

# HILL TOWNS - Environmental planning as a pre-requisite for disaster mitigation

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## Abstract

Mountains, essentially are the wealth of unique biological, functional and aesthetic resources for every country. They are the sources of water, forest produce, minerals, agricultural and horticultural produce and provide ample opportunities for tourism and recreation, thereby contributing significantly to the national economy. They also offer immense biodiversity i.e. flora and fauna both, which have high cultural and economic value. It is also very well known that the mountains play a very vital role in determination, regulation and modification, of the climatic regime including the rainfall in the country. Some of the mountainous regions form a very closed eco-system wherein the various sub-components of the system are so fragile that any disturbance through human intervention can cause irreparable damages, whereas some of the regions are able to tolerate the interference over to a slightly extended time period. Nevertheless, all mountainous eco-systems, geologically younger or older are more or less fragile eco-systems. "Nearly half of the world's population i.e. about 3 billion is concerned in one way or the other with mountainous regions and about 10 per cent of the earth's population lives in mountainous areas on higher altitudes while 40 per cent occupy the lower altitudes", reports Agenda 21 Nature is also very unkind to mountainous region. Natural disasters like floods, earthquakes, landslides and fire etc. cause large scale destruction to houses year after year in different sub-regions.

## Disaster Reduction in Hill Areas and Environmental Planning

Disaster in today's world can be both natural and manmade, in fact sometimes it is becoming difficult to ascertain as to which of the human action is going to or is leading to occurrence of a particular disaster. While the link between natural disaster reduction and urban/regional planning is less evident, there is an established connection between environmentally degrading practices and occurrence of natural disasters. As the population of our country becomes more concentrated, the natural resources have become increasingly eroded and degraded. Indiscriminate felling of trees particularly on upper slopes can cause mudflow and landslides on the lower slopes. Filled up marshes and wetlands can exacerbate flood problems. Sometime the same can also lead to crack in foundations. A large number of natural disasters can be prevented (except perhaps earthquake, which cannot be predicted) through effective environmental planning measures.

In India, there are two broad hill regions, viz. The Himalayan region and the Deccan Plateau. The hill states are Jammu & Kashmir, Himachal Pradesh, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Many hill areas are also located in Assam, Goa, Karnataka, Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal and the union territory of Daman & Diu.

## Conflicts between Developmental Needs and Environmental Conservation

The human settlements within the mountainous region are highly dependent on local resource base including the bio-mass for their daily survival. The Himalayan region although physically a one entity, stretching from west to east presents varied nature of problems. All the cities are located in the low lying areas involving a perennial drainage problem. The soil is very good for agricultural purposes and has good productivity. **It is therefore seen that there is a strong linkage between resources available and the location of human settlements.**

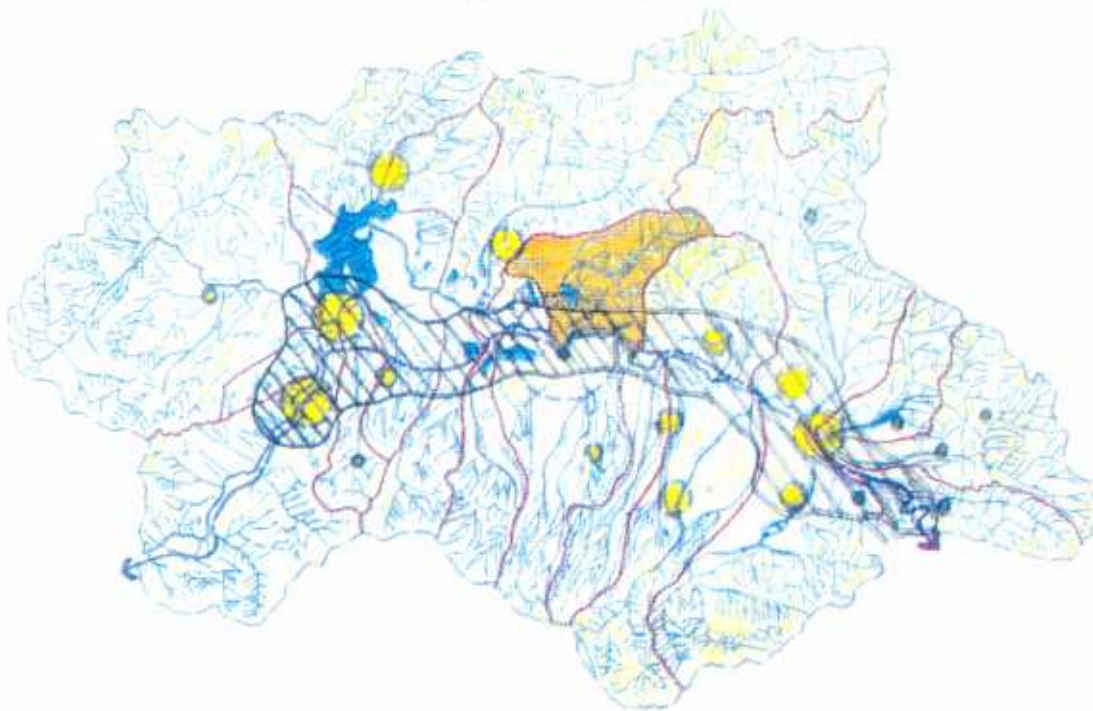
Even at low level of 8.70 per cent urban population, Himachal Pradesh is confronted with problems of over urbanisation and fast environmental degradation. As a

result of consistent increase in urban population during the last three decades, pressure on land and resources has increased manifold. With 36.46 percent growth rate of urban population during 1981-91, Himachal Pradesh witnessed unprecedented haphazard and unauthorised construction in and around towns, along the highways and in major river valleys. Having complex geological structure, the Himalayas have fragile and delicate eco-system. They are highly vulnerable to human interference. The rapid, but unscientific and haphazard development of roads, has aggravated their environmental degradation. Roads have caused colossal destruction of vegetal canopy and triggered off massive erosion on slopes. Sliding debris has chain effects of destabilising the Eco-system of beautiful valleys and subsequently the plains. Modernisation and technological revolution have uprooted some ancient customs and traditions that had a direct bearing on ecological and environmental conservation. **At the present rate of devastation, it is feared that Himachal Himalayas may turn into a desert in next century.**

The story repeats itself in UP portion of Himalayas. "Himalayas is becoming the victim of the great Himalayan blunders. On the basis of more than half a century's experience of life in the Himalayas, I see at least four Himalayan blunders", says Sunderlal Bahuguna, a noted environmentalist. He further elaborates the same as "the long term impact (social, cultural and ecological) of large Dam projects including their contribution to major landslides. The other three issues are mass displacement of hill people, loss of rich fertile soil and stoppage of ground water recharging and massive deforestation even by government itself."

The North Eastern region comprises of the most valuable tropical rain forests. The human settlements in this region are facing the same challenges as described in the above two regions. 80 per cent of the population lives in the rural areas. North East is rich with natural resources in the country and is endowed with huge oil deposits and other minerals, priceless forests and sprawling tea plantation. The per capita forest availability is in excess of national average of 0.11 hectare with Arunachal Pradesh having 8.0 hectare per capita. On the overall basis, around 65 per cent of the total area in northeastern region is

## Kashmir Valley

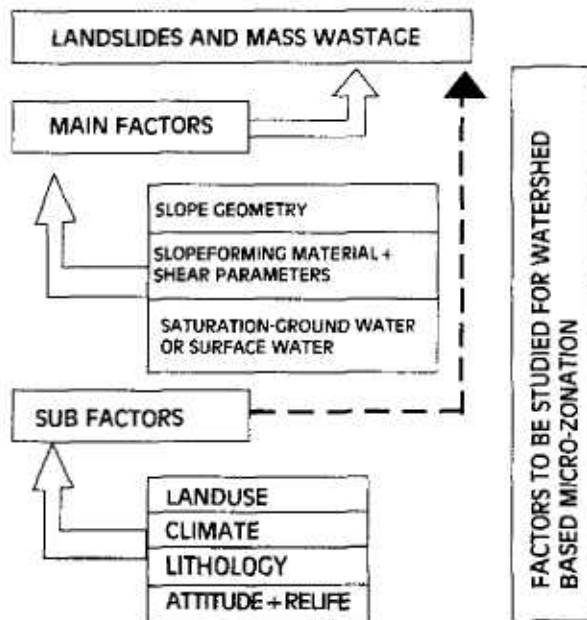


Catchment/watershed/micro-watersheds should be adopted as the area units for hazard micro-zonation, so that the problems related with natural disasters and developmental issues (including impact assessment) can be addressed together.



The Valley is prone to earthquakes (very high damage and high damage risk). Part of the valley is also in the wind hazard zone. Most of the settlements are located within the flood basin of Jhelum river. Drainage problems are perennial. The river brings in enormous silt load annually, which further reduces the capacity of low-lying areas for absorption of excess floodwaters. This area has high density of population and intensive economic activities.

Dal Lake Catchment (316 sq.kms) produces 64 acre feet silt annually which is deposited in the Dal Lake.





covered under forest. So far, the northeastern region land ownership is traditionally in the hands of society and is based on 'social good'. Till date this system has prevailed. However, changing phenomenon of development and transition from traditional to industrial activity may lead to cutting this rich bio-resource and ecosystem. The average rainfall in the region is the highest in the country. Mass destruction of forests in this area can lead to floods and devastation.



Sinking of hill and the road - Arunachal Pradesh

**The traditional land ownership which is based on the concept of land as "social good" and not as an 'economic good' or factor of production has led to a situation wherein the entrepreneurship development, agricultural productivity (marketable surplus) is a casualty**

Tourism is being viewed as an essential economic activity for the hilly regions, which could generate good employment opportunities. Considerable success has been achieved in this sector, wherein, it is seen that number of small and big settlements are fully dependent on tourism. However, the potential for the development of tourism, with latest management techniques, has still not been achieved. It is also seen that the excessive exploitation or commercialization on the pretext of tourism has led to considerable damage to the ecology of the region.

### Occurrence of Natural Disasters

The Himalayas and the North Eastern region presents a 'Treasure House' of landslides having no parallel in the world due to wide variations in geology, geomorphology, climate, altitude and rock types. In the recent years, unprecedented and unwise exploitation of Himalayas by men do combine with its immature geology, heavy rainfall, varying climate, hydrological conditions, seismicity, flash floods etc. *"To trigger a variety and class of landslides leaving the beautiful pine forests barren and therefore more vulnerable to the onslaught of bigger mass-movement to follow. When left uncontrolled, landslides charge themselves generating more furrows, more gullies and more landslides blocking natural drainage, uprooting trees and carrying down all that would have otherwise turned green and gay by the turn of the season, says RK Bhandari - the leading scientist on natural disasters. Occurrence of flash flood, particularly in a narrow river gorge, seem to be one of the much feared cause of some of the major Himalayan landslides. Accumulation of slipped masses, shooting boulders, charge of river silt and above all massive rocks transported by the turbulence of flowing water throttle the narrow river passage building up a reservoir of water (pressure) that eventually flushes the obstacles. The resulting drawn down effect trigger slides in the region, eventually jeopardizing*

*the stability of the hill as a whole. Some of the formidable landslides have often created landslide dams in the narrow river gorges",* he further explains. *"Being the youngest mountain system in the world, still in the process of formation and haunted by the frequent occurrence of landslides. During last hundred years or so, it has been noticed in Alaknanda catchment twice - Birhi (1892), Bela Koochi (1970), and Bhagirathi catchment thrice - Sera, Jalkoor (1930), Lonarinag (1959), Dabrani (1978). After the Uttarkashi earthquake, the hills have developed cracks and there were huge landslides and blockade of Bhagirathi near Loharinag and Dabrani in the very first monsoon. Even if the dams withstand tremors, nobody can prevent the repetition of Vi-jont Dam (Italy) tragedy of 1963, when a hillock tumbled into the reservoir, causing a flash flood killing 2,000 people. Even in normal conditions, dams cause flash floods. When there are heavy rains just after the monsoon, excess water is to be flushed for the safety of the dam itself. The experience of Bhakra in 1988 should not be forgotten" says Sunderlal Bahuguna. In a newspaper report of early 90's. The recent landslide at Malpa testifies this. **These areas which were covered by forests a decade ago are now barren. This cannot be ignored, in the recent episode at Malpa,** says Gautam Kaul, Director General of Indo-Tibetan Border Police.*

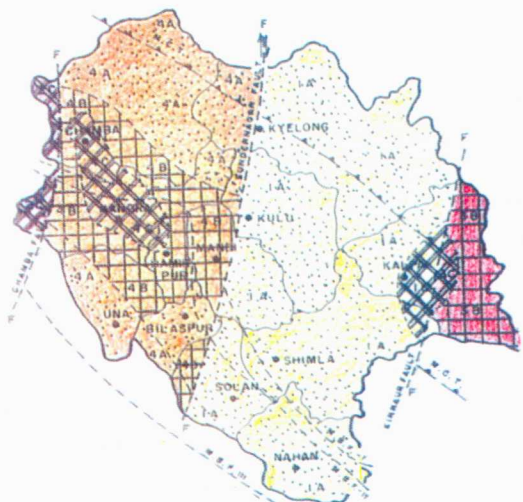


Meandering river under cutting the hill - Arunachal Pradesh

Of all the man-made structures, the collapse of engineered and non-engineered buildings during an earthquake is the main contributor to the loss of lives and injuries to the people. More than 55 per cent of India's land area particularly in the north Eastern region falls in the seismic zone of moderate to severe intensity. The entire Himalayan range from Kashmir to Assam, Western and central Himalayas (including Nepal Himalayas) are earthquake prone. Earthquakes of magnitude more than 5.0 on Richter scale have been known to occur in the historical past or recorded in the last 80 years. In certain regions, even earthquake of giant size, more than 7.5 on the Richter scale have also occurred and the largest magnitude earthquake with M-8.7 had its origin in the Shillong Plateau in 1897.

**The most important issue which needs to be emphasized here, is the fact that traditional houses, constructed with traditional materials and techniques have survived the onslaught of massive earthquakes where the new construction has shown severe damages.** Disaster management involving pre-disaster activities does not form part of the mandate of any institution. However, to make prediction in advance has also not been successful so far. Agenda 21 in the chapter on "Sustainable Human Settlements" says, *"Construction programs should emphasize local materials,*



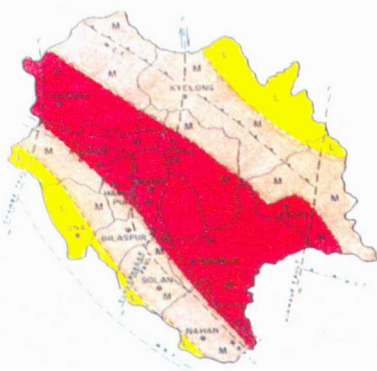


**BLOCK-WISE HAZARDS**

- Kangra Block (Highest Seismic Hazard)
- Garhwal Block
- Chamba Block
- Shimla Block (Least Seismic Hazard)

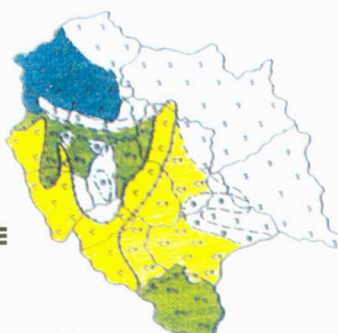
**RELATIVE HAZARDS WITHIN THE BLOCKS**

- Highest
- Intermediate
- Least



- High Hazard Zone
- Medium Hazard Zone
- Low Hazard Zone

**THEMATIC MAP DEPICTING LANDSLIDE HAZARDS OF HIMACHAL PRADESH**

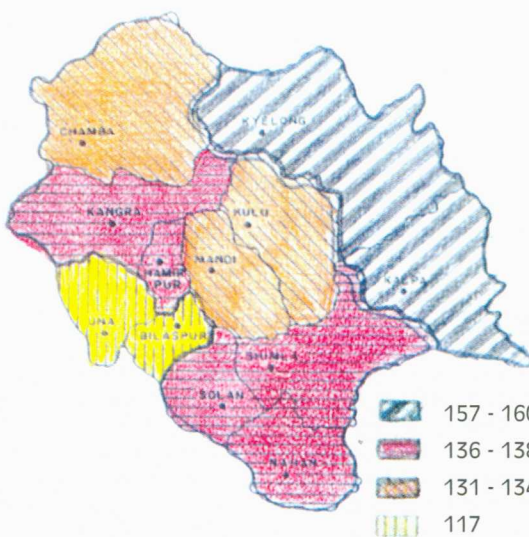


- Snow Cover with Grazing Land
- Forest Land with Nominal Cultivation
- Barren/Waste Land
- Cultivated Land
- Forest with Cultivation
- Cultivation with Forest

**LAND USE PATTERN IN HIMACHAL PRADESH**

**GEO-ENVIRONMENTAL STATES OF HIMACHAL PRADESH (REGIONAL LEVEL)**

Source : Geological Survey of India



**Levels of Geo-environmental status derived from the rating methodology**

Level	Description	Score
I	Pristine	65
II	Maginal Degradation	66-120
III	Relook Necessary	121-150
IV	Remedial Measures Necessary	151-181
V	Serious Concern	181-200
VI	Alarming/Irreversible	201

- 157 - 160
- 136 - 138
- 131 - 134
- 117



energy efficient designs, materials that do not harm health and the environment, and labour intensive technologies that employ more people To reduce migration to the big cities, governments should improve rural living conditions and encourage the development of medium-sized cities that create employment and housing. Sound management is needed to prevent urban sprawl onto agricultural land and environmentally fragile regions It is also important to see that settlements are built in locations and using designs and materials that reduce the risk of damage from such natural disasters as flooding, earthquakes and landslides.



Dokhimat Landslide (1998) - Uttar Pradesh

The Himalayan rivers are fed by the melting snow and glaciers of the Himalayan range during the spring and summer period and by the rains during the monsoon. The Hydro-Meteorological factors like the incidence of heavy rainfall and occurrence of heavy and continuous melting of snow in the hills with other sources associated with the promotion of a hydraulic surcharge in water levels and including the presence of natural or man-made obstructions in the floodway such as bridge piers, weirs, floating debris are the contributory causes for inundation of land and damage to property Says an NBO report The continuous erosion leads to silting up of the riverbeds causing floods, which is a perennial problem of hill states. The settlements which are located in the valley floors along the rivers, are the most vulnerable **Habitation in river valleys, around lakes and water bodies will continue due to pressure of population and economic compulsions.**

One of the unwelcome but frequent hazards in most countries which seem to go hand in hand with industrial and urban development is fire Direct damage by fire can occur not only to buildings but to equipment, work in progress, stores, records and other contents Incidental damage also arises from heat, smoke and the water used in fire fighting. Buildings of all types - residential, industrial, community and office buildings account for a sizeable portion of capital investment and national wealth and represent potential fire hazard. The cities/settlements in the mountainous regions, have suffered tremendously due to fire hazards. **The traditional cities have high density development, without any setbacks, and also the greater use of wood has resulted in fires, which destroy large number of houses each year.**

The zoning regulations including the building bye-laws only give glimpse of requisite measures to be undertaken, either in the growth of the city or construction of buildings. There is a need to utilize the vulnerability atlas, prepared by the government (Ministry of Urban Development) and reflect the same in land use zoning regulations and building bye-laws

## Need for Linking Geo-environmental Studies with the City Planning Process

To begin with it is necessary to conduct geo-environmental studies, which recognizes and respects environmental resources and natural process. The growth of Hill towns can be accommodated at no greater short run cost, and almost certainly at lower long run costs, measured not only by money but by quality of life and other intangible factors including reduction in the costs/avoidance of enormous expenditure involved in the post disaster rehabilitation. Traditional planning has been based on design, economic, engineering and transportation concepts that have considered natural process only coincidentally partially and indirectly. In other words in the frequent conflicts between conservation and development, the conservation has seldom being the winner, the result has been destruction of irreplaceable resources and creation of ecological imbalances with serious immediate and future consequences including natural disaster.

The geo-environmental studies evolving the assessment of eleven parameters such as Geology/Lithology, Minerals, Soils, Climate, Water resources, Land use, Forest and Agriculture Natural Hazards, scarification due to mining and communication, were conducted for the State of Himachal Pradesh by Geological survey of India. The predominant natural hazards, which affect the state, can broadly be classified as land slides/mass wastage and earthquakes. Land slides and mass wastage process have been categorized under relative intensity classes of low, moderate and high on the basis of various parameters, like (i) slope geometry (ii) slope forming material and their shear parameters and (iii) saturation either by ground water or rain water Other parameters having second order control are forests/vegetal cover, climate lithology, altitude and relief The landslide/mass wastage map and earthquake hazard map have been super imposed and the integrated map was prepared, wherein the picture of natural hazards for the state can be visualized. The limestone production has led to significant land degradation, the 200 slate mines have resulted in creation of large pits - 5 to 10 M down deep into the hill. In addition to this 70 per cent of the forest i.e. lost during a span of last 20 years is due to the extension of agricultural activities on to un-viable slopes

All these have resulted in increased vulnerability of the population and the land to the natural disasters Districts of Chamba, Lahul - Spiti and Kannaar require immediate remedial measures. The districts of Kangra, Nahan, Solan and Shimla requires relook. All these districts have high population density and intense economic activities. It is quite clear from the study that the environmental degradation and the natural disaster can not be divorced from each other and no solutions to the problems of natural disasters can be found unless the issues are appraised with the comprehensive framework These regional studies have to be immediately followed by the assessment and appraisal at the local settlement levels, which may be an urban, or a rural complex together and preferably on watershed basis.

For instance the Shillong township which is a growing town needs for expansion The unauthorized expansion at present taking place has led to a situation wherein houses have been constructed at slopes, which is more than 20 to 30 degree. The natural drainage system has been completely altered/disrupted and the potential aquifer recharge areas have also come under urban expansion. The existing Shillong town faces an acute water shortage despite receiving a very high rainfall (2400 mm per year) The geo-environmental study which was initiated for finding the suitable location of new shillong township has indicated that the unplanned urbanization