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Climate Change Adaptation in Himalayan Region

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- **INCCA REPORT # 2**
- **CLIMATE CHANGE AND INDIA:A 4 X4 ASSESSMENT**
- **A SECTORAL AND REGIONAL ANALYSIS FOR 2030**
- **November 2010, Ministry of Environment & Forests, Government of India**

INCCA 4X4 Report 2010



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4 Regions

- the Himalayan region,
- the Western Ghats,
- the Coastal Area and;
- the North-East Region.

4 Sectors

- **Agriculture**
- **Forests**
- **Human Health**
- **Water**



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Key Findings for Himalayan Region



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Temperature Parameters

- Increase in temperature by 0.9 degree C to 2.6 degree C by 2030s with respect to 1970s
- Increase in intensity by 2-12% in 2030s with respect to 1970s



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Probable impacts on ecosystems

- Increase in Forest fires
- Increased glacier melt



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Impacts on Rainfall

- The PRECIS run for 2030's indicates that the annual rainfall in the Himalayan region may vary between 1268 ± 225.2 mm to 1604 ± 175.2 mm respectively.
- The projected precipitation show a net increase in 2030's with respect to the simulated rainfall of 1970's in the Himalayan region by 60 to 206 mm.



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Impacts on Rainfall

- The winter rain in the months of January and February are also projected to increase by 5mm in 2030's with respect to 1970's, with minimum increase in October, November and December.

Temperature

The annual temperature is projected to increase from 0.9 ± 0.6 °C to 2.6 ± 0.7 °C in 2030's. The net increase in temperature is ranging from 1.7 °C to 2.2 °C with respect to the 1970's.

Winter temperatures during October, November and December in the Q1 simulations show a decrease by 2.6 °C in 2030's with respect to 1970's.



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Thermal Stress

- The analysis for the baseline period and the 2030 scenario has shown the likely increase in THI in many parts of Himalayan region between March-September with a maximum rise between April- July.



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Thermal Stress



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- In the Himalayan region for 2030 scenario, thermal discomfort is likely to increase with $\text{THI} > 80$ compared to the baseline scenario, thereby indicating that in the 2030's, most places in this region are likely to remain under high temperature stress as compared to the baseline period.

Impact on Water

- It is estimated that Himalayan mountains cover a surface area of permanent snow and ice of about 97,020 sq km, with a volume of 12,930 sqkm. In these mountains, it is estimated that 10%–20% of the total surface area is covered with glaciers while an additional area ranging from 30%–40% has seasonal snow cover. These glaciers, providing snow and glacial meltwaters, keep our rivers perennial.



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Impact on Water



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- Most of the glaciers in western Himalayas are receding (expect a few in Jammu and Kashmir, which do not show any change or are advancing).
- The glaciers in the region show fluctuations in retreat rates during the last century, possibly due to the mixed influence of variable topography, temperature and snowfall regime



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Impact on Water

- The Himalayan region is mainly fed by the Indus river system. The whole area is exhibiting an increase in the precipitation in the 2030s scenario. The increase varies between 5% and 20% in most areas, with some areas of Jammu and Kashmir and Uttarakhand showing an increase of up to 50%.



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Himalayan ecosystem

- Following on from the experiences of other mountains, with current level of increase in mean annual temperature over various parts of the Himalayas, an upward movement of plants is expected

Himalayan ecosystem

- Climate change signatures have already begun to appear in the Indian Himalayan Region (IHR) in the form of shift in the arrival of monsoon, long winter dry spells (5–6 months as experienced in 2008–09), increased frequency of forest fires during winter, the early flowering/fruiting of native trees,



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Impact of climate change on forests

- The entire Himalayan region is covered by 98 IBIS grids, out of which 55 (56%) are projected to undergo change. Thus, over half of the forests are likely to be adversely impacted in the Himalayan region by 2030's.



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Impact on Agriculture

- Apple is a cash crop in Himachal Pradesh and accounts for 46% of the total area under fruit crops and 76% of the total fruits production.

Impact on Agriculture



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- The apple productivity trends in the last two decades studied for Shimla, Kullu and entire Himachal Pradesh (Figure 5.10), showed a decreasing trend. In recent years, the area under apple has fallen from 92,820 ha in 2001-02 to 86,202 ha in 2004-05 in the entire state, whereas, the area in Lahaul & Spiti and Kinnaur district which lie above 2500 m MSL showed an increase every year in the last ten years.

Impact on Health

- Increase in incidence of malaria due to opening up of transmission windows at higher latitudes
- Increase in morbidity due to unprecedented rise in temperature



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Impact on Health

- Loss in forest litter & wood used for heating purposes in the cold season – morbidity due to extreme cold
- Flash floods leading to large scale landslides and hence loss of agriculture area affecting food security



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Impact on floods

- As per the simulated models the flooding varies from 10% to over 30% of the existing magnitudes in most of the regions. This has a very severe implication for existing infrastructure such as dams, bridges, roads, etc., in the areas and will require appropriate adaptation measures to be taken up



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Thank you