



Climate Change and Its Impact on Agricultural Productivity in India

Dr. Shrabanti Mondal

State Added College Teacher, Raja Ram Mohun Roy Mahavidyalaya, Department of Geography,
shrabantimondal1984@gmail.com

Abstract:

Agriculture is crucial for ensuring food, nutrition and livelihood securities for India and it engages almost two-third of the workforce in gainful employment. On account of its close linkages with other economic sectors, agricultural growth has a multiplier effect on the entire economy of the country. Although in the past years, Indian agriculture had made a significant progress, but currently it faces many challenges. Stagnation of net sown area, plateauing yield level, and deterioration of soil quality, reduction in per capita land availability and the adverse effect of climate change are the major challenges to Indian agriculture. Moreover, the increased rate of population is pressurizing the agricultural sector for enhanced food production. The task is very challenging because, about 60% of the net cultivated area is rained and exposed to biotic and abiotic stresses arising from climatic variability and climate change. More than 80% of Indian farmers are marginal farmers, having cultivable land of less than one hectare or small farmers with cultivable land area of one to two hectares, with poor coping capacity. Additionally, the Indian farmers are heterogeneous and unorganized in nature. Climate change and its variability are likely to aggravate the problem of future food security by putting pressure on agriculture affecting its sustainability.

Keywords: Agriculture, Unorganized, Food, Farmer, Sustainability.

1. Introduction:

India is known as the land of agriculture as more than 70% of the global land is used by India for agriculture. At the same time, climate change has become one of the major threats to the agricultural sector that negatively impacts the productivity of agriculture in the various states of India. Global warming has increased the emission of carbon dioxide, carbon monoxide in the air that has changed the climatic condition of India. The emissions of these gases have a serious impact on the productivity of agriculture. India is known as one of the most populated countries with a diverse population of 1.30 billion therefore the requirement for food is high in the country.

2. Significance of the Study:

The study signifies the impact of climate changes on the productivity of crops in India. India is considered as one of the populated countries that need more agricultural practices to fulfil the food needs of the people. However, productivity of agriculture in India gets affected by the rapid climatic change. The study is

important to understand the various factors that are responsible for changing the climatic condition in India and how they adversely affect the productivity of the variety of crops in various states of India. The study is important to understand the impact on quality and quantity of the water due to climatic conditions as it is one of the major input in agriculture.

3. The objective of the Study:

1. To understand the impact of climatic changes on agricultural productivity in India.
2. To identify the factors responsible for rapid climatic changes in India.
3. To understand the challenges faced in agricultural productivity due to the rapid climatic changes in India.
4. To understand the relation between the population of India and agricultural productivity.

4. Hypothesis of the Study:

H1: There has been no impact of climatic changes on the agricultural productivity in India

H2: Agricultural productivity is impacted by the rapid climatic changes in India.

5 Methodology (Population/ Sample):

As per Thomson et al. (2020), population can be defined as the object or individual present in an area where the study is conducted and the sample is the number of individuals or objects who participated in the study from the targeted population (Etikan and Bala 2017). A sample helps to choose the respondents from the population selected by the researchers. In this study, the Agriculture sector in India is considered as a population whereas the chosen agricultural crop to see the impact of climatic conditions is considered as a sample.

6. Sampling Design:

Sampling design helps to choose the sample from the targeted population. It provides tools and techniques through which the researchers can select the samples from the targeted population (Etikan and Bala 2017). Probability and non-probability are the two types of sampling design

Used in the study. In this study, simple random non-probability sampling method has been used to select the sample as it reduces the biases of the study by providing equal opportunities to all the samples to be selected. It has been chosen in the study as it increases the rate of accuracy of the study.

7. Data Collection Techniques

Primary and secondary are the two data collection techniques used in the study based on the nature of the study (Golden 2018). In this study, a secondary data collection method has been used to gather the data. Pdfs, peer review literature and journals regarding the impact of climatic condition on agricultural productivity in India has been used.

8. Results of the data tables

Table 1: Water Resources in India

Particulars	Value
Geographical area	328 Ma
Rainfall variation	99 mm westernmost region to easternmost region
Average rainfall	125 cm
Available water resources	1868 billion cu. m
Annual precipitation	4000 billion cu. m
Present utilization (surface 63% groundwater 37%)	605 billion cu.m.
Imagination	500
Domestic	29
Industry energy and other uses	73
Per capita water availability	1720.6 cu. m
Utilizable surface water (storage and diversion)	1121 billion cu. M. 689
Groundwater (replenishable)	431

(Source; created by author)

9. Graphical Representation

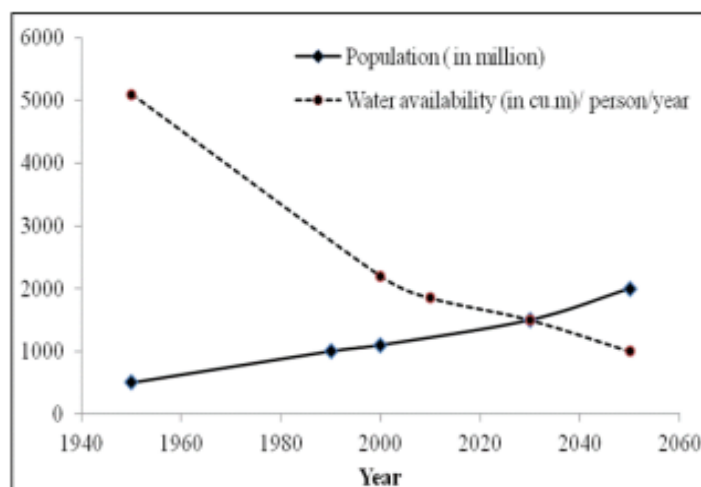


Figure 1: Observed and projected decline in per capita average annual freshwater availability and growth of population from 1951 to 2050

10. Analysis of the data

Impact of climate change on crop productivity

The agricultural productivity in India is influenced by the monsoons and there is a direct relationship between the rainfall and monsoon that originated through the Arabian sea in India. According to Aryal et al. (2017), the hydrologic cycle gets accelerated by the warmer climate and changes in the magnitude and time of the rainfall. More moisture is held by warm air that enhances the evaporation of the surface moisture. Crop evapotranspiration is directly impacted by rapid changes in the climate. In the various northern states including Rajasthan has increased 14.8 percent of total evapotranspiration. In the ecosystem zone of Rajasthan, the increment in the ET has impacted the fragile water resources. Climatic change directly impacts the quality of soil, groundwater recharge, and the frequency of drought and flood. The water cycle is also impacted by the changing climate (Ali et al. 2017).

The production of crops in India is directly dependent on weather and climate change. The growth of the crop is impacted by changes in precipitation and CO₂ concentration and temperature. The successful adoption of irrigation methods has impacted food production all over the world. The doubling of the CO₂ fertilization effect can increase global agricultural production. The imposition of climate changes on water resources impacts the productivity of agriculture. As compared to summer, India faces more seasonal variation with more warming. In the present time, climate change acts as a major threat to food security and agriculture. As per Ray et al. (2018), from the year 1892 to 2020, India has shown 22 large-scale droughts and the frequency of the droughts increased.

In India water is considered the most important input as more than 55% of the cultivated area in India has no irrigation facilities. At present, food supplies can be secure under varying conditions due to the various climate models. The various climatic models have predicted that droughts, storms, and heavy rainfall make the weather conditions more extreme. These extreme weather events show the impact of diseases in various areas (Wang et al. 2018). In a country like India, climatic change is considered a burden as the country is already facing the challenge of a socio-economic and ecological system. India is already facing the problem with urbanization, industrialization, and population and the climate of India has become warmer due to global warming.

11. Findings of the study and Results

The food consumption in India is about 550h per capita every day and the demand for food in the country is increasing day by day due to rapid increment in the population. India is facing major challenges for increase its food production to feed its entire population. The risk of seasonal to permanent saline gets interested into rivers and groundwater that adversely impact the quality of water. There are several effects of climatic changes on the productivity of agriculture (Campbell et al. 2018). More than 80 to 85% of the water is consumed by Indian agriculture. Through the year the demand for water for agriculture has increased. Groundwater and surface water resources have played an important role in irrigation. And helps in attaining self-sufficiency in food production. Table 1 has shown the water availability from the different sources and its utilization in the country. In India, utilization pattern has been studied to observe the changes in rainfall, surface temperature, and evaporations.

Agriculture creation is straightforwardly subject to environmental change and climate. Potential changes in temperature, precipitation and CO₂ fixation are relied upon to altogether affect crop development. The general effect of environmental change on overall food creation is viewed as low to direct with fruitful variation and satisfactory water system. Worldwide agrarian creation could be expanded because of the multiplying of CO₂ preparation impact. Horticulture will likewise be affected because of environment

changes forced on water assets. India will likewise start to encounter more occasional variety in temperature with more warming in the winters than summers. India has encountered 23 enormous scope dry spells beginning from 1891 to 2009 and the recurrence of dry seasons is expanding. Environmental change is representing an incredible danger to horticulture and food security (Campbell et al. 2018). Water is the most basic farming contribution to India, as 55% of the complete developed regions don't have water system offices. As of now we can get food supplies under these differing conditions. All environment models anticipate that there will be more outrageous climate conditions, with more dry spells, weighty precipitation and tempests in rural creation areas. Such outrageous climate occasions will impact where and when illnesses will happen, accordingly forcing serious dangers and potential yield disappointment.

12. Discussion:

There is a need to produce 50% more crops by the year 2025 to feed the population of India. In India, 64% of the people are dependent on agriculture for their survival. As per Burgess et al. (2017) the urbanization, increasing population, and rapid industrialization has increased the water demand. Changes in land-use patterns, cropping patterns, and over-exploitation of groundwater have changed the hydrologic cycle in many climatic regions in India. For agricultural products, the availability of water is the primary requirement. The quantity and quality of water are considered as primary constraints in India that adversely affect the quality of water (Mall and Sonkar 2017).

In agricultural nations like India, environmental change is an extra weight since biological and financial frameworks as of now face pressures from quick populace, industrialization and monetary turn of events. India's environment could become hotter under states of expanded air carbon dioxide. In India, normal food utilization at present is 550 g for each capita each day, while in China and USA are 980 and 2850 g, separately. The nation faces significant difficulties to expand its food creation to the tune of 300 mt by 2020 to take care of its consistently developing populace which is probably going to arrive at 1.30 billion constantly 2020. To fulfill the need for food from this expanded populace, the country ranchers need to deliver half more grain by 2020 (Burgess et al. 2017). The all out gross flooded region has more than quadrupled from 22.6 million ha in 1950-51 to 99.1 million ha in 2011-2012. In spite of the fact that, horticulture contributes 14% in the Gross Domestic Product (GDP) in India, 64% of the populace relies upon agriculture for their work. Throughout the long term, interest for water has expanded because of urbanization, expanding populace, quick industrialization and other formative drives. Likewise, changes in trimming and land-use designs, over-double-dealing of groundwater and changes in water system and seepage have adjusted the hydrologic cycle in numerous environment districts and stream bowls of India. Accessibility of water is the main element in agrarian creation. Water quality and amount are not kidding imperatives for agriculture in many pieces of India. Farming should adjust to changing climatic conditions by tapping water assets and creating further developed water the executives draws near. At the same time, there is likewise need to create and carry out advancements and strategies which will help in decreasing and alleviating ozone depleting substance outflows. Hence, evaluation of the accessibility of water assets is future public necessity and expected effect of environmental change and its changeability is basic for pertinent public and local long haul advancement techniques for manageable turn of events.

13. Conclusion:

It can be concluded that agriculture is one of the important sectors in India however, it is adversely impacted by the changes in the climatic condition. The vulnerabilities in agricultural productivity are influenced by the increasing rate of global warming that changes the concentration of various gases in the environment. The adverse changes in the emission of CO₂ and temperature adversely impact the productivity of agriculture. It

is needed to mitigate the challenges of climatic changes faced by India to increase the productivity of agriculture.

14. Recommendations/ Suggestions:

- It is recommended to use smart water management for increasing the productivity of crops in limited water. Smart water management helps inadequate flow and supply of water in both the rural and urban areas. It is used to manage the water effectively by reducing the wastage of water.
- It is recommended to select health tolerant varieties that will allow the crops to maintain productivity at higher temperatures. Using heat-tolerant varieties will provide a positive impact on the productivity of the variety of crops.
- It is recommended that government should make proper strategy and policy for increasing the renewable sources of energy to reduce pollution as global warming is considered as one of them in the reason for changing the climatic condition in India. For sustainable development government should more focus on sustained farming and avoid the use of non-renewable resources that increases the temperature, precipitation, and quality of the air.

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