
IMPACT OF GLOBAL WARMING ON ENVIRONMENT AND AGRICULTURE IN INDIA

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ABSTRACT

Agriculture is India's main economic driver, and the country's economy is highly dependent on the monsoon season. The Intergovernmental Panel on Climate Change (IPCC) projected that the global mean surface temperature will likely rise, which may result in uneven climatic changes such as irregular rainfall patterns, increased surface temperature, and elevated CO₂ content in the atmosphere. The IPCC made this projection in their report in 2007. According to the findings of several research studies, the effect of weathering parameters throughout the cropping season is significantly higher (67%) than that of other factors, such as the management of soil and nutrients (33%). According to the findings of many studies, the agricultural output drops by between 3% and 5% for every degree Fahrenheit that the temperature rises. The current study demonstrates that the production of crops is sensitive to temperature and takes the form of a funnel regardless of the time of year. At lower temperatures, the two qualities are almost perfectly linearly associated with one another; nevertheless, as the temperature rises, the correlation increases, but it does so with a great deal of scattering. The findings might be useful in the research of how the effects of climate change are going to affect agricultural productivity.

Keywords: *global warming, climate change, Indian agriculture,*

INTRODUCTION

The human race should be concerned about climate change and its variability. The persistent droughts and floods pose a significant risk to the way of life of billions of people throughout the world who rely on the land to provide the majority of their requirements. Extreme weather phenomena, such as droughts and floods, cold and heat waves, forest fires, landslides, and other natural disasters, are having an increasingly negative impact on the economy of the entire world. Even though they are not directly connected to meteorological catastrophes, natural disasters such as earthquakes, tsunamis, and volcanic eruptions have the potential to alter the chemical make-up of the atmosphere. It will ultimately result in natural calamities connected to the weather. An increase in aerosols, which are atmospheric pollutants, as a result of the emission of greenhouse gases like Carbon Dioxide from the burning of fossil fuels, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), etc., Ozone depletion and UV-B filtered radiation, eruption of volcanoes, the "human hand" in defor The absence of forest cover, which under normal circumstances deflects precipitation and enables it to be absorbed by the ground, makes it possible for rain to spread out over a wider area, which erodes the top soil and can lead to both flooding and droughts. In paradoxical fashion, the absence of trees also makes dryness worse during dry years by hastening the rate at which the soil dries out. Because it absorbs long-wave radiation from the

atmosphere and then re-emits it at the surface of the planet, carbon dioxide (CO₂) is the primary greenhouse gas responsible for global warming. The term "global warming" refers to nothing more than the heating of the surface atmosphere as a result of the release of greenhouse gases, which leads to an increase in the temperature of the atmosphere all over the world over an extended period of time. The term "climate change" refers to these types of shifts over extended periods of time in the surface air temperature as well as the harmful effects these shifts have on rainfall. The term "climate variability" refers to the phenomenon in which certain factors display year-to-year changes or cyclic tendencies.

However, according to the official definition provided by the United Nations Framework Convention on Climate Change (UNFCCC), climate change is defined as a change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to the natural climate variability that is observed over comparable time periods. This definition was established by the United Nations. However, scientists frequently use the phrase to refer to any change in the climate, regardless of whether the change is caused by natural causes or by human activities. In particular, the Intergovernmental Panel on Climate Change (IPCC) defines climate change as a change in the state of the climate that can be identified by changes in the mean and / or the variability of its properties, and that persists for an extended period, typically decades or longer. In other words, climate change is a change in the state of the climate that can be identified by changes in the mean and / or the variability of its properties.

Global Scenario

The effects of climate change might be felt all around the world. According to the Intergovernmental Panel on Climate Change (IPCC), many of the changes that have been documented as a result of climate change are unprecedented. It is anticipated that the global sea level would increase between 0.17 and 0.41 metres by the year 2050. It has been noticed that the pace of rise in sea level throughout the previous two millennia, up to the middle of the 19th century, has been greater than the average rate. The Intergovernmental Panel on Climate Change (IPCC) found that increases in precipitation will not be uniform, and that severe events will grow more intense and frequent over the majority of the mid-latitude and moist tropical areas. The recent discovery of an upward trend in severe precipitation leads to the implication of a larger danger of flooding on a regional scale. Since 1850, the three decades that have passed since then have been consistently warmer than any previous decade on the surface of the Earth. Since the middle of the 20th century, the frequency of heat waves has grown throughout a significant portion of Asia (IPCC, 2014). In addition, the increase in temperature is caused by the increased concentration of CO₂ and other greenhouse gases. According to the IPCC study, the total amount of greenhouse gases that mankind emits will determine the amount of warming that may be predicted in the 21st century as well as the rate at which it will occur (National academics of sciences report, 2014). These observable variations are responsible for varied climates in different regions of the Earth, and it is possible that this variation may occasionally result in extreme weather occurrences.

The United States was hit by Hurricane Katrina in 2005, which is widely regarded as one of the most powerful hurricanes in the past one hundred years. It affected the Gulf Coast region, and assessments have indicated that this calamity is responsible for the highest loss of agriculture productivity. Before Katrina struck in the same year, sections of the Midwest had already endured major crop losses as a result of the extended drought. These kinds of climatic occurrences have an effect on ecosystems all across the planet. The crop yield may either increase or decrease due to climate change depending on the latitude of the area and the amount of irrigation that is applied. The potential for decreased crop productivity in the future due

to rising temperatures and changing precipitation patterns. The temperature may be a significant factor that has a significant impact on the amount of crop yield that is achieved all over the world. Therefore, studies concerning the effects of temperature on crop yield may assist the agricultural sector in developing a more effective strategy for the future and thereby enhance the economy.

Weather and climate

The term "weather" refers to the collection of meteorological conditions that exist at a specific time and location, including wind, rain, snow, sunshine, temperature, and so on. The term "climate," on the other hand, refers to the general and long-term features of the weather that is experienced in a particular location. The climate of an area has a significant impact on the ecosystems, crops, ways of life, and communities found within that region. Because of this, one way to think about climate is as a long-term summary of weather conditions that takes into consideration both the average circumstances and the variability of these variables. The term "climatic variability" refers to both the swings that take place from year to year as well as the statistics of extreme situations such as the frequency with which catastrophic storms or exceptionally hot seasons occur.

The geological evidence of ice ages and fluctuations in sea level, as well as the records of human history spanning many hundreds of years, both demonstrate that the climate of the Earth has seen significant shifts in the past. Although it is not always possible to determine what caused changes in the past, it is widely accepted that these shifts were connected to shifts in ocean currents, solar activity, volcanic eruptions, and other natural phenomena. The difference between then and today is that average global temperatures have increased at an alarmingly quick pace over the course of the past several decades. There is substantial evidence pointing to an increase in the average temperatures of the world's air and oceans, widespread melting of snow and ice, and a rise in the average level of the world's seas. The Fourth Assessment Report from the IPCC comes to the conclusion that there is no doubt that global warming is occurring. Temperatures in the atmosphere and oceans are currently at their highest point in at least the last five centuries, and most likely for the better part of a millennium. Scientists have known for a long time that the greenhouse gases in the atmosphere act as a blanket, which traps incoming solar energy and keeps the surface of the Earth warmer than it otherwise would be, and that an increase in the atmospheric greenhouse gas levels would lead to additional warming if there were to be a further increase in those levels.

OBJECTIVES

1. To study global warming effect on environment and Indian agriculture.
2. To study weather and climate.

Effects of climate change on key sectors at Global Level

The most likely effects of climate change are described in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) Working Group II: Impacts, Adaptation, and Vulnerability. These effects include increases in the frequency and severity of extreme events. In the absence of any preventative measures, the following is a summary of the impacts on important industries:

Water: The areas that are experiencing the effects of the drought are likely to be more widespread. It is very likely that the frequency of events with heavier precipitation will increase, which will lead to an increase in

the risk of flooding. It is likely that by the middle of this century, the availability of water will decrease in the dry tropics, in the mid-latitudes, and in other regions that are supplied by the water that melts off of mountain ranges. At the moment, the existence of more than one sixth of the world's population depends on the water that is melted from mountain ranges.

Food: Many areas at lower latitudes, particularly those that are seasonally dry and tropical, are likely to experience a negative impact on crop production as a result of rising temperatures and the increased frequency of droughts and floods. This could lead to an increase in the number of people who are at risk of starvation, as well as increased levels of migration and displacement. While some areas at middle latitudes and high latitudes will initially benefit from higher agricultural production, many other areas at lower latitudes will benefit from higher agricultural production.

Industry, settlement and society: In general, industries, settlements, and societies that are located in coastal areas and river flood plains, as well as those whose economies are closely linked with climate sensitive resources, are the most susceptible to the negative effects of climate change. This is especially true for areas that are already predisposed to experiencing extreme weather and, more specifically, for regions that are undergoing rapid urbanization. The economic and social costs of extreme weather events are expected to rise in areas where such events become more intense or more frequent.

Health: The predicted shifts in climate are likely to have a significant impact on the health of millions of people around the world, including an increase in the number of people who die, become ill, or are injured as a result of extreme heat, flooding, storms, fires, or droughts. In some regions, an increase in malnutrition, diarrheal diseases, and malaria will lead to an increased vulnerability to extreme public health issues. In addition, the long-term damage that natural disasters cause to health systems will put development goals in jeopardy.

Impacts on Agriculture and Food Production

The amount of food that can be produced in India is very susceptible to changes in the climate, such as variations in the amount of rainfall that occurs during the monsoon season and temperature shifts that occur throughout the seasons. According to research conducted by the Indian Agricultural Research Institute (IARI) and other organisations, it is anticipated that the Rabi crop would suffer significant damage. Wheat output drops by 4-5 million metric tonnes for every 1 degree Celsius increase in temperature. Even minute shifts in temperature and precipitation can have a considerable impact on the quality of agricultural products such as fruits, vegetables, tea, coffee, aromatic and medicinal plants, and basmati rice. Temperature and humidity have a significant impact on the population dynamics of pathogens and insect populations; hence, shifts in these factors can have an effect on population dynamics. Other negative effects on agriculture and associated industries include reduced yields from dairy cattle and a drop in fish reproduction, migration, and harvests. Other negative effects on agriculture and related industries include There will be a decrease in crop productivity of between 10 and 40 percent by the year 2100, according to global assessments.

The southwest monsoon has a significant impact on the climate of India and is responsible for the majority of the country's annual precipitation. It is essential for the provision of potable water as well as water for irrigation purposes in agricultural production. Agricultural productivity is sensitive to two broad classes of climate-induced effects: (1) direct effects from changes in temperature, precipitation, or concentrations of carbon dioxide; and (2) indirect effects through changes in soil moisture and the distribution and frequency

of infestation by pests and diseases. Direct effects come from changes in temperature, precipitation, or concentrations of carbon dioxide. It is possible that climate change may lead to a significant reduction in rice and wheat yields (IPCC 1996; 2001). However, the susceptibility of agricultural production to climate change is not only dependent on the physiological response of the affected plant; it is also dependent on the ability of the affected socio-economic systems of production to deal with changes in yield, as well as with changes in the frequency of droughts or floods.

The over-reliance of Indian farmers on natural causes, combined with a dearth of complementary inputs and inadequate institutional support mechanisms, severely limits the farmers' capacity to adjust to changing conditions. It is projected that a temperature increase of 2 to 3.5 degrees Celsius will result in a loss of net revenue at the farm level ranging from 9 to 25 percent. In addition, researchers calculated that a rise in mean temperature of 2 degrees Celsius and an increase in mean precipitation of 7 percent would result in a net revenue decrease of 12.3 percent for the whole nation. It has been determined that agriculture along the coasts of Gujarat, Maharashtra, and Karnataka is the sector that is most badly impacted. The key food-grain producing regions of Punjab, Haryana, and western Uttar Pradesh have also shown some signs of suffering from minor losses. On the other side, it is anticipated that West Bengal, Orissa, and Andhra Pradesh would profit, albeit to a limited level, from climate change.

Impacts on Water Resources

Alterations in crucial climatic factors, such as temperature, precipitation, and humidity, may have substantial long-term repercussions for both the quality and quantity of the water supply. The river systems of the Brahmaputra, the Ganga, and the Indus, which benefit from melting snow in the lean season, are anticipated to be significantly affected by the drop in snow cover. This is because melting snow is one of the few sources of water for these river systems. According to India's NATCOM I, a decrease in the total runoff is expected for all river basins, with the exception of Narmada and Tapi. The Sabarmati and Luni basins are also projected to have a reduction in runoff that is greater than two-thirds. The rise in sea level will cause fresh water supplies that are close to coastal regions to become contaminated with salt water.

Impact of Climate Change

The effects of climate change on agriculture might lead to issues with food security and could put at risk the activities that provide a livelihood for a large portion of the people. Agricultural inputs like water, the amount of solar radiation that affects plant growth, and the prevalence of pests can all be impacted by climate change, which can have both positive and negative effects on crop yields, as well as on the types of crops that can be grown in certain regions. This is because climate change can affect the amount of solar radiation that reaches the earth, which in turn affects plant growth; it can also affect the amount of pest

The environment in many developing nations is expected to become less favourable for agricultural operations that are now being carried out as a result of a warmer and more humid atmosphere. This is the consensus of forecasters, notwithstanding the complicated geographical disparities caused by climate change. Stern Report 2007, authored by Nicholas Stern, Head of the United Kingdom Government Economic Service and Advisor to the Government on the Economics of Climate Change and Development, projected that a 2°C increase in average temperature would reduce global gross domestic product by approximately 1 percent. However, World Development Report of the World Bank (2009) stated that Climate Change will cause a decrease in annual GDP of 4 percent in Africa and 5 percent in India.

According to a report published by the World Bank in 2013 titled "Turn Down the Heat: Climate Extremes, Regional Impacts and the case for Resilience," an increase of 20 degrees Celsius in the world's average temperature over the course of the following decades is anticipated to make India's summer monsoon extremely unpredictable. Because of the changing rainfall pattern, some regions will be completely submerged, while others will be left without sufficient water for power generation, agriculture, and even, in some cases, drinking. According to the report, by the year 2040, India would experience a major loss in crop output as a result of the high heat. In India, where groundwater resources are already at a critical level and approximately 15% of the country's groundwater tables are over exploited, the situation is likely to worsen as a result of reduced water availability as a result of changes in precipitation levels and falling groundwater tables. This is likely to make the situation even more dire.

More than sixty percent of the agricultural area in India is dependent on rain for its sustenance, which makes the country very susceptible to changes in the patterns of precipitation brought on by climate change. It is projected that by the 2050s, the amount of water available for agricultural production in the river bases of the Indus, Ganges, and Brahmaputra would decrease even more, which may have an effect on the ability of around 63 million people to get an adequate amount of food.

CONCLUSION

The current study demonstrates that temperature has an effect on the output of crops. It can be seen that total production, which includes rabi and kharif, has a shape similar to a funnel, which indicates that their output is dependent on temperature. When temperatures were low, the tail section of the plant was only seen in rabi (wheat) production, but not in kharif (rice). This demonstrates that rabi output has been harmed far more at lower temperatures than kharif production has. Both forms of production exhibit an upward tendency at high temperature ranges. In addition, it has been shown that the amount of scattering that occurs during manufacturing rises when the temperature is high. The findings of our study back up those of the IPCC report, which predicts that increased temperatures would have a negative impact on agricultural productivity. As a result, temperature has the potential to be an important variable to include in research on crop development.

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