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Original Article

Impact of Climate Change on the Agricultural Sector in the Marathwada Region

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Abstract

Climate change has impacted the economic, political, and agricultural economy of the Marathwada region more than other geographical and political divisions of Maharashtra. Available literature shows that the impact of climate change on the agricultural sector in Marathwada has not been extensively studied. Considering Marathwada as a whole, the uneven distribution of rainfall is seen as a result of climate change. Considering the past few decades, the negative impact of climate change on the agricultural sector of Maharashtra has been seen. The dependency on the agricultural sector in Marathwada is seen to be greater than that of other sectors of the economy; it is necessary to study climate change and its impact on the Marathwada region. The present research paper reviews and analyses the effects of climate change on the agricultural sector in the Marathwada region. The secondary data have been used for the research study and analysis. While studying the present topic, some important conclusions can be drawn, such as that the agricultural sector in the Marathwada region has been negatively impacted, and a comprehensive remedial plan will have to be devised to promote and sustain the agricultural sector in Marathwada. To address the climate change crisis, require national policies as well as local policy measures that should be environmentally friendly and sustainable.

Keywords: *Marathwada region, Climate change, drought, sustainable development.*

Introductions

Climate change has become a major and crucial issue in recent times. Climate change is affecting all human species as well as the biodiversity on Earth. (UNFCC CONVENTION, 1992) Humans have made tremendous progress on the basis of science and technology. While achieving this progress, humans have also caused immense damage to nature. Natural damage, pollution, deforestation, river pollution, air pollution through industrialization, and the decline in biodiversity can be said to be a sign of directionless progress. On the one hand, through material development and the efforts to achieve human welfare, humans have caused irreparable damage to nature. In fact, climate change is not a local issue but a global one, and its negative impact on all citizens of all countries and their lives is being seen. Temperature rise, water scarcity, drought, unseasonal rains, rising sea levels, melting glaciers, etc. Biodiversity is under threat due to natural disasters. Climate change has a huge impact on the agricultural sector and threatens the food security of the country and the world. Due to climate change, the increase in the temperature of the earth's atmosphere and the earth's surface is causing the loss of moisture in the soil, and due to this, the moisture or humidity required by crops is reduced, which leads to stunted crop growth and reduced crop production. (Mahapatra, Mahapatra, & Han, 2022) Further, drought, hunger, and food security are threatened. Many studies show that temperature changes are responsible for all these processes. While examining the impact of climate change on the agricultural sector in Marathwada, one also has to review global climate change and climate change in India because climate change at the local level depends on climate change at the global level. If we want to tackle climate change and achieve sustainable development, we have to formulate environmentally friendly economic and social policies.

Objectives: The main objective of this study is to study the impact of climate change on the agricultural sector in Marathwada region

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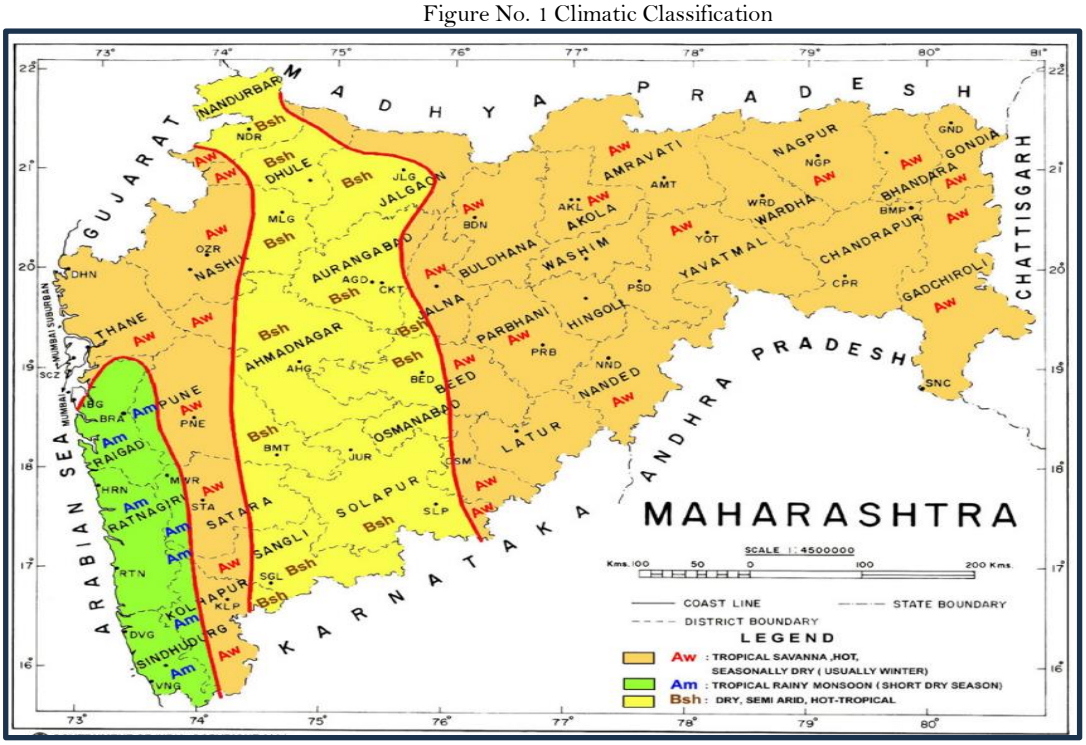
Research Methods:

This research study is based on secondary literature. To understand the general climate of Maharashtra, the report Climate of Maharashtra State' published by the India Meteorological Department, Pune, has been taken as the basis. Also, the data from Environment and Climate Change of Maharashtra State has been reviewed. Along with this, data and information references on government and private websites, important research articles, current papers, and information available on the internet have also been used for the study purpose.

Climate in Marathwada:

According to the United Nations, climate change is the long-term change in temperature and weather. These changes may be natural, but since 1800, human activities have been the main driver of climate change. This is mainly due to the burning of fossil fuels (such as coal, oil, and gas) that produce heat-trapping gases. This is what we call greenhouse gas emissions. Many studies have shown that there has been an unprecedented increase in surface temperatures over the past century. Considering the Indian subcontinent, the impact of climate change is seen in different ways on the land of India due to its diverse geographical features. The negative impact of climate change is seen on the land of Maharashtra and Marathwada. It can be said that Marathwada is known as a region prone to temperature increase and drought, which is a recent recognition due to climate change. Maharashtra has a tropical monsoon climate, with heavy rainfall during the monsoon season. Summers are very hot, and winters are cold.

Figure No. 1 Climatic Classification



Source : Climate of Maharashtra State, 2005, India Meteorological Department, Pune

Maharashtra is divided into four meteorological subdivisions, viz. Konkan-Goa, Madhya Maharashtra, Marathwada, and Vidarbha (Figure 1). The climatic subdivision of Marathwada includes the districts of Ch. Sambhaji Nagar, Beed, Hingoli, Jalna, Latur, Nanded, Osmanabad, and Parbhani. There is significant variation in the spatial distribution of rainfall in different parts of Maharashtra. Konkan-Goa in the Western Ghats is the rainiest region. Madhya Maharashtra and Marathwada receive less rainfall than Konkan and Vidarbha, mainly due to their location in the rain shadow region of the Western Ghats. To understand the climate of Marathwada, we need to know the general climate and temperature distribution of Maharashtra.

The climate of Maharashtra can be classified into the following main types:

a) Coastal and adjacent Ghat region: This region receives more than 100 cm of annual rainfall. The annual temperature range in the coastal region is very low, not exceeding 50° C. The average daily temperature is above 22° C throughout the year.

b) Dry climate: Generally, the districts of Madhya Maharashtra are included in this region. The average daily temperature is between 18 °C and 22 °C in winter and above 22 °C in the remaining months.

c) Tropical Rainfall: Marathwada and the entire Vidarbha region have a tropical monsoon climate. Precipitation is limited to the monsoon season only and is more than 70 cm.

The broad classification based on the Koppen classification is based on the difference in temperature and rainfall. Based on the above analysis, it can be said that Marathwada falls under the tropical monsoon climate type. Also, since Marathwada is in the interior of Maharashtra, it

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is far from the ocean currents, hence there is a huge increase in temperature here.

Impact of climate change on the agricultural sector in Marathwada:

a) Impact on food security

Precipitation is an important parameter in climate. It plays a crucial role in the lives of living and non-living things. It also affects various human activities like agriculture, mining, animal husbandry, inland fishing, etc. Agricultural activities mostly depend on weather factors such as rainfall, temperature, humidity, etc. The growth of crops depends on the increase in temperature, changes in rainfall, increased carbon dioxide in the atmosphere, and increased oxygen in the atmosphere. According to the Institute for Sustainable Communities, a private environmental organization, this research has shown that climate change has had a negative impact on major crops in Maharashtra. This report has concluded that due to the decrease in soil moisture in the monsoon season, the crop is damaged and the production is reduced. Considering Marathwada, the major crops of the Marathwada region, such as soybean, cotton, wheat, gram, jowar, bajra, sugarcane, etc., are affected by the weather. (Bhagawat & Nazareth, 2021)

b) Pest and diseases incidence

Another impact of climate change on the agricultural sector is that farmers' production decreases due to diseases or pests affecting crops. Farmers are also unable to cover investment costs. Many studies have shown that farmers in Marathwada are discouraged and turn towards suicide due to a lack of proper social security.

c) Precipitation and climate change:

Understanding the variability of rainfall in a rain-fed region is essential for planning agricultural activities. Marathwada experiences wide spatial and temporal variations in rainfall. This region is prone to water scarcity and drought conditions. The moderate drought conditions in Marathwada result in scarcity of surface and subsurface water resources in the region. The decline in agricultural income is leading to the migration of laborers dependent on agriculture to cities.

According to Skymet Climate Change, a private organization, Marathwada is the most drought-prone region. There are some major reasons behind this, such as the geographical location of Marathwada, which is seen as the reason for Marathwada not receiving rainfall. (Skymate, 2016) Marathwada is the most interior part of Maharashtra and is also far from the influence of the sea. Due to the huge Sahyadri mountain range, even the southwest monsoon rains cannot reach Marathwada due to this reason. Although the overall rainfall in the country is consistent, the distribution and area covered are irregular, which adversely affects the production of farmers. For example, Kharif crops - rice, maize, jowar, bajra, cereals, pulses, soybean, groundnut, cotton, which are known as monsoon crops, are very affected by the fluctuation of rainfall, while Rabi crops - wheat, barley, gram, linseed, mustard - are grown as winter crops; changes in temperature have a greater impact. Also, hailstorms have occurred in many parts of the state, over large areas, and for a long period. Such effects are likely to further aggravate the problems of the agricultural sector, which is already facing a severe crisis.

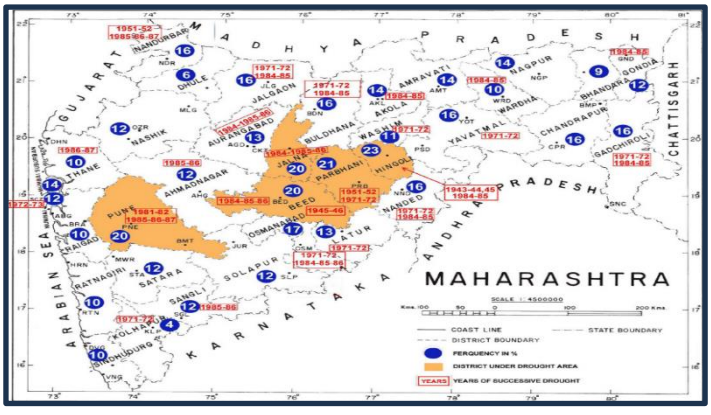
d) Climate change and agriculture allied sector:

If the farmers' crops fail, their income-generating secondary industries like livestock, poultry, and dairy farming have come under threat. Hailstorms and unseasonal rains destroy green or dry fodder. Also, livestock is adversely affected due to water and inadequate fodder, rising temperatures, and drought. (Mahapatra, Mahapatra, & Han, 2022). Climate Change also impacted the agriculture and its allied sector. In the Beed district, more than 50 percent farmers own livestock, primarily cattle, however, observations are number of cattle declined due to persistent drought conditions. Migration for livelihoods is prevalent, with more than 30 percent of families sending members for sugarcane cutting in neighbouring districts. (Pardhi & Thakur, 2024)

e) Drought and migration :

According to the India Meteorological Department, drought is defined as any area where the rainfall deficit is 26% or more of its long-term normal. It is classified as moderate drought and severe drought depending on whether the rainfall deficit is 26% to 50% and more than 50%, respectively. (IMD, 2005)

Figure No. 2 Probability of Drought and Drought Areas



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Source : Climate of Maharashtra State, 2005, India Meteorological Department, Pune

According to the Climate of Maharashtra report 2005 from the period 1914 to 1990, Marathwada, Beed, Hingoli, and Parbhani districts have experienced drought for 10 years; these districts fall under the drought-prone area. Other districts in the subdivision have experienced drought for 5-8 years. Most of the districts experienced drought in 1972 and 1985-86. (India Meteorological Department, 2005)

Hingoli district experienced severe droughts in 1941 and 1950. Maharashtra has a probability of drought of 16 percent and a probability of severe drought of about 2 percent. However, data shows that the Marathwada region has the highest probability of experiencing droughts compared to the rest of Maharashtra.

Table No. 01 Showing districts affected by successive droughts

Sr	Districts	Years of drought
1	Sambhaji Nagar	1984-1985-1986
2	Beed	1945-1946, 1984-1985-1986
3	Hingoli	1943-1945-1946, 1984-1985
4	Jalna	1984-1985-1986
5	Nanded	1971-1972, 1984-1985
6	Osmanabad	1971-1972, 1984-1985-1986
7	Parbhani	1951-1952, 1971-1972
8	Latur	1971-1972

Source: Complied from Climate of Maharashtra State, 2005

The table shows that most drought-affected districts of the Marathwada region in the period 1985-1986 are Sambhaji Nagar, Beed, Hingoli, Jalna, Nanded, and Osmanabad. Showing districts affected by successive droughts are more vulnerable to food security, employment and livelihood, extreme poverty, and migration to nearby urban areas.

f) livelihood and Farmers' Suicide:

The most vulnerable to the effects of climate change are the poor who are engaged in agriculture and highly dependent on the the agriculture for livelihood. Considering the last few decades, the number of farmer suicides is high, mainly in Marathwada and Vidarbha. In Maharashtra, 83.75% of suicides have occurred in the Vidarbha and Marathwada regions. A total of 29,602 farmers have committed suicide in Vidarbha and Marathwada between July 2001 and 2018. (Ade, 2021)The reasons behind these suicides are attributed to water scarcity, drought, lack of social security for farmers, and not getting fair prices for their crops due to untimely rains. However, many studies (ade, 2020) (Tikadar & Kamble, 2024)have found that climate change is the main reason behind all these consequences.

g) Water crisis

Climate change have adversely impacted water level table in the Marathwada region. Marathwada's arid climate and overexploited groundwater limit irrigation options. Study shows that majority villages in the Marathwada region has seen drop in groundwater level due to over-extraction of groundwater. It also affects the rural women's health as rural women face the burden of fetching water from a long distance for drinking and domestic use. (Deshpande, 2021) In addition lack of irrigation infrastructure and water management exacerbates agricultural crisis and adversely affects rural livelihood. (Rajale, 2025)

Recommendations

1. To cope with climate change vulnerability, adopt climate-resilient agriculture practices, including crop diversification, climate-smart agriculture, and precision agriculture. Drought-resistant seeds, improved water management, such

as micro irrigation, and watershed management, are great initiatives

2. Community-based agriculture practices like community farming, cooperative farming, Selp Help Group and gender sensitive initiatives should be adopted

3. Government role includes crop insurance, subsidies, and a climate forecasting mechanism, agricultural extension services, and farmer agriculture education. Policies aligned with the sustainable development goals enhances comprehensive and inclusive approach to development.

Conclusion:

The main reason why Marathwada is a drought-prone region is its geographical location. The effects of climate change in the Marathwada are not limited to the agricultural sector alone, but affect the entire rural It seems to have affected the economy, social life, and mentality. Collective efforts will be needed at local, national, and international levels to combat climate change. To cope with climate change vulnerability, adopting Smart-climate agriculture practices, such as encouraging the cultivation of climate-smart crops, heat-tolerant seed varieties, smart livestock practices, and precision-agricultural farming, is need of hours. Climate change is directly linked to food security and livelihood. Therefore, crops and seeds that are adaptable to climate change will have to be used in the future.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper

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