



## Climate Change: Its Effects on Water Resources and Crop Insurance

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### INTRODUCTION

Climate change is defined as the changes in state of climate that can be identified by changes in its properties and that persist for an extended period, typically decades or longer, due to natural internal processes or external forcing or to persistent anthropogenic changes in the composition of the atmosphere or in land use (Intergovernmental Panel on Climate Change (IPCC)).

### Causes of Climate Change

It can be regarded as a complex interaction between Earth, atmosphere, ocean, and land systems; so the changes in any of these systems can be both natural and anthropogenic, based on changes in atmospheric concentrations of greenhouse gases (GHG), aerosol levels, land use and land cover, and solar radiation affecting the absorption, scattering, and emission of radiation within the atmosphere and at the Earth's surface.

### Threats to freshwater ecosystems

Five broad threats to freshwater biodiversity include overexploitation, water pollution, flow modification, destruction or degradation of habitat, and invasion by exotic species. Recent extinction trends can be attributed largely to sedimentation, stream fragmentation, chemical and organic pollutants, dams, and invasive species. Common chemical stresses on freshwater ecosystem health include acidification, eutrophication and copper and pesticide contamination. Unpredictable synergies with climate change greatly complicate the impacts of other stressors that threaten many marine and freshwater fishes.

### Climate impacts on water resources

- The main climate change consequences related to water resources are increases in temperature, shifts in precipitation patterns and snow cover, and a likely increase in the frequency of flooding and droughts.
- Higher temperatures will generally intensify the global hydrological cycle. Climate change may also markedly change the seasonal variation in river-flow.
- Climate change tends to increase the frequency and intensity of rainfall; there may be an increase in the occurrence of flooding due to heavy rainfall events. Uneven distribution of rainfall. Groundwater recharge may also be affected with a reduction in the availability of groundwater for drinking water in some regions.
- Low water and droughts have severe consequences on most sectors, particularly agriculture, forestry, energy, and drinking water provision. Activities that depend on high water abstraction and use, such as irrigated agriculture, hydropower generation and use of cooling water, will be affected by changed flow regimes and reduced annual water availability. Moreover, wetlands and aquatic ecosystems will be threatened. This will affect the sectors that depend on the goods and services they provide.
- In fact, “most of the climate change impacts come down to water,” says Upmanu Lall, director of the Columbia Water Center. When people talk about climate change affecting agricultural output, sea level rise, wildfires and extreme weather — “they’re all essentially a water story,” says Lall.
- **Precipitation Pattern Shifts: Drought and Deluge:** Climate change disrupts the water cycle and precipitation. According to scientists from the Intergovernmental Panel on Climate Change (IPCC), “It is likely that anthropogenic influences have affected the global water cycle since 1960,” and such effects are the increased likelihood of more intense droughts and precipitation events. With higher average temperatures and warmer air that can hold more water, a pattern might emerge of lengthy dry spells interspersed with brief but heavy precipitation and possible flooding. The back-and-forth between precipitation extremes is sometimes described as “drought and deluge” or more recently, “precipitation whiplash.”
- Current observations and climate projections suggest that one of the most significant impacts of climate change will likely be on the hydrological system and, hence, on river flows and regional water resources. Variability in climate causes flooding patterns in space and time.
- **Run-off:** widespread increases in runoff largely due to the suppression of evapotranspiration by increasing CO<sub>2</sub> concentrations.
- **Droughts**
- **Floods:** The causes of flooding are many and include heavy rainfall, torrential rain, and snowmelt.
- **Water quality:** There has been an increase in temperature as observed in the past century, and climate change models also predict increasing temperatures. Warmer temperatures can affect water quality in several ways, including decreased dissolved oxygen levels, increased contaminant load to water bodies, reduced stream and river flows, increased algal blooms, and an increased likelihood of saltwater intrusion near coastal regions. Acid rain is one of the primary reasons for degrading water quality.
- **Groundwater:** Global warming will likely affect groundwater resources by altering precipitation and temperature patterns, which will likely be further aggravated by overexploitation
- **Snowmelt and glacier melt:** Glaciers are sensitive to every hydrological variable,

including precipitation, humidity, and wind speed, but mostly to temperature, and hence are a good indicator of global warming. There is clear evidence of glacier retreat on every continent, with global warming having a noticeable influence.

### **Climate change and crop insurance**

In India, agriculture is inherently a risky venture due to uncertainty in production and volatility in price, and more so in the context of increased climatic aberrations and globalisation. Therefore, there is a great need for crop insurance to provide economic support to farmers, stabilise farm income, and induce farmers to invest in agriculture, reduce indebtedness and decrease the need for relief measures in the event of crop failure. Agriculture dependent economies are invariably the low-income countries and are thus most vulnerable to climate change due to their high exposure with least adaptive capacity. Their high levels of susceptibility and low coping capacity have been linked to a range of factors that include a high reliance on natural resources, low per capita GDP and high poverty, limited ability to adapt financially and institutionally, and a lack of safety nets.

India being located in the low latitude region of South Asia is extremely vulnerable to climate change because of its tropical climate, monsoon rain, long coast line, greater dependence on agriculture, high incidence of poverty, low irrigation coverage and inadequate resources and technology to combat climate change. Agriculture is the

dominant sector in Indian economy. Crop insurance is a coping mechanism and ex-ante adaptation measure by which risk is transferred from the insured to the insurer. Crop insurance indemnifies the farmer if there is ultimate crop failure in spite of all the precautionary measures taken by him.

Crop insurance protects producers from shocks due to unexpected weather events, allowing them to preserve working capital, repay loans and sustain their commercial viability. As such, it is an important risk management tool for producers. Agricultural insurance plays a key role in risk mitigation both for farmers at the individual level and for governments at the macro level. Nevertheless, agricultural insurance markets are generally not very well developed due to intrinsic market failures. Currently in the country there are two main crop insurance schemes namely the Pradhan Mantri Fasal Bima Yojana (PMFBY) and the Revised Weather-Based Insurance Coverage Scheme (RWBICS). PMFBY is yield-based insurance that uses crop-cutting experiments (CCEs) to determine the yield lost by farmers due to natural catastrophes and adverse weather conditions. The yield obtained through the CCE's determine the payout made by the insurance firm to the farmer. However, there are several problems that exist with the PMFBY such as the delay in crop cutting experiments and its associated high costs, delayed/non-payment of insurance claims to farmers and lack of transparency. As a result, farmers lose interest in the crop insurance schemes.