

Chapter 19

Climate Change and Agriculture: Impacts, Adoption, and Mitigation

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ABSTRACT

Increasing evidence shows that shifts in Earth's climate have already occurred and indicates that changes will continue in the coming years. This chapter is an attempt to distil what is known about the likely effects of climate change on food security and nutrition in coming decades. Apart from few exceptions, the likely impacts of climate change on agricultural sector in the future are not understood in any great depth. There are many uncertainties as to how changes in temperature, rainfall and atmospheric carbon dioxide concentrations will interact in relation to agricultural productivity. The consequences of climate change on various important aspects of agriculture such as crop production, livestock, availability of water, pest and diseases etc. are discussed and summarized. Each of this aspect of agriculture sector will have certain impact which may be positive or negative. The chapter also discusses on the possible mitigation measures and adaptations for agriculture production in the future climate change scenarios.

INTRODUCTION

Climate is a measure of the average pattern of variation in climatic parameters like precipitation, temperature, humidity, wind, atmospheric pressure, atmospheric particle count and other meteorological variables in a given region over long periods of time. These climatic parameters are changing due to global warming. So the climate change has long-since ceased to be a scientific curiosity and is no longer just one of many

environmental and regulatory concerns (UNEP, 2015). In addition, the CO₂ concentrations and other greenhouse gases such as methane, nitrous oxides, chlorofluorocarbons and chlorofluorocarbon substitutes will continue to rise (Hartwell et al. 1996). The American Meteorological Society (AMS, 2015) explained climate change may be due to natural external forcing, such as changes in solar emission or slow changes in the earth's orbital elements; natural internal processes of the climate system; or anthropogenic forcing.

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The world's climate is changing, and the changes will have an enormous impact on people, ecosystems, and energy use. According to the latest report of the Intergovernmental Panel on Climate Change (IPCC), average global temperature is likely to rise by another 2 to 8.6 degrees F by 2100. Further UNEP (2015) reported that there is alarming evidence that important tipping points, leading to irreversible changes in major ecosystems and the planetary climate system, may already have been reached or passed. It is a growing crisis with economic, health and safety, food production, security, and other dimensions. The shifting weather pattern has threatened food production and food security on the globe. At the end of this century, different locations will experience different levels of increases in temperature, with the greatest impact toward the North Pole and the least increase toward the South Pole and in the tropics.

Climate is the long-term statistical expression of short-term weather. Climate can be defined as "expected weather". When changes in the expected weather occur, we call these climate changes. American Meteorological Society defines climate and climate change as follows (AMS, 2015).

- **Climate:** The slowly varying aspects of the atmosphere–hydrosphere–land surface system.

It is typically characterized in terms of suitable averages of the climate system over periods of a month or more, taking into consideration the variability in time of these averaged quantities.

Climatic classifications include the spatial variation of these time-averaged variables. Beginning with the view of local climate as little more than the annual course of long-term averages of surface temperature and precipitation, the concept of climate has broadened and evolved in recent decades in response to the increased understand-

ing of the underlying processes that determine climate and its variability.

- **Climate Change:** (Also called climatic change) is defined as any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer.

It is well known fact that agriculture production is dependent on set of climatic conditions. Each crop requires a particular climate for its growth, development and completion of its life cycle. This is the one of the reason that farmers can cultivate a specific crop in a particular region which is having suitable climatic condition to that crop. For example an apple crop can be cultivated in temperate climatic conditions. The climatic resources which cannot be manipulated by the human beings are the deciding factor for successful cultivation of any crop. The one of these resources includes availability of the water for the crop. The availability of water for irrigation and the source of the water both are climate dependant factors. Both shortage and excess of water will interfere the agriculture production. The latest reports (FAO, 2013) of statistics of utilization of world land says that thirty percent of the earth's land is used for crops and pastures and seventy percent of all abstracted freshwater is directed towards irrigation to produce the food that people and livestock need for a stable food supply. This large-scale utilization of land and water resources is increasingly threatening environments. Furthermore, farming is important because it provides the livelihood of hundreds of millions of people.

Agriculture system in many countries are particularly vulnerable for several reasons like (i) climate already too hot and often too dry; (ii) water supply is limited and variable (iii) low

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