CLIMATE CHANGE & WATER FUTURE: HIMACHAL PRADESH

An Integrated Approach of Adaptative Rural Development Based on Climate Science

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THERE WAS A TIME WHEN CLIMATE CHANGE WAS A SERIOUS THREAT IN THE FUTURE. THAT TIME IS GONE. THE FUTURE IS HERE AND NOW.

WHAT NOW?

We are living through climate change. The seasonal pattern is changing all around us. Extreme weather events are more frequent now.

Temperature rise affects soil moisture, crucial for seed germination, and indirectly impacts water availability. Changes in the amount and intensity of rainfall will directly impact the water regime. Extreme events like floods, droughts, and cyclones will further impact crops, lives, livelihood, and infrastructure. This has grave implications on agriculture and the future socio-economic well-being of small and marginal farmers. The financial implications of climate change are dramatic. For ordinary people, institutions, and the entire nation.

Various government departments make deep and long-term investments in rural development, to generate widespread social and economic well-being. These investment are at great risk due to climate change. **Adaptation** to the impact of climate change is critical to safeguard investments for development programmes.

Since development schemes are affected by climate change, all programmes now need to be tweaked in accordance with the changing climatic scenario. **Science** plays a key role by providing region-specific projections for the future, based on the scenarios for greenhouse gas emissions, by aiding the planners with clues about local hydrology, soil conditions, and economic activities. The planners can determine special vulnerabilities, and focus their programmes to address them.

The planners will need to engage the local communities that are repositories of time-tested, location specific **traditional knowledge** to deal with adverse situations.

THIS IS A BRIEF DESCRIPTION OF DISTRICT LEVEL VULNERABILITY, BOTH BIOPHYSICAL & SOCIO-ECONOMIC, OF HIMACHAL PRADESH, TILL 2050, BASED ON LOW EMISSION MODEL

HIMACHAL NOW

Area:55,673 sq.km | **Avg. Annual rainfall:** 704.7 mm-2062.8 mm
Mean Temperature (max): 24.5°C–27.1°C | **Mean Temperature (min):** 12.5°C–14.5°C

Himachal Pradesh, situated in the Himalayas, at the foothills of Dhauladhar range is a small state where 70 per cent of the population is dependent on agriculture and horticulture for their livelihood. The sector contributes to 45 per cent of the state's GDP while other important economic contributors are forestry, hydropower generation and tourism. It is obvious that all the major economic activities in the state are directly dependent on the availability of water and temperature regime hence, climate change plays an important role in the well-being of the state. Changes in snowfall, and glacier behaviour greatly affect water availability across the state.

THE TREND SO FAR

An analysis of 63 years (1951-2013) of data from the Indian Meteorology Department shows that annual maximum and minimum temperatures have been increasing in Himachal Pradesh. Although, a statistical analysis shows that the trends for both maximum and minimum temperature are not strong enough to draw conclusions from.

However, a similar analysis predicts a definite decrease in annual rainfall for the state. More importantly, there is a strong trend towards the decrease in the number of rainy days, resulting in the annual rain for the state falling on fewer days. This implies more intense rainfall, increasing the possibility of flash floods, enhanced soil erosion, and landslides. This forbodes increased vulnerability to natural disasters for the state.

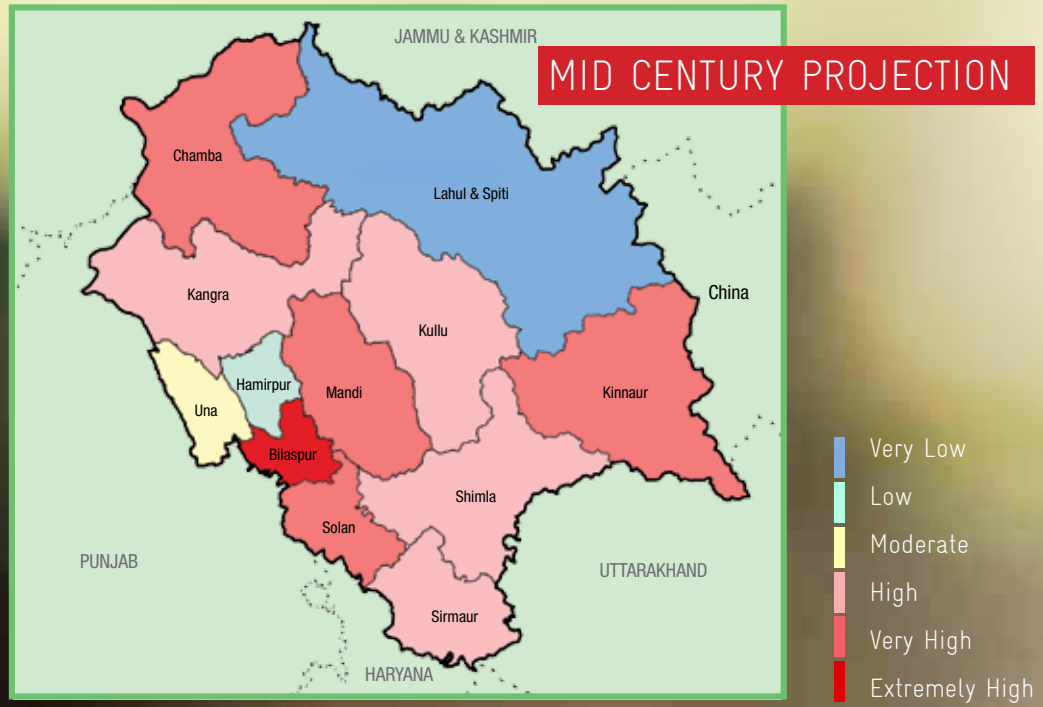
PRESENT DAY

THE PROJECTION FOR 2050

ASSUMING LOW EMISSION SCENARIO:

- MEAN ANNUAL MAXIMUM TEMPERATURE TO INCREASE BY ABOUT 1.4°C
- MEAN ANNUAL MINIMUM TEMPERATURE TO INCREASE BY ABOUT 1.4°C
- MEAN ANNUAL RAINFALL IS TO DECREASE MARGINALLY BY ABOUT 5.9%
- NUMBER OF RAINY DAYS WILL DECREASE

The district of Lahul & Spiti will be the exception here. The district's minimum temperature is projected to increase from the current -3.8°C to -2.1°C. This will have dire implications on tourism since the number of Ice Days in the district will decrease due to an increase in temperature. Increase in temperature will also result in more evaporation and require more irrigation for crops. Though annual rainfall will decrease, South west monsoon (June, July, August, September) will increase from 8 to 22.5 per cent. The number of rainy days will also decrease, indicating intense rainfall with increased flow and possibility of flash floods, substantially raising the risk of soil erosion.



SOCIO-ECONOMIC FUTURE

The change in the biophysical regime in the future, will have severe socio-economic implications. The heat stress conditions are likely to appear, particularly in the months of May, June, July, August and September in the districts of Bilaspur, Hamirpur, Kangra, Sirmaur and Solan. Places with an increased humidity and temperature will undermine the well being of livestock.

The change in temperature regime will also affect horticulture production and will have direct economic effects on the large population and the state's economy. An increase in extreme events will require investments in disaster preparedness and risk management. The increase in extreme events and increase in temperature will also affect tourist inflow.

Bilaspur district in Himachal Pradesh is of High vulnerable category from threats of climate change.

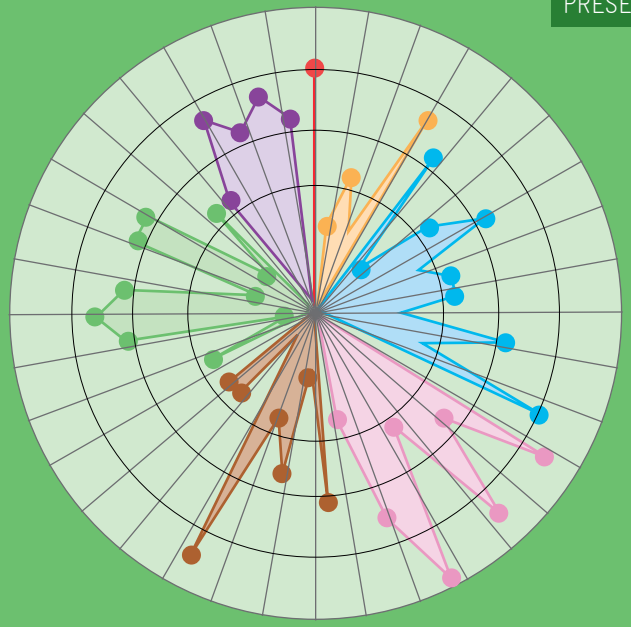
CONCLUSION

This study is an important starting point to look at the future of the state in a scientific manner. The study analyses water availability for a biophysical analysis and in turn predicts various socio-economic aspects and how they are going to be affected in the future. This is to alert administrative officials of the district wise future of various sectors of the economy in the face of certain climate changes.

The state government and district administration can plan and prioritise adaptation projects using these findings. Moreover, the administration can relook at all development projects and rework them to withstand the onslaught of climate change. This way, the investment for development can be secured for a longer period. Moreover, as the intensity and frequency of extreme events increase, officials can prepare for proper measures for disaster management risk reduction, thereby minimising loss of lives, property, and livelihoods.

BILASPUR

PRESENT SOCIO-ECONOMIC VULNERABILITY



According to the assessment, Bilaspur's vulnerability will remain High in mid century. Taking the risk into account, GIZ has been working on an intervention promoting soil conservation, water harvesting and multi-cropping by the villagers and local government as adaptation intervention.

Bilaspur is projected to receive increased rainfall during the South west monsoon in less number of rainy days, making the district vulnerable to intense rainfall resulting in soil erosion. The district will get reduced rainfall during the North east monsoon and is expected to have longer dry spells, which will make the district extremely high vulnerable in the water sector.

The temperature will rise making people vulnerable to heat stress. The population will also face increasing incidences of malaria. Livestock population will face a threat of disease from rising Temperature Humidity Index.

METHODOLOGY

Temperature and rainfall data (1951-2013) from India Meteorology Department is analysed to understand the trends in weather patterns of the districts. Then a projection of temperature and precipitation is created using Regional Climate Models (RCMs), of various emission scenarios for two different time periods, 2050 and 2100. These values are analysed through hydrological model SWAT (Soil and Water Assessment Tool) to predict various water balance elements. Future water availability, seen through demographic and economic parameters gives a big picture of vulnerability of each district.

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