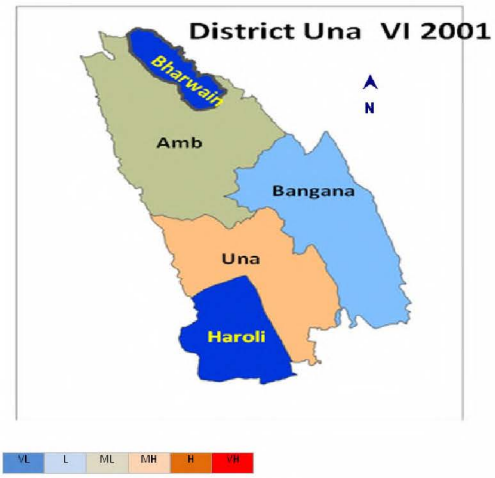
Vulnerability Index Scenarios – District Una at Tehsil Level



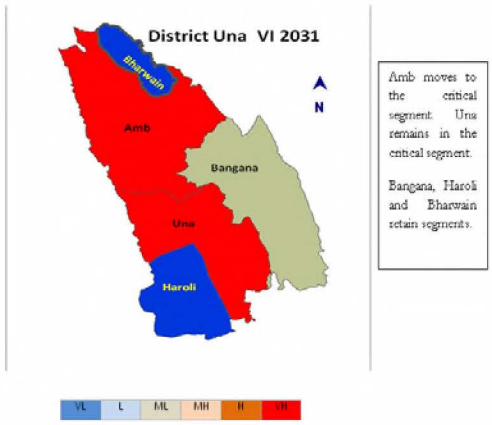
Range

Vulnerability Categorization	Color Code
Very low vulnerability	
Low vulnerability	
Moderate low vulnerability	
Moderate high vulnerability	
High vulnerability	
Very High Vulnerability	

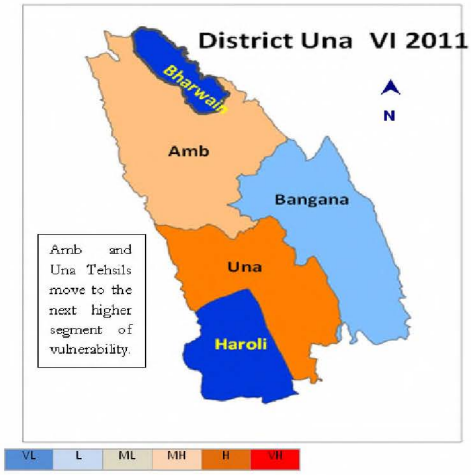
2001



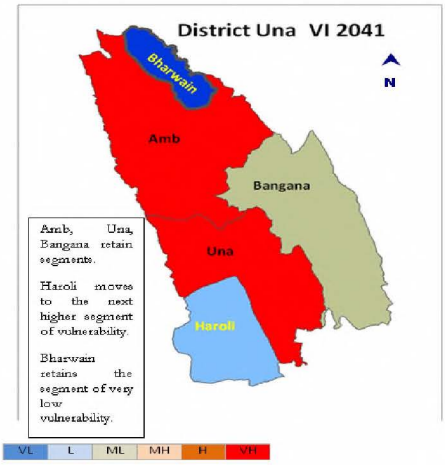
2031



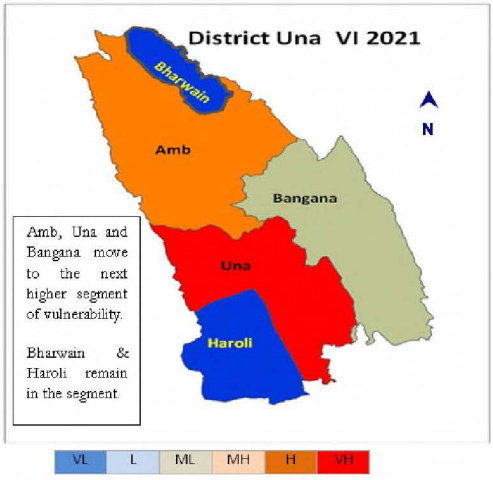
2011



2041



2021



Prepared by:

IRG Systems South Asia Pvt Ltd.

For

Department of Environment, Science & Technology (DEST)

Narayan Villa, Shimla, Himachal Pradesh, INDIA – 171 002

WebSite: www.himachal.gov.in/environment E-mail: dbt-hp@nic.in

Tel.: +91-177-2620559, +91-177-2627608 Fax. : +91-177-2627609