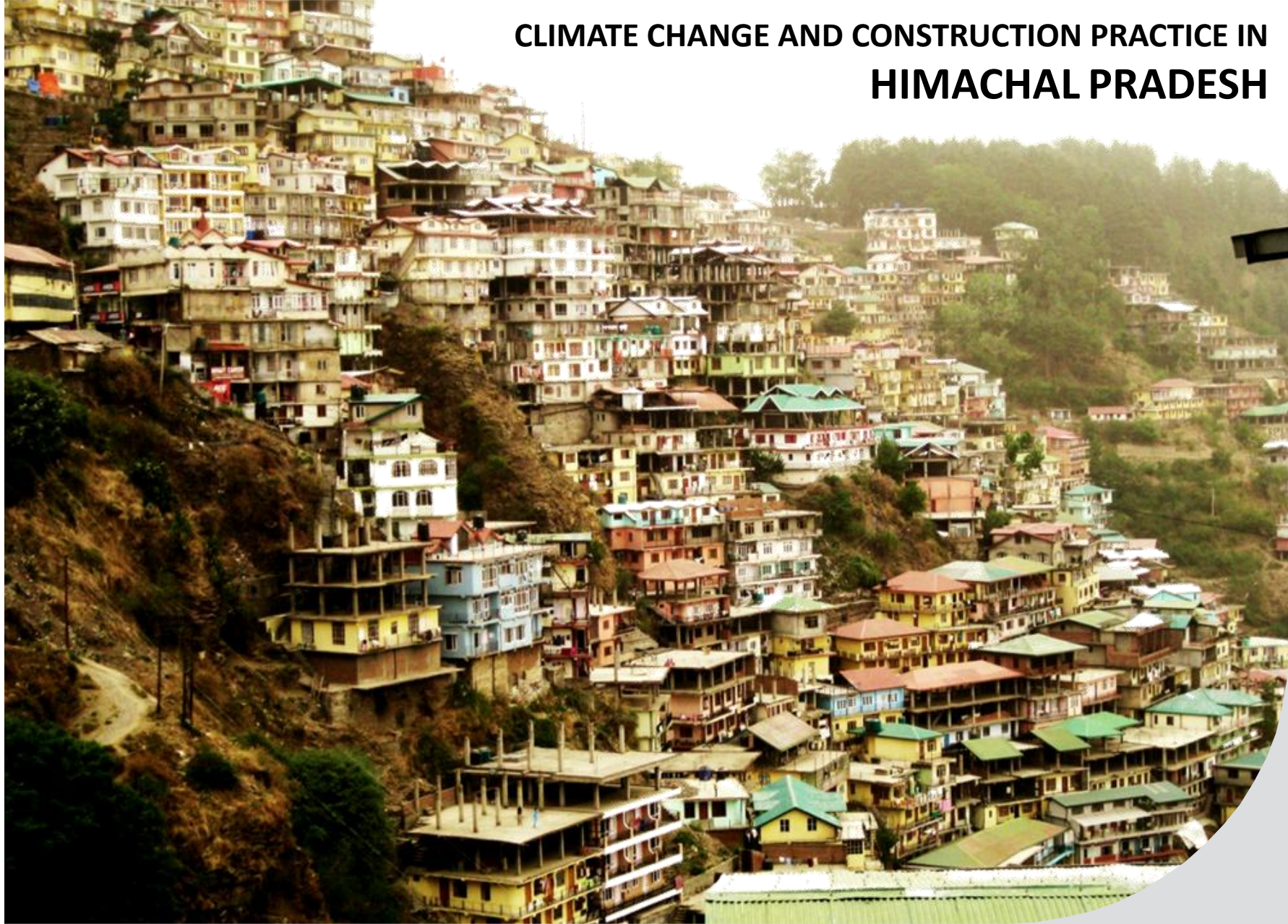


CLIMATE CHANGE AND CONSTRUCTION PRACTICE IN HIMACHAL PRADESH



Defining Climate Change

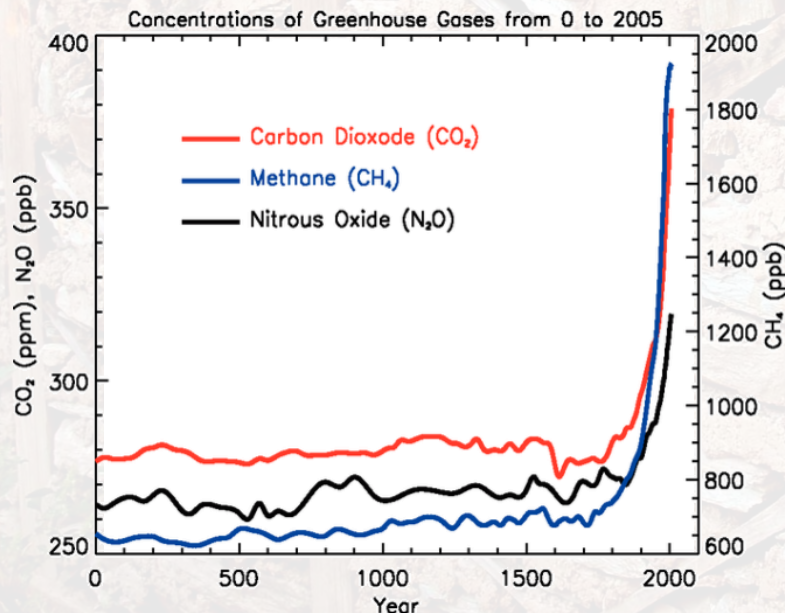
Climate is...

“ the mean and variability of relevant parameters like temperature, precipitation, and wind over a period of time, usually averaged over 30 years.”

-The Intergovernmental Panel on Climate Change

Climate change is...

the fluctuations in the “average weather” or variations in patterns of temperature, wind and precipitation over extended periods as well as the occurrence of extreme weather events.



GHG Concentrations during the last 2000 years

Source: IPCC's Fourth Assessment Report

“Human activity alters the composition of global atmosphere both directly and indirectly, and is, to a large extent, responsible for climate change.”

- United Nations Framework Convention on Climate Change

Global Impacts of Climate Change

76% of all disaster events(1988-2007)

were hydrological, meteorological or climatological in nature.

45% of deaths by natural disaster

79% of economic losses caused by natural hazards.



Over the period 1991-2005,

- 3,470 million people were affected by disasters
- 960,000 people died
- US\$ 1,193 billion economic losses

-International Strategy for Disaster Reduction,
United Nations

Global Impacts of Climate Change

PREDICTED CHANGE

Fluctuating precipitation patterns

Increased droughts, cyclones, floods.

Temperature extremities

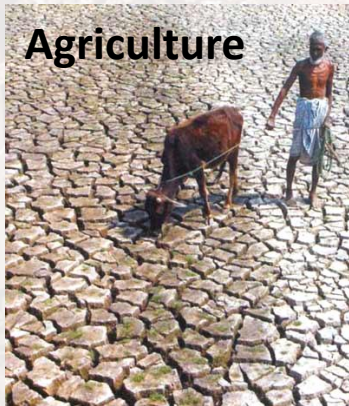
Increased heat & cold waves

Rise in sea levels

Submerging of low-lying coasts

PROJECTED IMPACTS ON

Agriculture



Health

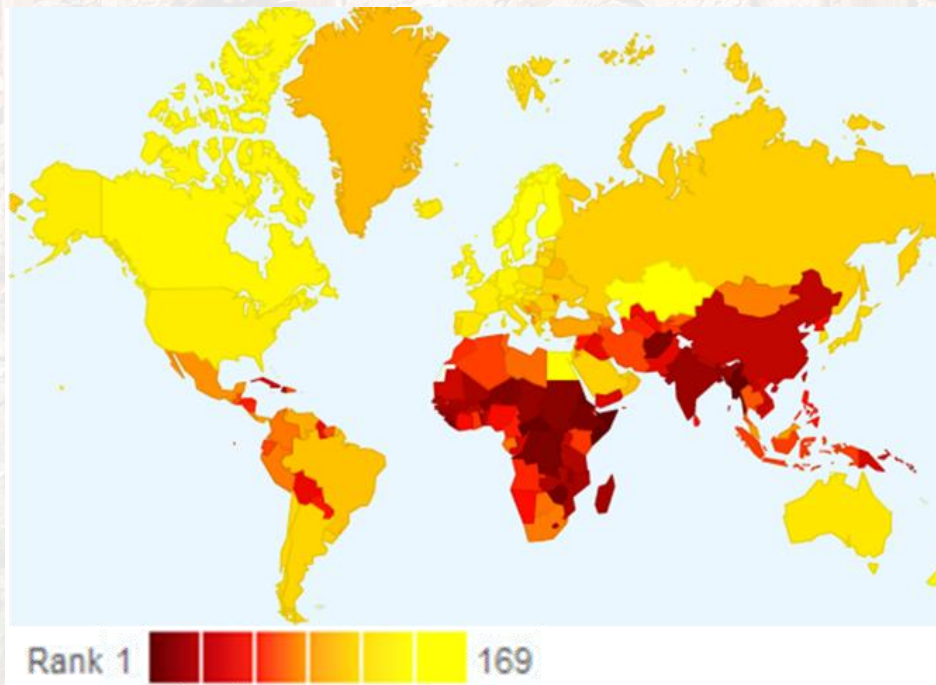


Shelter



Global Impacts of Climate Change

Climate change mostly affects the developing countries of the world.
In developing countries a large proportion of the population is more strongly connected with natural resources.



Global Climate Change Vulnerability Map
Source: Centre of Global Development

“Most economies relying on agriculture and natural resources, are expected to be seriously affected by the adverse impacts of climate change.”

- IPCC 4th Assessment Report, 2007

Impacts of Climate Change in South Asia

PREDICTED CHANGE

- Increased droughts, tropical cyclones, floods
- Rise in sea level
- Rise in air and sea temperatures

PROJECTED IMPACTS ON

Agro-based livelihoods



Water systems



Ecosystems



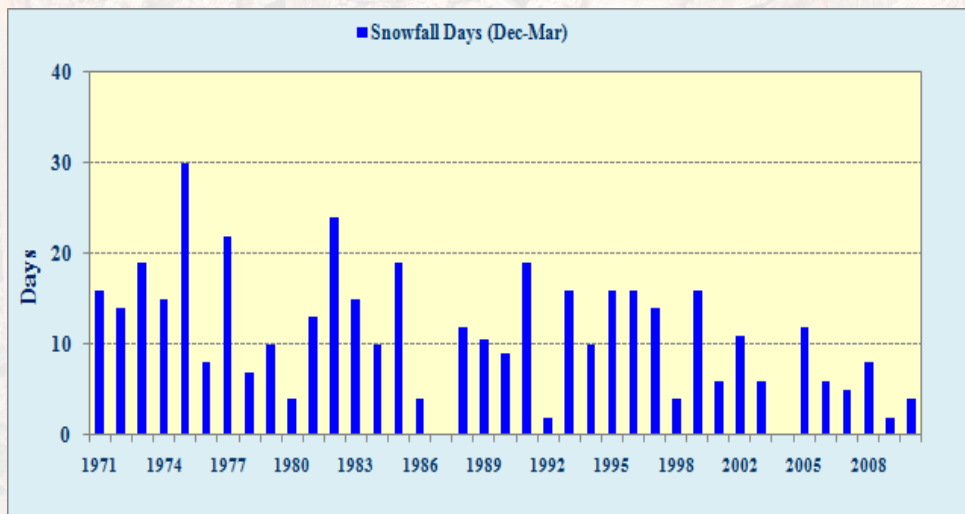
Habitat



Impacts of Climate Change in Himachal Pradesh

RECORDED CHANGES

- Rise in temperature in the NW Himalayan region by about 1.6°C in the last century.
- Decline in the average snowfall days in Shimla over a period of 30 years from 1970 to 2010.
- 17% decrease in rainfall in Shimla observed from 1996-2000 onwards till 2007.



Snowfall Days in Shimla During the Winter Season (Dec-Mar)



Impacts of Climate Change in Himachal Pradesh



The Western Himalayas is one of the most vulnerable ecosystems in the world.

PREDICTED CHANGE

- Increase in mean monthly air temperature
- Intensification of precipitation

PROJECTED IMPACTS

- Increase in flash floods and landslides
- Increase in soil erosion
- Threat to the natural resources like forests.

“Global warming in the Himalayan region has been much greater than the global average.”

- International Centre for Integrated Mountain Development

Calamities and Extreme Weather Events in Himachal Pradesh

Floods and landslides:

- Flash flooding caused by cloudbursts leads to landslides.
- Since 2000, there have been 3 major flash floods in river Satluj in 2000, 2001 and 2005 which have affected regions in Kinnaur, Kullu, Mandi, Shimla, Solan, Hamirpur and caused damage to crops, houses and public utilities worth more than Rs. 15000 crores.

Earthquakes:

- Lies in seismic zones IV and V with very high risk earthquakes of magnitude > 8 .
- Largest earthquake: Kangra (1905) killing at least 28,000 people.
- Lesser magnitude earthquakes: Kullu (1906), Sultanpur (1930), Lahaul-Spiti (1955), Chamba-Udhampur (1962), Dutung (1975) and Kangra (2004).



Flashflood



Landslide



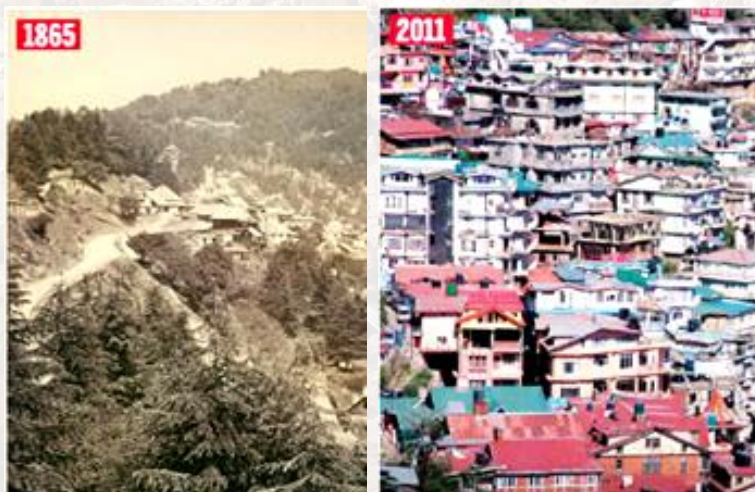
Earthquake

“Of all the natural disasters that hit the State and cause damage to, both, life and property, floods are most widespread in the state.”

- Floods and Flash Floods in HP:
A Geographical Analysis

Factors Contributing to Climate Change in Himachal Pradesh

- Deforestation that removes natural carbon sinks and alters natural geographical buffers to climatic extremes
- Alteration of the land profile with road cutting to meet demands of increasing urbanization.



- Detrimental methods of sourcing building materials like mining mine natural resources such as limestone for cement, slate, etc, have been carried on unrestricted for years.

Importance of the Construction Sector

GLOBALLY, the construction sector :

- Accounts for 40% of the total flow of raw materials into the global economy every year.
- Contributes 9% of global Gross Domestic Product (GDP).



IN INDIA, the construction sector:

- Is amongst the fastest growing sectors today : 156% growth from 2000 to 2007, providing employment to 18 million people directly.
- Was estimated at 70.8 billion dollars in 2008-09, in a trillion dollar economy.
- Has been steadily contributing about 8% to the national GDP over the last 5 years.

How does Climate Change affect Construction?

Changed needs of habitat and shelter in response to climate change.



Water shortage

Water efficiency and capture

Uncomfortably hot or cold temperatures, high velocity winds and intense precipitation

Climate resilience in design and construction of buildings

Increased incidence of extreme weather events

Increased durability and performance

Flood and earthquake proneness of HP

Building design and location

Generation of huge amounts of debris from damaged buildings

Appropriate disposal and reutilization of debris



How does Construction affect Climate Change?

Building construction and operation activities have extensive direct and indirect impacts on the environment.

At the national level,
activities of the
construction sector

Emission of about 22% of the total annual national CO₂ emissions (80% results mainly from production of energy intensive building materials - steel, cement, bricks and lime)

Rapid increase in housing
construction

Alteration of water cycle, land degradation,
impact on local communities and impact on
air quality

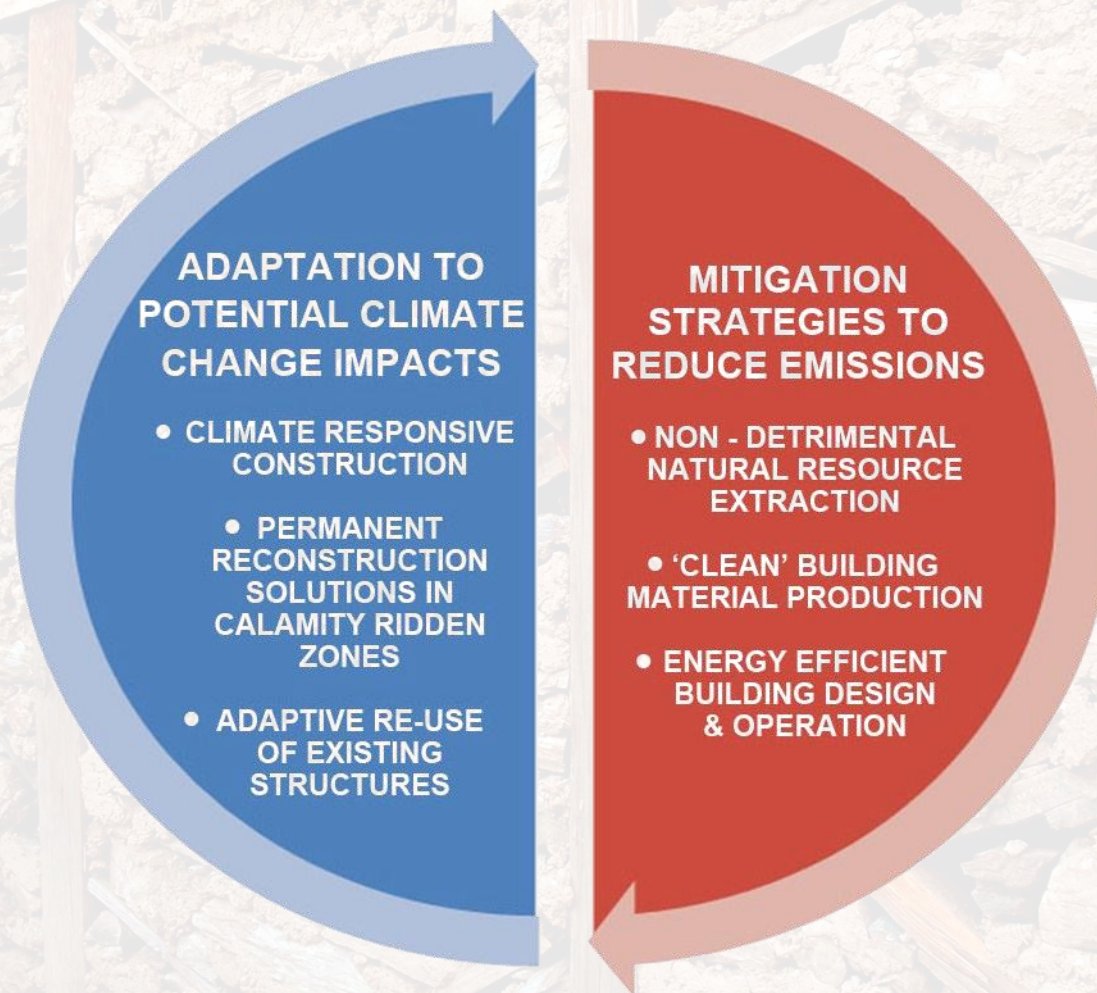
Extraction of naturally materials
such as building stone, wood,
limestone (for cement) and
soil for making bricks

Disturbance of the natural carbon balance
and drastically alteration to natural
geographies in the long-term

Operational energy needs of
buildings contributes to peak in
electricity consumption

Green house gas (GHG) emissions

Construction and Climate Change: a cyclic link



Conventional Building Practice



RICH TRADITION OF CLIMATE RESPONSIVE VERNACULAR ARCHITECTURE

(timber, soil and stone)

Design based on:

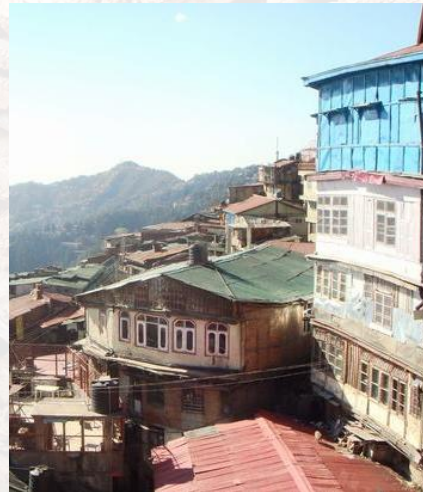
- Thermal performance
- Earthquake resistance



Increasing rate of urbanization

Locally sourced material like earth, stone, thatch and timber is still used to construct houses. CGI roofs are the most prevalent option for sloping roofs.

RURAL AREAS



URBAN AREAS

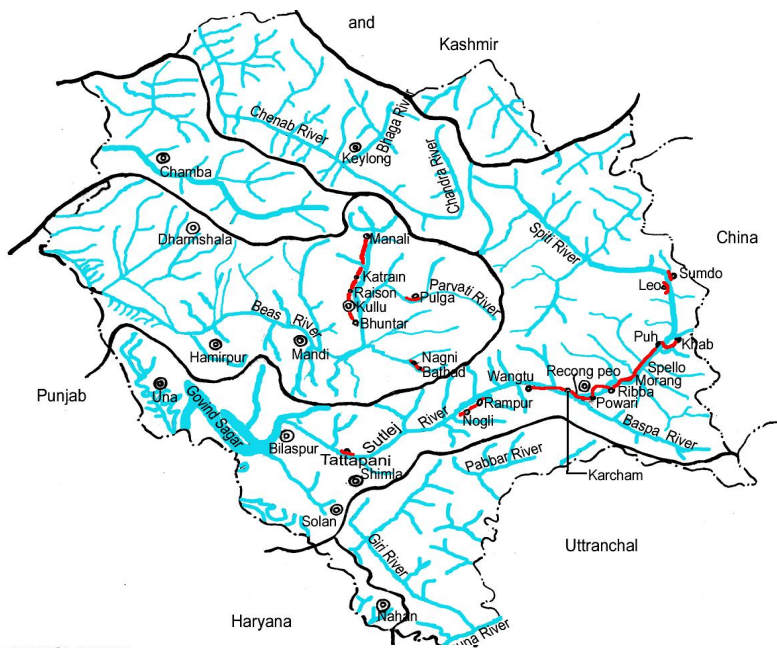
Conventional construction uses burnt brick masonry or stone masonry in RCC framed buildings and flat RCC roofs or CGI sheet sloping roofs.

Resources in Himachal Pradesh

WATER RESOURCES

RICH NATURAL RESOURCE BASE

- Glaciers
- Perennial streams draining into rivers
9 major river systems with a total catchment area of 55,673 sq. km.
- Natural lakes
- Man-made reservoirs
- Water springs
- Large stocks of sub soil water



LEGEND

- Major Rivers with their Tributaries
- River Basin Boundary
- Road With Station
- Flood Prone Area

“About 70 per cent of the total geographical area of HP can be affected by floods.”

– Central Water Commission (2000)

Sources: D.D. Sharma, *Floods and Flash Floods in HP: A Geographical Analysis*
SoER HP, Dept. of Environment Science & Technology, Govt. of HP

Resources in Himachal Pradesh

FOREST RESOURCES

FOREST COVER

- 26.66% per cent of the area is under forest and tree cover.

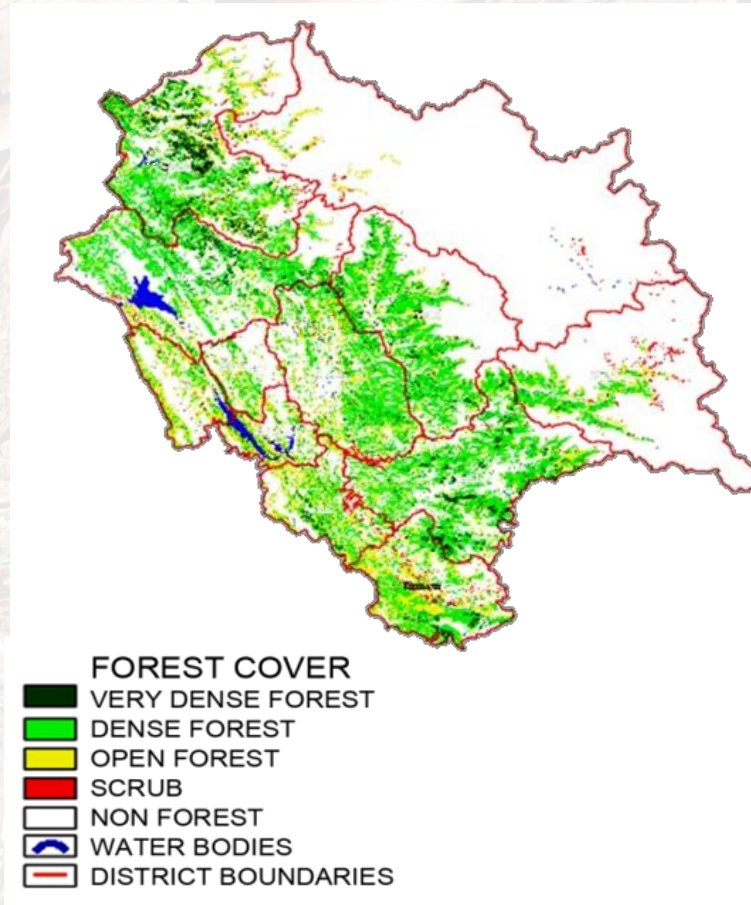
FOREST PRODUCE:

Accounts for 8% of the state GDP

- **Timber** : used extensively in the region's vernacular architecture from local deodar easily available and other mixed forests. Now, as a counter measure to deforestation, the use of timber has largely gone out of practice.
- **Medicinal plants and herbs, resin, bamboo, charcoal, fuel-wood, *bhabhar* grass, *khair*.**

“At least two-thirds of the geographical area should be under forests in mountainous states like Himachal Pradesh.”

- National Forest Policy (1988)



CONCERNS:

- Reduced forest cover.
- Sustainable harvesting of timber.

Resources in Himachal Pradesh

MINERAL RESOURCES

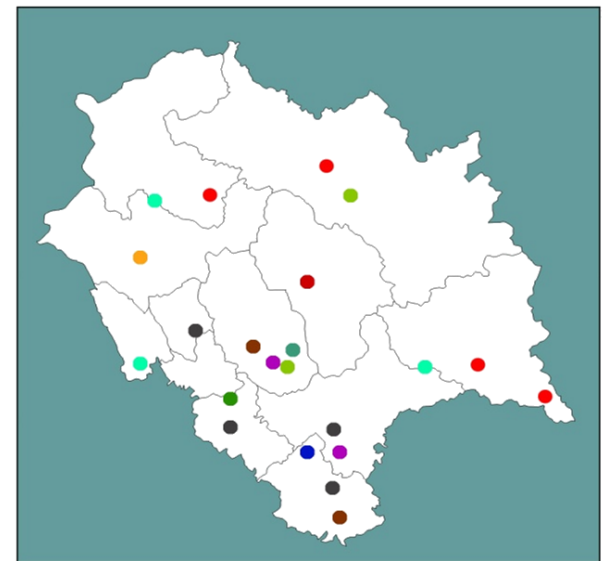
- **Building Stone:** Limestone is the most heavily quarried mineral and provides raw material for 3 major cement plants.
- **Soil:** Approximately 35 lakh tonnes of sand, gravel and boulders are extracted annually from river/streams to meet the demand of road construction, bridges, building material, etc. 260 stone crusher units set up based on these.

As per the land capability map of HP:

- 21.4% of land is suitable for agriculture
- 37.9% of land is suitable for grazing and forestry
- 40.7% of land is permanently snow covered

Soil is hence a very critical resource.

Therefore, it is not feasible to use clay bricks as a mainstream material without a large transportation component.



MINERALS

- | | | |
|------------|----------|--------|
| GLASS SAND | DOLOMITE | GYPSUM |
| LIMESTONE | SALT | GOLD |
| IRON | SULPHUR | |
| COPPER | COAL | |

Pressures of Extracting & Processing Building Materials in Himachal Pradesh

Indiscriminate mining and other construction activities

Over 50,000 hectares of land affected negatively

Large scale deforestation and loss of forest cover

Loss of carbon sinks, irregular water flow (drying up of natural springs and increased vulnerability to flash floods during rains).

Uncontrolled and illegal mining of sand, concrete and stones

Altered riverbank ecosystems, Increased risk of avalanches and flash floods

Construction of big power projects, roads and buildings

The dust, smoke and silt coming out of these plants are heavy sources of pollution.

Cement is one of the biggest industries

Large scale destruction of natural resources with open cast mining of limestone, turning green hills barren.

Challenges faced in Himachal Pradesh

Under the increasing pressure of urbanization, the rapidly expanding footprint of built-up area in the State needs to take into account various factors.



Challenges faced in Himachal Pradesh

Excessive heat storage in the mass of buildings in a concrete jungle

Urban heat islands

Over-exploitation of ground water

Water imbalance

Transportation of building materials over large distances to meet the massive requirement and use for infrastructure

Vehicular pollution

Cutting of slopes for construction

Landslides

Building debris aggregation

Disposal issues

Material extraction land clearing

Deforestation

Earthquakes, landslides & floods

High susceptibility to loss of lives & property

Thank you



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