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# THE IMPACT OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTIVITY- A CASE STUDY OF HARYANA STATE OF INDIA

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## Abstract

*This study examines the impact of climate change on Indian horticulture. Use a 40-year regional-level information index covering over 200 Indian sites to assess the impact of irregular annual climate change on agricultural outcomes. Ranchers within-year alterations to yearly weather conditions shocks can rely on these board gauges. These estimates, based on short-term weather conditions, are important for predicting the medium-term financial impact of climate change, assuming ranchers are unable to adapt quickly. I aspire to be a writer. Furthermore, anticipated climate change reduces substantial crop yields by 4.5 to 9% from 2010 to 2039. The long-term impact (2070-2099) is emotional, reducing yields by 25% or more without long-term fluctuation.*

*The current study aims to determine the impact of climate change on horticultural production in Haryana from 2000 to 2012. Climate change in India is manifested in many ways, including rising temperatures, reduced rainfall in dry fields, reduced production and expansion in stormy regions, and accelerated cold liquefaction. The effects of climate change have been studied from different perspectives in different parts of the country, and it has been found that climate change has a greater impact on agriculture than in other parts of the country. According to one study, B. dry season events affect the yield of heavy rainfall that results in a harvest. As a result, changing climatic factors continue to reduce agricultural production, threatening long-term food security. This leads to a focus on the impact of climate change Haryana's agricultural creation.*

***Keyword:****Impact of Climate Change, Agricultural Productivity.*

## 1. Introduction

Climate change is perhaps the most important global ecological challenge facing humankind, affecting food production, healthy habitats, freshwater availability, and human well-being, among others. Climate is one of the most important factors in agricultural development. Climate change and its impact on agricultural production are of global concern. Analysts and regulators have the potential for agriculture as the effects of climate change can impact domestic and global regulations, trade design, asset use and food security in the

future. I am concerned about harm and benefit. Climate change is a long-term climate change that is directly or indirectly due to human activity that alters the formation of the Earth's atmosphere, despite the typical climate change observed on a similar timescale (IPCC). , 2007). There is no doubt that changes in climatic factors will have a significant impact on crop yields and production, as climatic variables has a direct impact on horticulture. Higher temperatures, changes in precipitation, and higher barometric CO2 concentrations are examples of climate change scenarios. There are three ways in which the greenhouse effect can be important in horticulture. First of all, increased levels of CO2 in the air can have a direct impact on the growth rate of crops and weeds. In addition, CO2-induced climate change can change temperature, precipitation, and insulation, affecting plant and animal productivity. Finally, rising sea levels can lead to loss of farmland due to submergence of beach areas and increased salinity in groundwater.

Despite the significant advancements in agricultural innovation over the last 50 years, agricultural development is still heavily reliant on climate and climate. Crop development reproduction evaluations demonstrate that even a small increase in temperature under dry land/down-poured farming reduces the yield of specific harvests in tropical stations. Tropical harvest yields would be significantly harmed if there was also a significant reduction in precipitation. Several studies show that climate change will reduce the incomes of the poor and will surely increase the number of people at risk of starvation. Food security in some parts of the world might be harmed by climate change, mostly as a result of enlarged boundaries and fleeting/spatial shifts. The Intergovernmental Panel on Climate Change (IPCC) concluded in its recently released fourth Assessment Report (IPCC, 2007) that increased global air and sea temperatures, ice melting, and rising global mean ocean level demonstrate that the climate is warming.

Individuals are concerned about climate change and variation. The repeated dry seasons and floods seriously jeopardise the livelihoods of billions of people who rely on land for the great bulk of their needs. Extreme events such as the dry season, floods, cold and violent waves, forest fires and landslides regularly have a negative impact on the global economy. Normal catastrophes, such as earthquakes, waves, and volcanic eruptions that are not related to climatic catastrophes, can alter the synthetic structure of the air. As a result, weather-related disasters occur. Expansion (contamination) of steam atomizers due to the release of ozone-destroying compounds such as carbon dioxide (CO2), hydro chlorofluorocarbons (CFCs), hydro chlorofluorocarbons (HCFCs), hydro fluorocarbons (HFCs), and per fluorocarbons (PFCs) from petroleum products upon.

## 2. Review of Literature

S.K.Sinha and M.S. Master Than (1991) calculated that a 2 ° C increase in average temperature would reduce rice cultivation at 0.75 tonnes / hectare in high-yielding areas and 0.06 tonnes / hectare in low-yielding beach areas. In addition, a 0.5 ° C increase in winter temperatures will reduce the wheat harvest period by 7 days and reduce yields by 0.45 tonnes / hectare. In high-yielding areas of Punjab, Hariyana and Uttar Pradesh, a 0.5 degree increase in winter temperatures reduces wheat production by 10%.

AKS Gosain, S. Rao et al (2006) In this study, the current situation under GHG was the severity of the dry season in certain parts of the country and the severity of floods in other parts of the country. It turns out that it is changing in terms of heightening. It can make the country worse. In any case, the GHG scenario shows the overall reduction in available spills. Luni can face severe water shortages along with the westward Kutch and Saurastra rivers, which cover about a quarter of Gujarat and 60% of Rajasthan. Water scarcity also affects the basins of the Mahi, Penar, Sabalmati and Tapi rivers.

The impact of climate change on Indian agriculture has been reviewed by Raymond Guiteras (2007). This study investigated the impact of climate change on agricultural yields at 200 sites in India. He found that climate change reduced the productivity of major crops from 4.5% to 9% between 2010 and 2039, but had a 25% less long-term impact (2070-2099). In the absence of long-term variability, the negative effects of climate change on agriculture are also in dire straits. He argued that climate change imposes significant costs on Indian horticulture. This tends to be reduced only if rapid and appropriate techniques are introduced in connection with rising temperatures.

Tata.N.Rao (2011) highlights the role of human diversion in responding to climate change, the potential state impacts on agricultural frameworks, and the potential changes in food production and pricing. .. Studies show that agricultural land yields in developing countries could decrease by 20% by 2080 due to climate change, while yields in developed countries would decrease by 6% and yields in non-industrial countries would decrease by an average of 15%. It is predicted. Horticultural productivity is strongly influenced by the weather. This review supports the UN Climate Change City (UNFCC)'s cultural capacity for food production in the face of climate change as one of the key inspirations for reducing the emission of ozone-depleting substances. It shows that. Inspiration for its existence and efforts to reduce the emission of ozone-depleting substances as one of the key inspirations for its existence and efforts to reduce it ozone depleting substance emanation

## 3. Climate change and agriculture

Based on some of the prior experiences, the influence of climate change on farming will be one of the major game changers affecting humankind's future food security on the planet. Agribusiness is not only vulnerable to climate change, but it is also one of the major contributors to it. Figuring out how weather conditions vary over time and modifying management practises to get greater harvests are all challenges to the agriculture sector's progress. Because there is local variation in precipitation, temperature, crops and editing

frameworks, soils, and board rehearses, agribusiness' climate responsiveness is questionable. The differences in temperature and precipitation across years were far greater than the expected variations in temperature and precipitation. If the expected climate change causes the climate to fluctuate more, the yield losses may increase. 6 As an unnatural weather shift has a complicated influence, different harvests will respond differently. The jungles are increasingly dependent on horticulture, with 75 percent of the population living in the jungles and 66 percent of these people working in agribusiness. Given the low levels of innovation, various stimulants, diseases and weeds, land corruption, irregular land occupancy, and rapid population growth, the impact on tropical agriculture affects their employment. Rice, wheat, corn, sorghum, soybeans and grains are the top six crops in the world, accounting for 55% of meatless calories and more than 70% of animal diets feed in a 40 percent edited zone (FAO, 2006). As a result, any impact on these yields would have a negative impact on food security.

## 4. Climate Change in Haryana

Human activities have resulted in an expansion in the arrangement of the earth's climate as a result of the Industrial Revolution. Haryana is also located in a region with the highest level of environmental consciousness. Haryana is likely to face increased water scarcity as a result of a general decline in precipitation as a result of climate change. Haryana's precipitation is confined, From 300mm southwest to 1,100mm east of the top. The states located in the Indus and Yamuna river basins receive water from the Satrezi and Yamuna rivers and some surplus water from the Rabbi and Bees rivers under various intergovernmental agreements. There is no permanent river in Haryana. Gagar is the main sporadic stream that runs through the northern part of the state. Gagar rises outside the Himalayas between Yamuna and Stregis and flows into Haryana near Pinjor in Punchkura. It travels via Ambala and Hisar before arriving in Bikaner, Rajasthan, and runs 467 kilometers before disappearing into the desert of Rajasthan. Temperatures in Haryana range from 31.4°C to 17.4°C. The mean most extreme temperature exhibits no discernible pattern; the least extreme temperature shows a 37year increase of roughly 1.0 0 C to 1.2 0 C. The base temperature is expanding faster in Fatehabad, Jhajjar, and Karnal (1.1 0 C to 1.3 0 C). It isn't necessary to enshrine yearly diversity. The seasonal variation in the most extreme and least extreme temperatures is estimated to be roughly 2 degrees Celsius. Before the rainy season and during stormy seasons, average maximum temperatures are

high, ranging from 35.4 ° C to 36.2 ° C. Similarly, average minimum temperatures are lowest in winter, ranging from 6.9 degrees Celsius to 7.6 degrees Celsius.

| Year | Average Annual rainfall (mm) | Maximum Annual Temperature Variation |
|---|---|---|
| 2000 | 517 | 25.2 |
| 2001 | 549 | 41.1 |
| 2002 | 485 | 0.7 |
| 2003 | 678 | 32.4 |
| 2004 | 525 | 83 |
| 2005 | 584 | 45.3 |
| 2006 | 436 | 43.2 |
| 2007 | 380 | 52.1 |
| 2008 | 632 | 38 |
| 2009 | 322.7 | 32.3 |
| 2010 | 584.2 | 55.5 |
| 2011 | 532 | 31.5 |
| 2012 | 317.1 | |

**Table:1.**Haryana's Rainfall and Temperature Variation

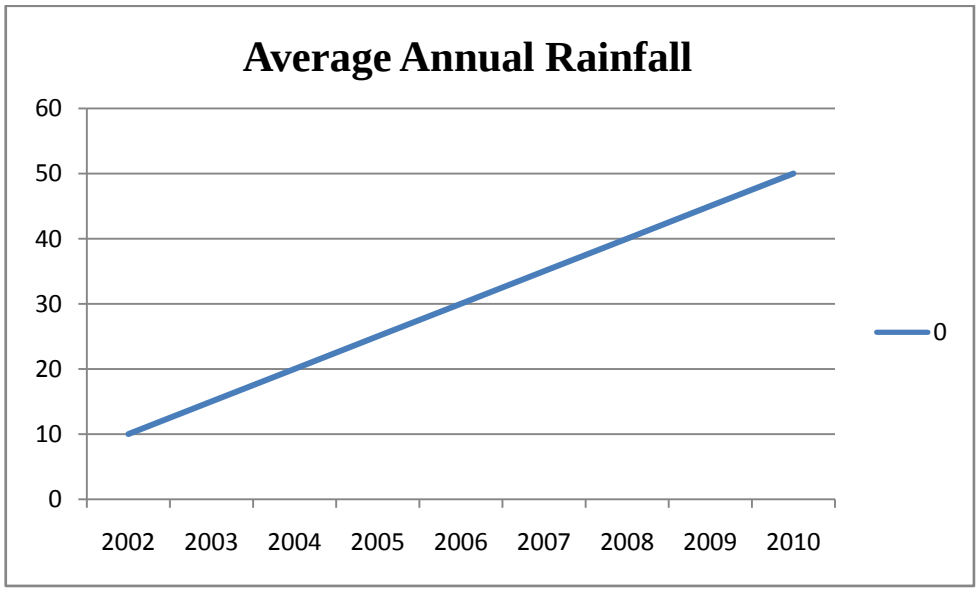


**Figure: 1**. Average Annual Rainfall in Rajasthan

The table and chart 1 show that the highest annual rainfall was 687 mm in 2003, followed by a decrease in precipitation, with the lowest rainfall in 2012, with a normal yearly precipitation of 216.1 mm, highlighting how climate change affects precipitation and how this drop may generate agricultural catastrophes in Haryana.

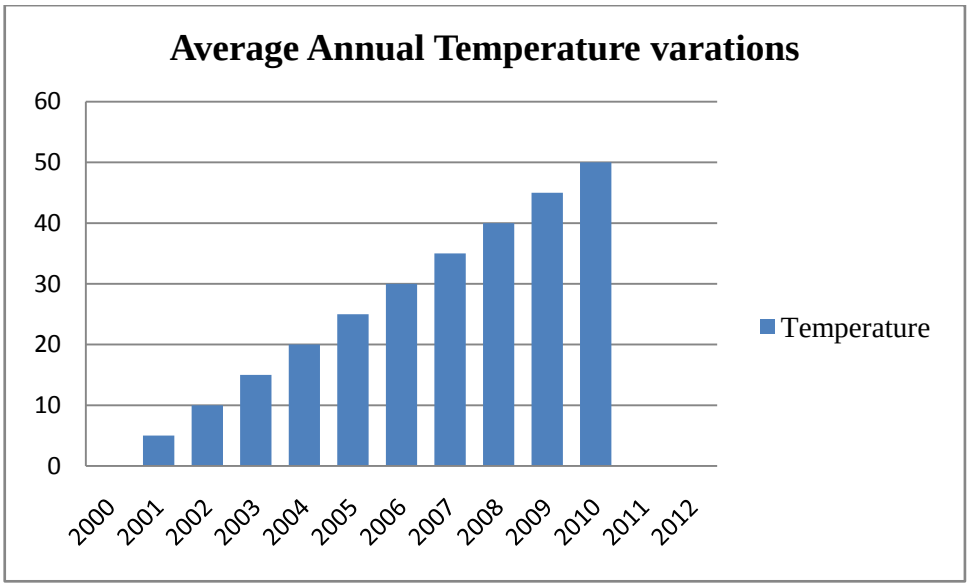


**Figure: 2.**Haryana's Average Annual Temperature Variation

Figure 2 depicts the most extreme temperature variation in 2000, after which it exhibits a consistent expanding and diminishing pattern until 2012, when, The temperature begins to rise from 30 0 C to above 40 0 C as a result of climate change, which is a warning indicator for an agribusiness because of the continuous appearance in temperature.

## 5. Impact of Climate Change on Disease

Any immediate yield losses caused by phytophagous bugs, plant microbes, and weeds could partially or completely compensate for increased CO2 or climatic change. As a result, determining the influence of these biotic imperatives on agricultural output as a result of climate change is crucial.

I) **Impacts on Plant Pathosystems:**Climate change may alter the microbe's physiology and resistance, as well as the phases and rates of its development. Shifts in host and microorganism topographical circulation, alterations in the physiology of host-microbe collaborations, and changes in crop tragedy are the most likely consequences. Changes in the feasibility of control processes could have a substantial influence as well.

II) **Geographical Distribution of Host and Pathogen:**If warming induces a post-ward shift of agro-climatic zones and host plants relocate to new locations, It's possible that new disease structures could emerge, and old diseases will lose their economic significance. Microorganisms would follow the migratory plants and potentially contaminate remaining vegetation from conventional plant networks that haven't been exposed to the frequently more powerful strains found in agricultural harvests.

Microbe dissemination systems, temperature suitability for dispersal, seasonal endurance, and any changes in their physiology and biology in the new climate will all influence how soon microorganisms establish themselves in another region. Changes in the type, amount, and relative importance of microorganisms can have an impact on the types of illnesses that afflict a given crop. This would be particularly emphasized in the case of bacteria that have different hosts. Plants occupying the climate's periphery could be subjected to constant pressure, potentially leading to an increase in insect and disease outbreaks. Warming and other changes could make ecosystems more vulnerable to microorganisms that aren't as common as they are now because of the harsh climate.

III) **Physiology of Host-Pathogen Interactions – Elevated CO2:** Many plants have expansions in leaf region and span, As a result of increasing CO2, leaf thickness, fanning, tillering, stem and root length, and dry weight have risen. Increased CO2 levels, according to researchers, will enhance the size and thickness of overhangs, leading in more biomass of high nutritious quality. Foliar diseases like as rusts, fine 17 moulds, leaf spots, and scourges are more likely to spread when combined with increased overhang stickiness. In a variety of bacteria, the breakdown of plant litter has a significant impact on supplement cycling and saprophytic endurance. Plant growth in high CO2 environments leads in a greater C:N ratio in litter. Researchers have observed that litter with a high CO2 content degrades more slowly. Increased plant biomass, slower litter breakdown, and warmer winter temperatures may improve microbe endurance on overwintering crop deposits, allowing more introduction inoculums to taint following harvests. Two distinct patterns on the consequences of elevated CO2 have evolved in parasitic pathosystems with host pathogen relationships. First and foremost, due to alterations in microbe forcefulness, the microorganism's core foundation may have been postponed or may be feeble. The second interesting result is that as CO2 levels rise, microbial productivity rises as well.

IV) **Elevated Temperature:** Temperature changes can affect physiology and cause opposition. There is a wealth of information available on heat-induced helplessness and temperature-sensitive traits. In rummage species, however, lignifications of cell dividers increased at higher temperatures, improving protection from parasite microbes. As a result, impacts would rely on the concept of host-microbe interactions as well as the instrument of obstruction. Agricultural harvests and plants in natural

networks may operate as symptomless bacteria transporters, and if plants are targeted in a hotter environment, disease may emerge. Pressure is a major contributor to the extinction of some woodland species.

## 6. Conclusion

As previously stated, climate change is having a negative influence on Haryana horticulture, which is heavily reliant on precipitation. Because of climate change, maximum and minimum temperatures are increasing, the length of each season is also increasing, and there are significant vulnerabilities in precipitation period and recurrence, heavy precipitation on unseemly time spans for farming and absence of precipitation when horticulture requires it, increasing recurrence of dry spells, and so on.

Given that horticulture accounts for almost 20% of India's GDP, climate change is expected to cost the country over the medium term, 1 to 1.8 percent of GDP every year is expected. In addition, agricultural productivity is particularly crucial for the poor's well-being. Climate change could reduce utilization among India's poor by at least 18 percent, according to a back-of-the-envelope calculation using Ligon and Sadoulet (2007)'s metric. Each percentage point of agricultural GDP growth increases usage of the lowest three deciles by four to six percent, according to a back-of-the-envelope calculation using Ligon and Sadoulet (2007)'s metric Long-term climate change could result in up to a 25% reduction in harvest yields if no rapid and complete shift occurs. The findings of this article point to two important conversation starters that should be investigated further in the future. To begin, what are the factors that explain the disparity between these negative consequences for a growing nation and the somewhat predictable outcomes for the United States found by Destines and Greenstone (2007)? Second, and most importantly for government support of Indian agriculture, how quickly can non-industrial country ranchers change their cultivating procedures for adapting to changing climates, and what strategies or enhancements will allow for quick change.

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