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Impact of climate change on agriculture in Jalna district: A geographical study

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Abstract

In the rural societies of the Jalna District, agriculture is the primary livelihood activity and the mainstay of the communities. Climate change is expected to impact agriculture by increasing water demand, limiting crop productivity, and reducing water availability in areas where irrigation is needed. Agricultural activity in Jalna district mostly depends upon the monsoon seasons which is uneven. About 82.41% of the total working force is promised in agriculture and its allied activities. Jawar, Bajra, Wheat, Pulses, Groundnuts, Cotton, Sugarcane are the major crops. The late onset of monsoon and intermittent dry and wet spells has impacted the growth of soybean and cotton. Excessive rainfall during the mid-kharif season will increase fungal diseases, weeds, and pests. This is likely to impact the production of pods in soybean and boll development in cotton. Climate change can affect agriculture in a variety of ways. Outside a certain range of temperatures, warming tends to reduce yields because crops speed through their development, producing less grain in the process and higher temperatures also interfere with the ability of plants to get and use humidity.

Keywords: Climate variability and change, agriculture, rainfall, drought, and change cropping pattern

Introduction

This study estimates the possible effects of change in climatic factors on the production of major crops in Jalna District. Marathwada has a semi-arid climate with an average annual rainfall of 729.7 mm, and an average monsoon from June to September with rainfall of 606.4 mm. Rainfall recorded at the Krishi Vigyan Kendra Kharpudi, located near Jalna city, also shows a decreasing trend during the last two to three decades. In 2012, the station recorded barely 200 mm of rainfall. Furthermore, data from the Badnapur Research Station in Jalna Local perceptions of recent climate trends among farmers and officials in Jalna are that temperature has increased, rainfall has been decreasing, the onset of the monsoon has become behind and erratic, and the number of rainy days has decreased. Though there is insufficient data to analyse long-term trends in climate, it is clear that there are changes in the circulation of rainfall, both year-to-year and during the season, in Jalna ^[1].

Study Objective

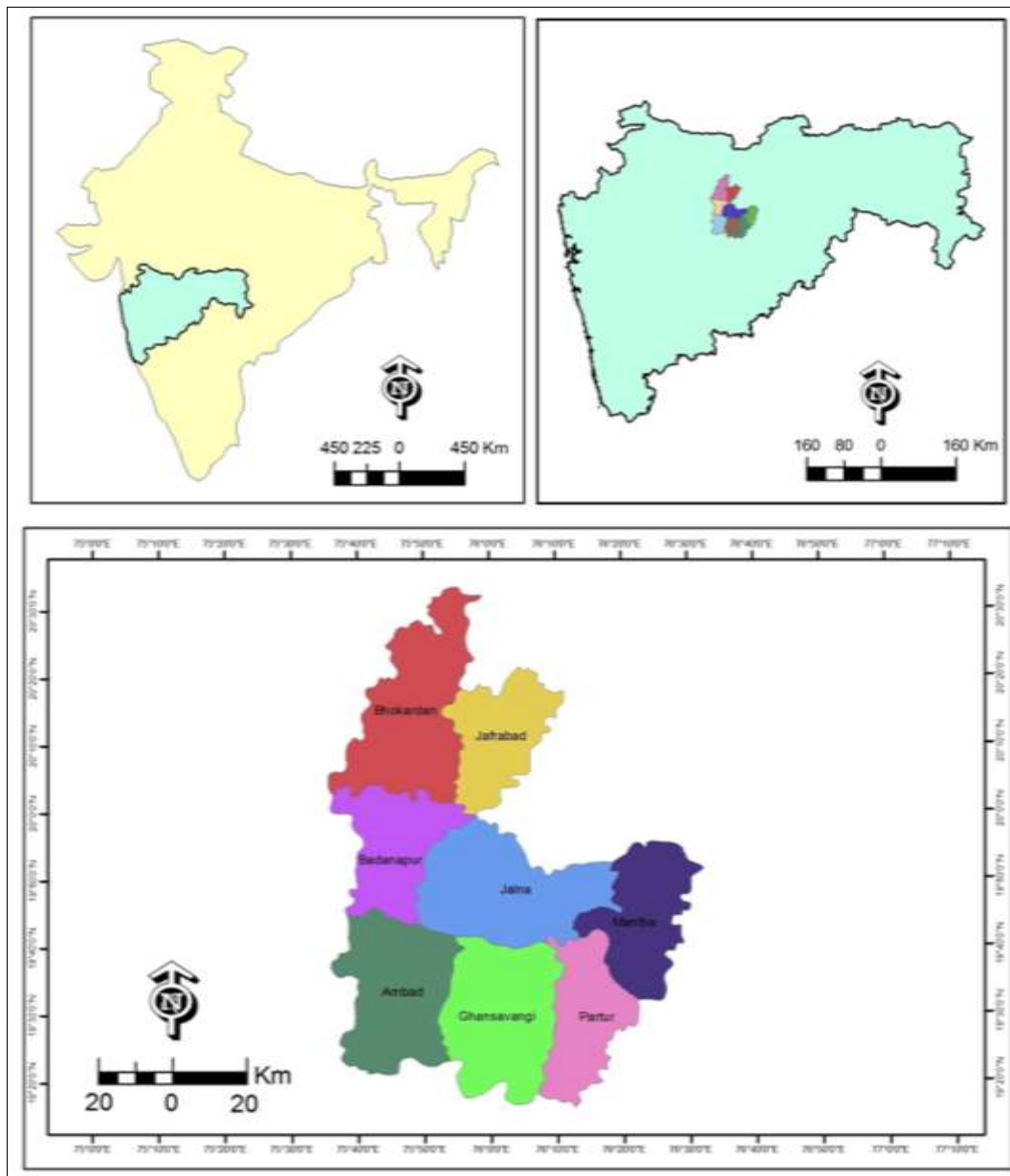
1. To study the geographical condition of Jalna District.
2. To identify the changes of agricultural impact in Jalna District.
3. To study effect of climate change on Crop Production.

Study Area

For the present study Jalna district has been selected. The district is located in the central part of Marathwada region in Maharashtra State. It is located between 190 15' and 200 32' North latitudes and 750 36' to 760 45' east longitudes. The North-South extension of Jalna district is 150 Kms and east-west stretch of the district is 110 kms. Jalna district has a significant location on Deccan plateau. Except Ajanta and Satamala range and river basins, majority part of the district comes under plateau region. The region has major portion under flat topography; hence it supports high concentration of population. Jalna district comprising 8 tahsils, 4 sub-divisions, and eight panchayat samities. The geographical area of Jalna district is 7727 Sq. KM. According to 2011 census, the total population of Jalna district has 19, 59, and 046 ^[2].

Out of this total population, the men population were 10, 11, 473, whereas women population were 9, 47, 573. Sex ratio in district is 937.

About 80.73% population lives in rural area on the other hand only 19.26% population lives in urban areas. The 2011 census shows about 71.09% literacy rate in the district [7-8].



Source: Survey of India

Map 1: Jalna District location map

Database and Methodology

The present study is based secondary source of data. Secondary data obtained from Economic Survey of Jalna District. The district has been taken as a unit for analysis of the cropping intensity in the study region [5]. To study the changes in Agricultural land use patterns over a period of time as well as in different decades the percentage of area under different categories of land use to the total reported area of Jalna was worked out and results are interpreted. Some of the simple mathematics and statistical tools like percentages, average, etc. have been used in the study.

Data Base

The present work is based on primary and secondary sources of data. Primary Data - Primary data is the raw data collected through various sources for which information collected from various farmers. Secondary Data-The

secondary data has been the major source and base for present study. Secondary data collected from Jalna district statistical Abstract, socio-economic abstract, Jalna district census handbook, department of Irrigation, district Land Record Office to obtain village-wise data on agriculture land use, agriculture statistical information from Zillah Parishads, Talathi offices, season and crop reports [6].

Causes of Climate Change

Human activities are the main reasons of Climate Change. Observations made in the last 50 years indicate that about 0.1o C per decade increase in atmospheric temperature has taken place. Industries, transportation, generation of electricity are the main reasons for the increase in temperature. Agriculture, forestry, and fisheries are sensitive to Climate Change impacts on the one hand, and are also contributing to emission on the other. Agriculture accounts

for 13.5 percent of global greenhouse gas emissions from fertilized soils, enteric fermentation, biomass burning, rice production as well as manure and fertilizer production.

Impact on Soil

The global Climate Change will have adverse effects on soil processes and properties which are important for restoring soil fertility and productivity. Increase in temperature, will reduce the soil carbon storage due to increased decomposition of soil organic matter by carbon dioxide emission, and ultimately leading to low water holding and nutrient supplying capacity. All these effects are highly region specific, depending on the greatness of the Climate Change, soil properties and climate condition ^[3].

Table 1: Crop Production Different in Jalna District

Sr. No.	Crops	Production (M.T.)	
		2000-01	2007-08
1.	Rice	200	50
2.	Jowar	76600	143500
3.	Wheat	27400	34200
4.	Bajra	65100	77300
5.	Maize	48100	128500
6.	Other Cereals	398	800
7.	Gram	7500	12100
8.	Pules	18300	33800
9.	Black Gram	5140	8800
10.	OtherPulses	3900	18300
11.	Sesanum	650	600
12.	Groundnut	2200	900
13.	Sugarcane	356000	723800
14.	Cotton	206500	270400
15.	Chillies	400	500
	Total	818388	1453550

Source: Socio-Economic, Abstract, Jalna district (2006).

Impact on water resources

The Climate Change will have impact on the predictability and variability in the availability of water, and also increase in frequencies of floods and droughts. The climate change indicate an increase in the average temperature by 2-4 °C during that period, India is heavily dependent on the monsoon to meet its agricultural needs and also for protecting the rich biodiversity. Subtle changes have already been noted in the monsoon rain patterns ^[10].

Impact on land

Rising sea levels owing to Climate Change would force communities in low-line coastal areas and river deltas to shift to higher ground levels. This migration of people would result in direct conflict and competition between migrant and established communities for access to land and water ^[9].

Climate change can affect agriculture

Through their direct and indirect effects on the crops, soils, livestock, and pests. Increase in temperature can reduce crop duration, increase crop respiration rates, the survival and distributions of pest populations, and thus developing new equilibrium between crops and pests, hastens nutrient mineralization in soils, decrease fertilizer use efficiencies, and increase in evapo-transpiration. Climate change also have considerable indirect effect on agricultural land use in India due to availability of irrigation water, frequency and intensity of inter- and intra-seasonal droughts and floods,

soil organic matter transformations, soil erosion, changes in pest profiles, decline in arable areas due to submergence of coastal land, and availability of energy ^[4].

Table 2: Tahsils wise co-efficient of variation of rainfall in Jalna District

Sr. No.	Tahsil	Co-efficient of Variation
1.	Jalna	22.12
2.	Bhokardan	37.18
3.	Badnapur	28.40
4.	Ambad	29.30
5.	Jafrabad	32.13
6.	Partur	29.25
7.	Ghansawangi	33.13
8.	Mantha	30.65

Source: Socio-Economic Abstract, Jalna District. (2011)

Critical challenges that agriculture sector would face in the event of climate change are

1. Water availability as result of changing rainfall patterns, variation in stream flow, and increase in crop water demand.
2. Worsening of water quality due to sea water imposition, transport of salts from the deeper soil layers as a result of over-abuse of aquifers, and faulty irrigation practices.
3. Increased frequency and intensity of dangerous weather events such as droughts, floods, and hurricanes and these would affect the production levels more than the impact of mean changes in the climate ^[11].
4. Heat stress due to higher temperature at critical stage of the crop growth ^[12].
5. Unpredictable change in pest and disease load. There is also possibility of minor pest becoming major pest with altering climatic condition.

Conclusion

Climate change effects on agriculture are likely to be total, both in terms of shortest and indirect impacts

1. Continuing plant health across the planet, in turn, is a key must for climate change mitigation, as well as the protection of biodiversity and the provision of ecosystem services under global change. Information collected so far has been fragmented and a comprehensive analysis of climate change impacts on agriculture is required. Untried research on a diverse range of crop biotic and abiotic systems is necessary to improve knowledge of climate change impacts on agriculture.
2. To maintain ecosystem health and services under variable, unpredictable, or unknown conditions, we need more resilient systems, decentralization, participatory research, and breeding networks. At the same time, increased involvement of the many stakeholders and scientists from outside plant pathology shows the importance of considering trade-offs with other objectives ^[13].
3. Increasing diversity would be in favour of a land-sharing approach, but may be relevant also to land-sparing scenarios depending on the spatial and temporal scale and the type of diversity genetic, species, species turnover, and ecosystem considered ^[14].
4. Climate change impacts, mainly in form of propulsions in temperature and rainfall patterns is likely to be

detrimental for the growth and development for each of the four crops, Soybean, Cotton, Wheat, and Gram in Maharashtra. The section below summarizes the key impacts for each of the crops based on the analysis of climate data and farmer interactions^[15].

5. Improving quality of inputs, Dissemination of better management practices, improved access to technology, improving soil fertility, enhancing rainwater harvesting and groundwater recharge, and Creating improved crop varieties for cultivation.

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