

P-ISSN: 2706-7483
E-ISSN: 2706-7491
NAAS Rating (2026): 4.5
IJGGE 2026; 8(8): 79-82
www.geojournal.net
Received: 16-06-2026
Accepted: 18-07-2026

Dr. Arjun K Katke
Department of Geography,
Shri Chhatrapati Shivaji
College, Omerga, Dharashiv
Maharashtra, India

Dr. Satish D Gavit
Professor, Shri Chhatrapati
Shivaji College, Omerga,
Dharashiv Maharashtra, India

A Geographical Study of the Impact of Climate Uncertainty on Agricultural Productivity in Latur District (2015-2026)

Arjun K Katke and Satish D Gavit

DOI: <https://doi.org/10.22271/27067483.2026.v8.i8a.852>

Abstract

Latur district, located in the Marathwada region of Maharashtra, is one of the most drought-prone districts in the state. Agriculture in the district is predominantly rainfed; therefore, climatic uncertainty—manifested through fluctuations in rainfall, recurring droughts, and rising temperatures—has a direct impact on agricultural productivity. This study examines the nature of climate uncertainty and its geographical impact on agricultural productivity during the period from 2015 to 2026.

The study is based on secondary data collected from District Socio-Economic Reviews, rainfall records, and Agricultural Production Index (API) statistics. Statistical analysis reveals a strong positive correlation ($r = 0.84$) between annual rainfall and the Agricultural Production Index. During severe drought years such as 2015 and 2021, the API declined by approximately 20-30 percent. Major crops, including soybean, pigeon pea (tur), and sugarcane, were the most adversely affected. Furthermore, the farmer suicide rate exhibited a strong negative correlation with rainfall ($r = -0.95$), indicating increased socio-economic distress during drought years.

The study highlights the urgent need to promote drought-resilient crops, strengthen watershed management practices, and formulate climate-resilient agricultural policies to ensure sustainable agricultural development in Latur district.

Keywords: Climate Uncertainty, Drought, Agricultural Productivity, Rainfall, Agricultural Production Index (API)

Introduction

Climate change and the resulting climate uncertainty have emerged as major global challenges for the agricultural sector. As India is predominantly an agrarian country, agriculture largely depends on the monsoon. The Marathwada region of Maharashtra is particularly drought-prone, and Latur district is one of the most vulnerable districts in this region. More than 70 percent of agriculture in the district is rainfed. Consequently, irregular rainfall, frequent droughts, and rising temperatures have led to significant fluctuations in agricultural productivity.

During the period from 2015 to 2026, Latur district experienced several drought years. Among these, 2015 and 2021 were the most severe drought years, with rainfall considerably below the long-term average. As a result, the Agricultural Production Index (API) declined sharply. The productivity of major crops such as soybean, sorghum (jowar), pigeon pea (tur), and chickpea (gram) decreased substantially. This led to increased economic stress on farmers and a rise in the number of farmer suicides. From a geographical perspective, these impacts need to be studied because agricultural productivity is influenced by the combined effects of soil type, topography, irrigation facilities, and local climatic conditions. The significance of this study lies in its close association with farmers' livelihoods and the rural economy. The findings will contribute to the formulation of climate-resilient agricultural policies. The study is entirely based on secondary data and employs appropriate statistical methods for analysis.

Study Area

Latur district is situated between $17^{\circ}52'$ and $18^{\circ}50'$ North latitude and $76^{\circ}18'$ and $77^{\circ}18'$ East longitude in the Marathwada region of Maharashtra, India. The district covers a geographical

Corresponding Author:
Dr. Arjun K Katke
Department of Geography,
Shri Chhatrapati Shivaji
College, Omerga, Dharashiv
Maharashtra, India

area of approximately 7,157 square kilometres (7.15 lakh hectares), of which about 6.65 lakh hectares are under cultivation. Administratively, the district comprises ten tehsils: Latur, Ausa, Nilanga, Udgir, Ahmedpur, Renapur, Chakur, Deoni, Jalkot, and Shirur Anantpal.

The soils of the district are predominantly black cotton soils, ranging from shallow to deep in depth. The climate is hot semi-arid, with an average annual rainfall ranging between 680 and 734 mm. The Manjara River and its tributaries constitute the principal sources of irrigation; however, the irrigated area remains limited. Being located in the rain-shadow region of the Western Ghats, the district experiences highly erratic rainfall. According to the 2011 Census, nearly 71.4 percent of the population is directly dependent on agriculture for their livelihood.

Objectives of the Study

1. To examine the uncertainty in rainfall and temperature in Latur district during the period 2015-2026.
2. To analyse the impact of climate uncertainty on the Agricultural Production Index (API) and the productivity of major crops.
3. To assess the relationship between rainfall and agricultural productivity.
4. To investigate the socio-economic impacts of climate uncertainty, including farmer suicides, migration, and indebtedness.

5. To suggest climate-resilient agricultural strategies based on geographical analysis.

Research Methodology

The present study is based entirely on secondary data. Data were collected from the District Socio-Economic Review (2010-11 to 2024-25), the Economic Survey of Maharashtra, reports of the Department of Agriculture, and published research papers. Information on annual rainfall, the Agricultural Production Index (API, base year 2010 = 100), and the farmer suicide rate was used for analysis.

The Pearson's Correlation Coefficient (r) was employed to examine the relationship between rainfall and agricultural productivity. Drought conditions were classified into Normal, Mild, Moderate, Severe, and Extreme categories. Statistical tables and graphical representations were prepared to analyse and interpret the data systematically.

Analysis of Climate Uncertainty

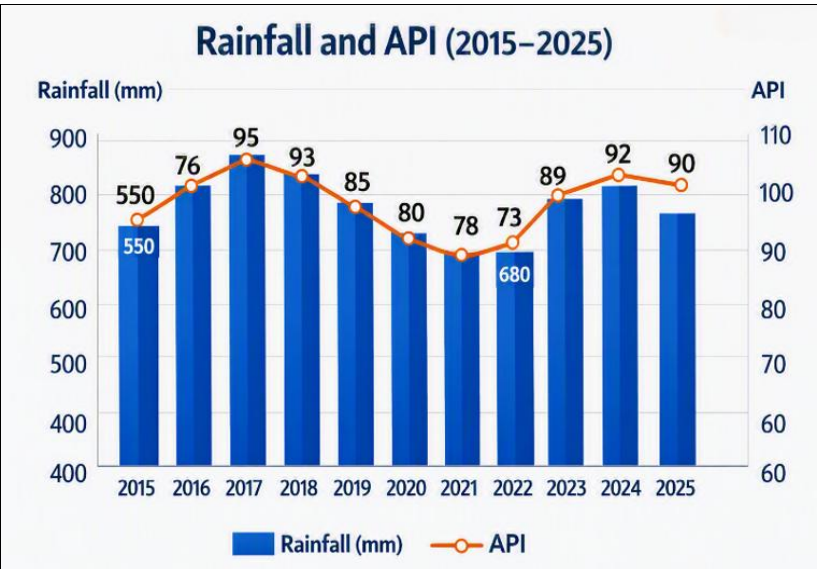
Analysis of Climate Uncertainty

Rainfall Variability

The average annual rainfall in Latur district is approximately 680 mm. However, considerable year-to-year fluctuations in rainfall were observed during the period 2015-2026, indicating significant climatic uncertainty. These variations have had a direct influence on agricultural productivity and drought conditions across the district.

Table 1: Latur District - Annual Rainfall, Agricultural Production Index (API), and Drought Status (2015-2026)

Year	Rainfall (mm)	API (Base Year 2010 = 100)	Drought Status
2015	550	76	Extreme
2016	820	95	Normal
2017	770	93	Mild
2018	650	85	Severe
2019	610	80	Severe
2020	590	78	Severe
2021	540	73	Extreme
2022	680	89	Moderate
2023	730	92	Mild
2024	610	98	Normal
2025	640	90	Mild-Moderate



The analysis indicates that the average annual rainfall of the district is 680 mm, with a standard deviation of 98 mm and a coefficient of variation of 14.42%, reflecting moderate

inter-annual variability in rainfall. The years 2015 and 2021 recorded the lowest rainfall and were identified as extreme drought years, resulting in a substantial decline in

agricultural production.

Temperature and Other Climatic Factors

The number of hot days has increased significantly over time. In 1960, the district experienced 147 days with temperatures above 32°C, whereas this number increased to 188 days by 2019. This trend is expected to continue under future climate change scenarios.

In addition, groundwater levels have declined considerably, and the depth of several wells has exceeded 600 metres, indicating increasing pressure on groundwater resources due to prolonged droughts and rising water demand. These environmental changes have intensified water scarcity and further reduced the resilience of the agricultural sector in Latur district.

Impact on Agricultural Productivity

The statistical analysis reveals a strong positive correlation ($r = 0.84$) between annual rainfall and the Agricultural Production Index (API) in Latur district. This indicates that higher rainfall generally leads to improved agricultural productivity, whereas drought conditions significantly reduce crop production.

During severe drought years, the Agricultural Production Index declined by approximately 20-30 percent. Water-intensive crops such as soybean, pigeon pea (tur), and sugarcane were the most severely affected. In contrast,

drought-tolerant crops such as sorghum (jowar) showed comparatively better resilience; however, their overall productivity also declined under prolonged drought conditions.

In the Kharif season, crops such as soybean and pigeon pea experienced substantial yield reductions due to erratic rainfall. Similarly, in the Rabi season, the productivity of chickpea and wheat was adversely affected by inadequate soil moisture. The years 2015 and 2021 witnessed extensive crop failures because of severe drought. Since only a limited area in the district is irrigated, agriculture remains highly dependent on monsoon rainfall, making crop production extremely vulnerable to climatic uncertainty.

Socio-Economic Impacts

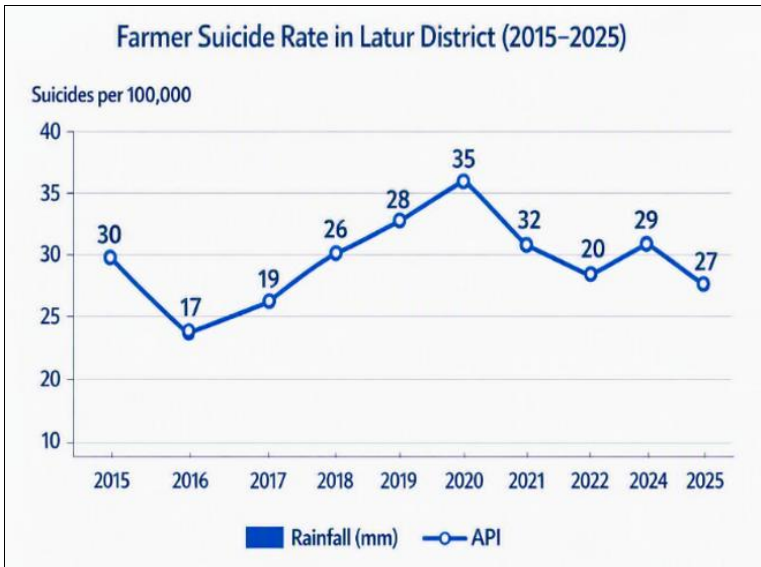
Climate uncertainty has imposed considerable economic and social stress on farming households in Latur district. Frequent droughts have resulted in increasing indebtedness, migration, school dropouts, and health-related problems, thereby affecting the overall well-being of rural communities.

The study found a strong negative correlation ($r = -0.95$) between annual rainfall and the farmer suicide rate. Lower rainfall and prolonged drought conditions were associated with a higher incidence of farmer suicides, reflecting the severe socio-economic consequences of climate variability

Table 2: Farmer Suicide Rate in Latur District (Per 100,000 Population)

Year	Farmer Suicide Rate
2015	30
2016	17
2017	19
2018	26
2019	28
2020	32
2021	35
2022	22
2023	20
2024	29
2025	27

Source: Compiled by the researcher based on secondary data.



The analysis of socio-economic impacts indicates that migration accounted for 30%, indebtedness for 25%, school

dropouts for 20%, health-related problems for 15%, and mental health issues for 10% of the major consequences

associated with climate uncertainty in the district.

Discussion

The findings of the study indicate that climate uncertainty in Latur district is closely associated with its geographical characteristics. The district is located in the rain-shadow region of the Western Ghats, resulting in highly irregular rainfall. Although the predominance of black cotton soils enables greater moisture retention, prolonged droughts eventually dry out even these soils, thereby reducing their capacity to support crop growth.

The limited extent of irrigation infrastructure has further increased the dependence of agriculture on monsoon rainfall. Consequently, climatic variability has a direct and substantial impact on agricultural productivity. The increasing cultivation of crops such as soybean, which require relatively higher water availability, has further heightened the vulnerability of the agricultural sector to drought conditions.

Prolonged droughts lead to reduced agricultural production, declining farm income and increasing indebtedness among farmers. These economic hardships often contribute to higher incidences of farmer suicides. The study also reveals geographical disparities within the district, with comparatively lower adverse impacts observed in areas having better irrigation facilities than in predominantly rainfed regions.

Conclusion and Recommendations

Conclusion

The present study concludes that climate uncertainty had a significant negative impact on agricultural productivity in Latur district during the period 2015-2026. A strong positive relationship exists between annual rainfall and the Agricultural Production Index (API), indicating that rainfall remains the most critical determinant of agricultural performance in the district. During extreme drought years, agricultural production declined by approximately 20-30 percent, accompanied by severe socio-economic consequences, including increased indebtedness, migration, and farmer suicides.

The study emphasizes that sustainable agricultural development in Latur district requires integrated approaches combining climate-resilient agricultural practices, efficient water resource management, and scientifically informed policy interventions.

Recommendations

1. Promote the cultivation of drought-resistant crops, such as sorghum (jowar), pearl millet (bajra), and indigenous pulse crops.
2. Strengthen watershed development programmes and promote rainwater harvesting to improve water availability.
3. Expand the adoption of drip and sprinkler irrigation systems for efficient water use.
4. Enhance the effectiveness and accessibility of crop insurance schemes to reduce farmers' financial risks.
5. Encourage organic farming and mixed cropping systems to improve soil health and climate resilience.
6. Develop taluka-level geographical planning and strengthen climate advisory services for farmers.
7. Establish mental health support services and counselling facilities for farming communities affected

by climate stress.

Future studies may utilize remote sensing, Geographic Information Systems (GIS), and climate modelling techniques to improve the accuracy of climate impact assessments. The effective implementation of climate-resilient agricultural policies will contribute significantly to enhancing the sustainability and resilience of agriculture in Latur district.

References

1. Jadhav VS. Statistical Analysis of Drought Impact on Agricultural Sector in Latur District, Maharashtra. *Int J Stat Appl Math.* 2025;10(7A):39-45.
2. Department of Agriculture, Government of Maharashtra. District-wise APY Estimates. 2025. <http://krishi.maharashtra.gov.in/>
3. Indian Districts. Agriculture - Latur. 2025. <https://indiandistricts.in/statistics/maharashtra/latur/agriculture/>
4. Katke AK. A Geographical Study of Change in Fruit Cultivation Area in Latur District. *Int J Geogr Geol Environ.* 2024;6(1).
5. Kelkar SM, Kulkarni A, Rao KK. Impact of Climate Variability and Change on Crop Production in Maharashtra, India. *Curr Sci.* 2020;118(8).
6. Zilla Parishad Latur. Agriculture Department. 2026. <https://zplatur.gov.in/en/agriculture-department/>
7. Agriculture Contingency Plan, District Latur. <https://agriwelfare.gov.in/sites/default/files/Latur.pdf>