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Impact of the 2015 Drought on Rural Livelihood - A Case Study of Masurdi Village in Latur District of Maharashtra, India

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Abstract: ***Drought is a global phenomenon. It mainly affects on agriculture and allied sector activities. Agriculture plays a substantial role in the development ofrural economies in the least developed countries, where agriculture largely depends on rainfall. The present study examines the impact of the 2015 drought on rural livelihoods in a Masurdi village of Latur district of Marathwada region, Maharashtra state. This paper is based on both primary as well as secondary data sources. The multistage sampling method is used for primary data collection. The 100 households sample survey data has been collected from the village through a semi-structured questionnaire. The rainfall data were obtained from the Department of Revenue, Office of Divisional Commissioner, Aurangabad, from 1991 to 2018. The study also examines climate variables' impact on the Latur district's total food grain production from 2000 to 2018 for 19 years. A multiple regression model is used to analyze the relationship between climatic variables and the total food grain production. The study finds that, out of 100 households, 24 are landless, 41 are marginal cultivators, 30 are small cultivators, 4 are medium cultivators, and only one is large. In the OBCs category, out of 42 households, 8 (19.05 %) are landless, 18 (42.85 %) are marginal, 15 (35.51 %) are small, and only one is a medium cultivator household. In the open category, 9 (28.12 %) are small cultivators. 6 (18.75 %) are landless households, 15 (86.87 %) are marginal cultivators, and only two households are large and medium cultivators. In the SCs category, out of 26 households, 8 (30.76 %) are marginal, 6 (23.07 %) are small cultivators, 10 (38.86 %) households are landless, which is more proportion than other categories, and only two are medium cultivators. The study has recorded a significant deficiencyin rainfall in 1991, 1992, 1994, 1997, 2009, 2014, 2015, and 2018, whereasin 1988, 1996, 1998, 2005, 2010, and 2016, there was recorded excess rainfall. The 2016 was the most excess rainfall year reported over the years from 1991 to 2018, where there was 1110.92 mm rainfall recorded, and in the year 2015 found a significant deficit in the rainfall where there was 413.48 mm rainfall recorded. The study found a significant depletion in livestock assets; farmers sold their livestock due to severe water scarcity and fodder problems; before the drought, the total number of livestock of the sample households was 85 (including goat, bullock, buffalo, etc cows). It is reduced tremendously in the drought year 2015, which was only 25. Crop production decreased tremendously due to inadequate rainfall in the drought year 2015. Approximately 27.43 % of the workforce migrated from rural to urban areas to searchfor jobs. About 48 % of the households' children faced education difficulties; they were not going to school during the drought. . Many households benefited from state government schemes, like drought subsidies, crop insurance, and bank loans. Out of 100 households, about 50 (50 %) have obtained financial support from the state government's subsidy scheme, 58 (58 %) have got crop insurance, and 41 (41 %) irrigated households have got bank loans from National banks; besides that, only two families have obtained loans from their relatives and moneylenders.***

Keywords: Rainfall, Drought, Agriculture, Maharashtra, Household

1. Introductoon

During the twentieth century, human and animal deaths, migration, financial losses, and social effects were widespread in Asia, Africa, America, Europe, and Oceania. Frequent drought in Africa and Asia still results in misery, erodes livelihood, damages the natural ecosystem's integrity, and causes disease and deaths due to poor-quality water and hunger (Sharma, 2004). Drought is extensively Known as an insidious hazard because of its complex and unique features. Drought disasters have brought enormous economic losses and significant social and environmental impacts worldwide (Xinyu Fu1 et al., 2013). In South Asia, millions of people face numerous challenges regarding food security and stability for their livelihood due to the climate's erratic nature (Hariharan et al., 2018). According to the IPCC report 2014, climate changes have affected over the past century in Asia, where it is reported that increasing the number of warm days and temperature extremes. Variability and trends in extreme rainfall have been found among various regions of Asian countries. Climate change has created many challenges in Asia, such as water scarcity, food security, food production, human health, livelihood, poverty, rapid urbanization, and sustainable development (IPCC, 2014). India has a long history of famines. Millions of people died due to starvation in the nineteenth and twentieth centuries (Mishra et al., 2019). According to the World Bank report 2006, India is the second-highest severe drought-affected county in Asia (Sam et al., 2020). Approximately 90 lakh farmers were adversely affected by drought in Maharashtra, its massive impact mainly in the Marathwada and Vidarbha regions. The 2015 Drought negatively impacted agriculture and allied activities, which has declined Kharifand Rabi crop production (Kakodkar, 2015). The government officially declared thatthe drought influenced over 29000 villages in Maharashtra, mostly in the Marathwada and Vidharbha regions (2016, May 12, Economics Time). It poses the following question. What is the drought impact on agriculture cultivators and labor in the study area?What difficulties did they face in the drought period, such as

Domestic water supply, education, credit, insurance, livestock, out-migration, employment, and crop production? The study's main objective is to study the social and economic consequences of the 2015 drought on rural livelihood, particularly in the study area. The study is classified into five parts; the first part deals with the introduction of the study. The second part provides a brief review of the literature. The third part presented the research design, the four-part described the result, and the last part covered the conclusion and policy measures.

2. Review of Literature

This study has gone through extensive literature. There is literature available on local, regional, national, and global levels. There is no study on drought at the household level in the study area. Hence, the researcher has chosen Masurdi village for a case study in the Latur district of Maharashtra in 2015. Latur was one of the most severe drought-affected districts among Maharashtra's Marathwada region.

GovindKatalakute et al. (2016) examined the impact of drought agriculture and social and economic activities of farmer communities in Maharashtra, India, from2011 to 2015. The study used graphical presentation techniques for data analysis. The study found that the rainfall decreased drastically in the Pune and Aurangabad divisions, with the severe impact of drought on the agriculture and allied sector activities in 2014 and 2015. People migrated from rural to urban areas to search for jobs. The highest number of farmer suicidal cases were reported in the Maharashtra's cotton belt areas. About 50 % pulses, oilseeds and cotton productivity decresed in the year 2014-2015. The farmers have shifted from traditional crops to cash crops like turmeric, banana, and sugarcane, requiring more water than cereals and pulses. **Udmale et al.** (2014) pointed out that the rural farming community's perception regarding drought and its effects on their socio-economic activities, and environment, at the household level. The study reported that consequences of drought on rural farmers' households at the households level such as households lose their employment, reduction in income, decresed in spending on festivals. In addition, it was found conflicts for water in society, effect on schooling children, population migration, hopelessness sense of losses, and failure of crop production. Furthermore, it was observed an increase in the average atmospheric temperature during the drought year compared to the normal year and dame to fish habitant wild life, and ground water deplation has also repoted. Based on these findings, the study suggests that the government helps farmersto promote various micro and macro-level administrative strategies to combat drought. Farmers should be changed their traditional food irrigation practices and adopt new irrigation practices such as sprinkler anddrip irrigation to increase crop production. **Ashraf and Routray (2013)** analyzed drought impacts on orchard farmer's agro-based practices. The paper mainly focused on understanding drought perceptions byfarming households and their coping and adaptive mechanism. This study is based on primary and secondary sources. The primary data was collected from 215 farm households following a structured questionnaire survey in north-west Baluchistan of Pakistan. A multistage sampling technique was employed to collect the survey data. The field survey was conducted from May to June 2011. The study pointed out that the farmers' perception of climate change and drought variability factors such as increased temperature, decreased precipitation, change in the rainy season, and other factors like the inadequate supply of electricity for irrigation, over exploitation of groundwater, and population growth. Moreover, they also reported that farmers significantly lost their orchard production of apples, grapes, and apricot. **Habiba and et al. (2012)** evaluated that farmers' perceptions and awareness relate to drought and climate change among the marginal, small, medium, and large farmers in both irrigated and non-irrigated areas. . The data conducted from both primary and secondary sources. The primary data has been collected from 718 farm households by a semi-structured questionnaire using a sample random sampling technique at the village level from two severe drought-prone districts of north-western Bangladesh between October and November 2010. They pointed out that climate and weather have changed for over30 years. Those non-climatic issues were accelerated drought severity in the irrigated and non-irrigated areas like to stop over-exploitation of groundwater, increasing population, sediment on the river, deforestation, lack of dragging river and canal. Furthermore, it has shown the tremendous impact of drought on agriculture, animal husbandry, fisheries, education, health, and daily life. **Udmale and et al. (2015)** evaluated the severity of the impact of drought on local water supply, crop production, unskilled rural employment, and rural households' financial status in 2012. The study was based on primary and secondary data. The primary data was collected by interviewing 223 households from the upper Bhīma catchment in central Maharashtra. The study found the severe impact of drought on domestic water supply. People fetchedmore water from distant sources in the drought yearcompared to a normal year, and they spent more timeon fetching water from remote areas with the help of bicycles, bullock-kart, tanker, and some people fetched water using their physical effortes. It also indicated the consequences of drought on reduction in income, damage of crop production, loss employment, and farmers compelled to borrow money from various sources such as money lenders, self-help groups, and relatives for different purposes. **Opiyo and et al. (2015)** pointed out various aspects of drought, adaptation, and coping strategies among the Turkana pastoralists of north-western Kenia. The study is based on multiple data sources, including 302 households' interviews, focus group discussions, and long-term rainfall data. The study shows that the majority of the respondents engaged in livelihood diversification activities. They were engaged in both climatic and non-climatic activities to complementof pastoralism. A maximum pastoralist adopts a long-term adaptation strategy. They believe in education, which helps a family memberto find better jobs in the modern sector. In addition to, many respondents sent their children to school to get quality food through school nutritional programs. Pastoralists adopted some coping strategies in the drought period; meanwhile, they slaughtered old and weak livestock and sold bush products, fuelwood, charcoal, migrated urban areas to search for jobs, and reduced food consumption. **Sam et al. (2020)** studied impacts of drought on rural households in the Balangir district of Odiasha. This paper is employed both qualitative and quantitative techniques to analyzeprimary data. The study reported that agricultural production

decreased tremendously, and various health issues arose during the drought; households reduced to rice and cereal consumption. The study suggested that fair price shops open in villages areas and weather based micro insurance implement to manage the loss of yields. **Carpena (2019)** investigated drought impacts on food expenditure and micronutrient consumption among India's rural households. The study found that dry shocks have a statistically significant and negative effect on rural household nutrition. It also observed that drought negatively affects the quantity of food and the food quality. **Dallmann and Millock (2017)** studied the impact of climate variability on internal migration using India's census data. The study calculated the standard precipitation index to measure drought's frequency, duration, and magnitude. The estimation results found significant effects on bilateral migration rates from drought frequency, with an average effect of 1.5%. For agricultural states, the effect of drought frequency is 1.7%. The bilateral migration rates increased following an increase in the magnitude of drought in agricultural origin states. Drought frequency has a robust effect on rural to rural inter-state migration. **Quandt, (2021)** described the impact of drought on smallholder farmers in Kenia. The qualitative research method is used for survey data analysis. The study illustrated that drought reduced agricultural crop production, livestock starvation, death, migration, water shortage in rivers, human hunger and disease, and violent conflict. **Hamal et al., (2020)** evaluated drought impact on crop yields across Nepal from 1987 to 2017. The study reported the most severe drought years over the three regions during the study period, which were 1992, 2006, 2009, 2012, and 2015. Furthermore, the study observed that soil moisture of various areas, in spring and winter season drought causes water tress due to that reduced summer maize and winter wheat yields**. Singh et al., (2013)** examined the drought impact on the rural livelihood of 10 villages of Meghalaya. They found that farmers sold their livestock during the drought due to green fodder and water unavailability. Furthermore, income from the various sources was negatively impacted by drought, such as the income of fisheries was heavily affected, followed by rice, vegetables, other crops, and animals. National Commission on Agriculture (NCA) has classified drought into three categories. metrological drought, hydrological drought, agriculture Drought (Bokil, 2000) . This study tries to investigted the impact of drought on rural farmeres household of a village related to agriculture drought.

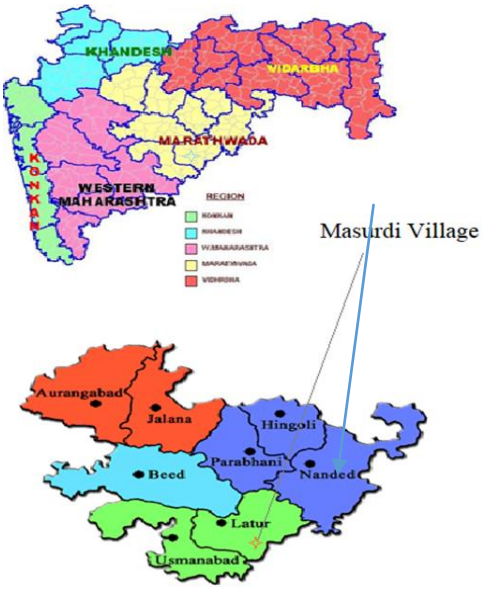
3. Methods and Materials

3.1 Study area

According to the 2011population census, Maharashtra has 112, 374, 333 total population, which is 9.3 % of India's total population. The geographical area is 9.4 percent, the rural population is 7.4 percent of the country. The state's national income was 13.8percent compared to Indiain 2019-20 (http://mahasdb. maharashtra.gov. in). Latur is a district place which is situated in the Marathwada region of Maharashtra. It has an ancient history. It was the native place of Ratta or Rashtrakutas. Amoghvarsa was the first king of Rashtrakutas. He developed the Latta or Lattaalura (Latur) town. The Rashtkutas called themselves the residents of Lattaalura. They seem to have formerly belonged to this place. They came in power after the Badami's Chalukyas in 753 A. D. (District Socio-Economic Review of Latur, 2017; District Census Handbook Latur, 2011). The district was provisionally ceded to the British Regim in 1853. It was reverted to Hyderabad state in 1860, with headquarters at Naldurga. Then it had known as the Naldurga district. In 1904, the Naldurga district was abolished. Furthermore, a new district formed that name was Osmanabad. It had most of the area that came under the Nizam's estate in the Marathwada region. It was called "Sarf-e-Khas. " (District Census Handbook of Latur, 2011). The Sarf-e-Khas merged into the Bombay state after the military action taken by India's government in 1947. Maharashtra separated from earlier Bombay state on May 1, 1960 (Bombay state, including Gujrat). Latur lies in the South-East of Maharashtra on the border of Maharashtra and Karnataka. Earlier the district was part of Osmanabad district. It was separated on August 16, 1982, from the Osmanabad district. It locates in the basin of Manjra and Tavarja Rivers. It has 10 Blocks, seven towns, and 928 villages, including 20 isolated villages (District Socio-Economic Review of Latur, 2017; District Census Handbook of Latur, 2011). Masurdi village belongs in the Latur district of the Aurangabad Division of Maharashtra state. It is situated 23 km. from Ausa Block and 43 Km west direction from Latur district. As per the 2011 population census, the total village population is 1971. Out of that, 1051 are males, and 917 are females. The total population in-between the age group of 0 to 6 is 246. Out of that, 131 are males, and 115 are females. The total number of households is 431. The scheduled caste population is 303, of which that 159 are males, and 144 are females. The village literacy rate is 66.51 percent, the male literacy rate is 58.97 percent, and 41.03 percent is female. Total cultivators are 798, of which that 454 are males and 344 are females. The total number of primary workers is 1065.

3.2. Location of the study area

Maharastra State



Marathwada Region

Source of the maps: http://slideplayer.com/slide/4456500/, http://msdb.gov. in/msdb/Marathwada1/newvidarbha_map. jg

3.3 The procedure of sample data collection

The study used a multistage sampling method for primary data collection. In the first stage, the Latur district was selected purposively based on water scarcity and low rainfall in 2015. The village has been chosen in the second stage due to decreased crop production, employment, severe drinking water problems, and livestock asset depletion. Meanwhile, 625 people migrated from the village. Therefore the Rajya Sabha Member, Mr. Sanjay Kakade, adopted the village under the Sansad Adarsh Gram Yojana (SAGY). Moreover, ultimately the 100 households were selected randomly from the village using a structured questionnaire. The study also employed descriptive statistics wherever necessary. Key informant interviews, focused group discussion, and SPSS software are used for tabulation purposes.

3.4 Key informant interview

The personal level interview has been taken for the study, such as village Sarpanch, Gramsevak, Talathi, Mandal officer in both Tehsil and block level, the Taluka agricultural officer and Resident deputy collector at the district level. The researcher also collected the information from editor of the local newspapers: Lokmat, Dainik Sakal, Maharashtra Times, PunyaNagari, etc. Further, The local journalist who those has been covered local news at the village level in the drought period of 2015. After discussed with all the village has been selected.

3.5 Rainfall deviations

The study also calculated rainfall deviations to find out the drought and normal years. According to drought manual 2016, the rainfall deviation calculated using the following formula.

RF dev = { (RFi – RFn) / RFn}*100
Where,
RFi = current rainfall (mm) for a comparable period and
RFn = normal rainfall (mm) (at least 30 years average) for the same period.

3.6 Multiple Regression model:

This paper examines the climatic variable impact on the Latur district's total food grain production for 19 years from 2000 to 2018. A multiple regression model was employed to determine the relationship between climatic variables and total food grain production of the Latur district. The climate variables are such as annual rainfall, maximum temperature, and minimum temperature. The study considered that Climatic variables are independent variables and food grain production as the dependent variable. Many studies used a multiple regression model (ordinary least squire technique) to evaluate the impact of climate change on agriculture crop production and productivity (Guntukula, 2020; Parthasarathy et al., 1988; Kelkar et al., 2020; Sarker et al., 2014) . The study developed a multiple linear regression model, which is used following the regression equation.

$$yi = b_1 + b_2\, rainf_t + b_3 maxtemp_t + b_4 mintemp_t + u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

yi = total foodgrain production (“00” tonnes), $rainf_t$ = annual rainfall (mm), $maxtemp_t$= average maximum temperature (℃), $mintemp_t$ = average minimum temperature (℃), u_t = error term.

4. Results and Discussion

4.1. Profile of the Householdsrespondent's

The village households' profile depicts category-wise distribution, including religion-wise distribution, family types, housing status, gender, marital status, age group, and household education status.

Table 1: Category wise distribution of the village Households

Sr. No.	Category	Total	Percentage
1	OBCs	42	42 %
2	Open	32	32 %
3	SCs	26	26 %
4	Total	100	100

Source: Auther's calculation from Primary data, 2015

Table No.1 depicts households' category-wise distribution from a Masurdy village in Maharashtra's Latur district. The data was collected from 100 households in the village. Among them, 42 percent belong to Other Backward Class (OBCs), 32 percent are Open, and 26 percent are Scheduled Castes (SCs) households.

Table 2: Religion wise classification of households

Sr. No	Category	Buddhist	%	Hindu	%	Muslim	%	Total
1	OBCs	00	00	40	95.27	02	4.76	42
2	Open	00	00	31	3.13	01	3.13	32
3	SCs	17	65.38	09	34.62	00	00	26
4	Total	17	17	80	80	03	03	100

Source: Auther's calculation from Primary data, 2015

Above table.2 describes the religion-wise classification of rural households; out of 100 Households, 80 percent of households belong to the Hindu religion, 17 Percent are Buddhist, and only 3 percent are Muslim households. In the OBCs category, out of 42 households, 40 (95.24 percent) Households are Hindu, and only 2 (4.76 percent) Families are Muslims. In the Open category, out of 32 households, 31 (96.88 percent) are Hindu, and only 1 (3.13) households Belong to Muslim. In the SCs category, out of 26 households, 17 (65.38) are Buddhist, and 9 (34.42) households are Hindus.

Table 3: Housing Status of Households

Sr. No.	Category	Hut	Kuccha	Pacca	Old house	Total
1	OBCs	2	34	4	2	42
2	Open	1	23	7	0	32
3	SCs	1	24	1	0	26
4	Total	4	81	12	2	100

Source: Auther's calculation from Primary data, 2015

Table 3 gives information about households' housing status. Out of 100 houses, 4 are hut, 81 are Kuccha, 12 are Paccas, and 2 are old houses. It means that many people living in Kuccha houses in the village. Only 2 are the old houses, and they belong to OBCs.

Table 4: Family and gender-wise classification of village households

Sr. No.	Category	Nuclear	Joint	Total	Category	Male	female	Total	Percent (%)
1	OBCs	34	8	42	OBC	92	75	167	38.04
2	Open	30	2	32	Open	65	58	132	28.02
3	SCs	12	14	26	SC	80	69	149	33.94
4	Total	76	24	100	Total	237	202	439	100

Source: Auther's calculation from Primary data, 2015

The above table 4 shows family and gender-wise information of the households. Out of 100 Families, 76 are nuclear families, and 24 are joint families. In the OBCs category, out of 42 families, 34 are Nuclear, and 8 are Joint. Total Open Families are 32 out of that only two families are joint families in the Open category, and the other is nuclear. It is a low ratio in the joint family. In the SCs category, the Nuclear and Joint ratio is nearly similar. Table no.3 also explains the category-wise gender analysis of household members; out of 439 respondents, 237 (55.99) are male, and 202 (46.01) are female. In the OBC category, out of 167 respondents, 92 (55.09) are male, and 75 (44.91) are female; in the Open category, out of 123 households, respondent 65 (52.85) are male, and 58 (47.15) are female. In the SCs category, out of 149 household respondents, 80 (53.69) are male, and 69 (46.31) are female.

Table 5 Marital Status of the households Members

Sr. No.	Category	Single	Married	Separate	Widow	Widower	Total
1	OBCs	68	92	2	3	2	137
2	Open	50	66	1	5	1	123
3	SCs	64	78	1	5	1	149
4	Total	182 (41.46)	236 (53.76)	4 (0.91)	13 (2.96)	4 (0.91)	439

Source: Auther's calculation from Primary data, 2015

Table 5 explains the marital status of household members. Out of a total of 439 household members, 182 (41.46) are single, 236 (53.36) are married, 13 (2.96) are widows, and 4 (0.91) are both separate and widowers.

Table 6: Age group distribution of households' members

Sr. No.	Category	Below 6	6 to 14	15 to 30	31 to 45	Above 45	Total	Percent
1	OBC	15	28	48	35	41	167	38.04
2	Open	8	17	43	20	35	123	28.02
3	SC	13	28	51	16	41	149	33.94
4	Total	36 (8.20)	73 (16.63)	142 (32.35)	71 (16.17)	117 (26.65)	439 (100)	100

Source: Auther's calculation from Primary data, 2015

Table 6 shows the age group-wise distribution of household members in the Masurdi village of Maharashtra. Out of 439 Household members, 36 (8.20 percent) are under the age group below 6.73 (16.63 percent) belongs to the age group of '6 to 14'.142 (32.35 percent) belongs to the age group of '15 to 30', 71 (16.17 percent) are coming in the age group of '31 to 45', and 117 (26.65n percent) are from the age group of'Above 45'.

Table 7: Education Status of Households

Sr. No.	Category	Balwadi Up to 1	Primary 1 to 4	Secondary 5 to 9	SSC 10^{th} pass/ Fail	HSC 11 to 12 pass/fail	Graduate	Master	Illiterate	Total
1	OBCs	16	30	36	23	16	6	1	39	167
2	Open	9	17	32	15	19	3	1	27	123
3	SCs	13	28	48	15	10	4	0	31	149
	Total	38 (8.66)	75 (17.08)	116 (26.42)	53 (12.07)	45 (10.25)	13 (2.96)	2 (0.46)	97 (22.10)	439

Source: Auther's calculation from Primary data, 2015

Table 7 shows that out of 439 household members, about 342 (77.90 percent) members are literate, and about 97 (22.10 percent) members are illiterate. Furthermore, 75 percent have completed their primary education, 116 (26.42 percent) have completed secsary school esucation, 13 (2.96 percent) have received graduated degree and only 2 (0.46 percent) have master degree holders. The table describes that most of people have illitrated and completed their primary and secondary level education and only few people have completed higher level education.

4.2 Impact of drought on village households.

Out of 100 households, 24 households are landless, 41 are marginal cultivators, 30 are small cultivators, 4 are semi-medium cultivators, and only 1is a medium cultivator. In the OBCs category, only 6 (19.05 percent) households are landless more households of OBC, which are small and marginal cultivators. In the open category, ten households are landless, and only 1 is medium cultivators. In the SCs category, about 10 (38.86) households are landless, which is more proportion than other categories. Drought has negative impacts on livestock assets, agriculture production, employment, the effect on school-going children, bank credit, and migration. The drought negatively impacts livestock and fodder, which is found a significant loss during the drought period. Livestock and related activities support farmers to boost their income, which is mostly related to the farm sector (Biradar and Sridhar, 2003; Leister et al., 2015; Mare et al., 2018; Goswami et al., 2018). The following cart No.1 described livestock asset status before the drought period, during the drought period, and after the drought period. There was a severe drought during 2014-15 to 2015-16, data collected after the drought year in December 2016-17, which was a rainy year, and 2013-14 was an average year that has taken as a before drought year. In that village, two small hotels were making only tea; in a drought period, one hotel was closed due to customer shortages, only one hotel was run. However, it did not open daily. Four retail shops and three pan shops were also available there, and their business was down; very few people came to shops and purchased fewer items than a normal year.

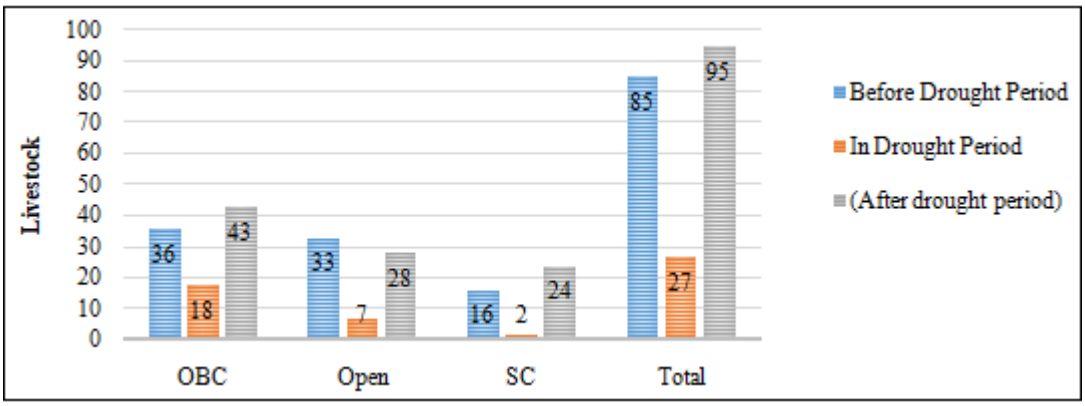


Figure 1: Livestock status of the village households
Source: Field survey, 2015

Figure 1 illustrates three periods' livestock status (all livestock added together like Cow, Buffalo, Goat, and Bullock). In a drought period, households sold livestock because of a lack of fodder and water shortages. Before the drought livestock, the total number of livestock was 85, but it is reduced tremendously in drought years. It was only 27. Biradar & Sridhar, (2009) indicated that the annual income of the farm households decreased to half in the 2003 drought year. It is also reported that livestock reduced by about 30 percent, and there was a significant difference found in farmers purchasing fodder during normal (50.92percent) and severe drought years (81.18percent). It was reported that 17.34 percent of households sold their livestock and the average herd size decreased from 4.15 ACU to 3.85 ACU. Furthermore, 70.80 percent of households have spent money on purchasing fodder, and out of them, 32.10 percent of households fed less fodder than the average quality. Ultimately the study indicated that the livestock was decreased durig the drought year 2003. Mare et al., (2018) examined the impact of the 2015 drought in South Africa on commercial livestock producers. The study found a significant impact of drought on average herd size, livestock feeding, and sheep population. A large number of cattle herd reduced in the drought year 2015 in many provinces. Vetter et al., (2020) examined goat and cattle census data and reported that about 43 percent of cattle farmers lost their cattle herd in the drought year 2015-16. Menghistu et al., (2018) observed the impact of the 2015 drought on smallholder farmer's livestock. It is found that tremendous loss in livestock reduction about (41.25 percent) cattle and (40.00 percent) poultry farming.

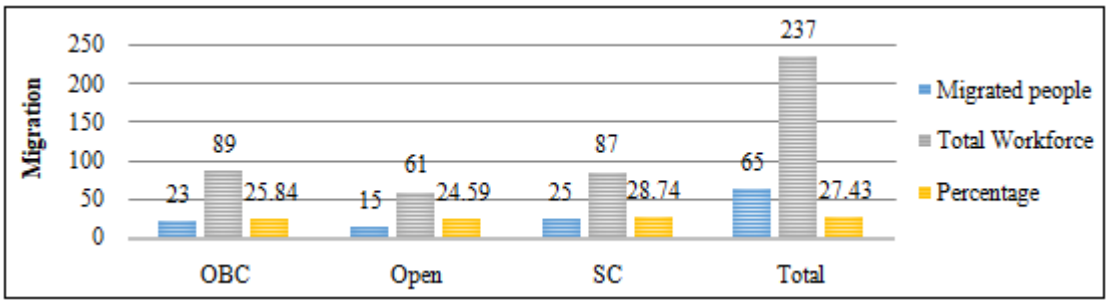


Figure 2: Migration of the village households
Source: Field survey, 2015

Figure 2 shows the information of migrated people in the drought period. Out of 237 workforces, 65 (27.43 percent) migrated because of the failure of agriculture, unemployment, and intensive water problems. The Marathwada region has been facing severe drought problems since 2011-12. Category-wise information shows that about 23 (25.84 percent) of the OBCs workforce, 15 (24.59 percent) of the Open workforce, and 25 (28.74 percent) of SCs workforce migrated from the village. Many young and older people migrated from rural to urban areas to search for jobs, and some families were also migrated with their children. They worked like cement workers in their migrated palaces, followed by making bricks, roadworks, security guards, building constructions, and driving heavy vehicles. The same kind of results was also reported in the study of Govind Katalakute et al., (2016). Afifi et al., (2014) found that the highest number of migrants farmers were reported among large farmers (2.46 %), followed by landless (1.18 %), after that medium and small farmers. Debnath & Nayak, (2020) observed that male out-migration has been abnormally high in drought-affected areas. Although seasonal and temporary movement occurs throughout the year, the severity of out-migration increases significantly during the drought year. A large number of landless, marginal, and small farmers resort to temporary out-migration to sustain themselves. People sold their livestock because of severe water scarcity and fodder shortages. They had spent more money on livestock fodder and drinking water.

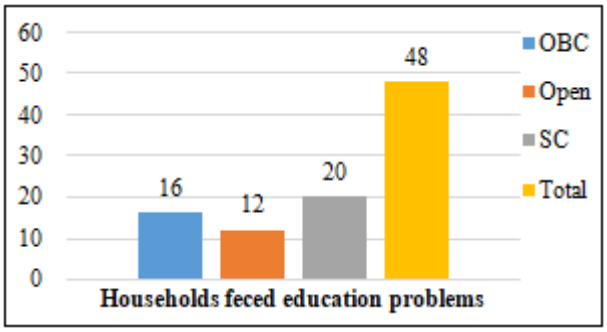


Figure 3: The school going children faced education troubles during the drought period
Source: Field survey, 2015

Figure 3 describes the educational situation in the drought period. Out of 100 households, 48 households children's were faced education problems because of drought. Government water takers came once a week; when they knew the water tanker had come to the village, that day, the student left their schools, they engaged in fetching water with their family members. In general, the students and family members were fetched daily water from the well which is 2 km away from the village. That was another reason they have not attended classes regularly. In a drought period, employment was not available in the village. Few students left their education permanently after completion of SSC and HSC. They migrated from rural to urban areas (like Pune, Mumbai, Nagpur) to take the job or earn money or give financial support to their families. For students studying in the school or colleges outside the village, their monthly expenditure was decreed because their family members could not provide adequate money. A similar finding reported by Udmale et al., (2014) found a significant impact of 2012 on school-going children. Furthermore, Joshi (2019) reported that a severe drought impact exam results and school attendance in rural Maharashtra.

Table 8: Status of Crop Insurance and Subsidy and Bank Loans.

Sr. No.	Caste	Subsidy	Crop Insurance	Bank Loans	Total Households
1	OBC	24 (57.14)	29 (69.05)	16 (38.10)	42
2	Open	17 (53.13)	18 (56.25)	20 (62.5)	32
3	SC	9 (34.62)	11 (42.31)	5 (19.23)	26
4	Total	50 (50.00)	58 (58.00)	41 (41.00)	100

Source: Field survey, 2015

Table 8 depicts that many households benefited from state government schemes (drought mitigation and relief), like drought subsidy, crop insurance, and bank loans. Out of 100 households, 50 (50 percent) have got a subsidy, 58 (percent) have got crop insurance, and 41 (41 percent) irrigated households have got bank loans from National banks; besides that, only two households have got loans from their relatives and moneylenders. The OBCs benefited more from crop insurance schemes than other categories. Their percentage was 29 (69.05). Out of 41 bank loan Households, about 20 (62.5 percent), Open Households have benefited more than SCs and OBCs.

Table 9: Annual rainfall deviations of Latur District From 1991 to 2018.

Sr. No.	Year	Average Rainfall	Actual rainfall	deviation	Ctegory
1	1991	738.39	492.22	-33.34	Deficient
2	1992	738.39	585.86	-20.66	Deficient
3	1993	738.39	679.1	-8.03	Normal
4	1994	738.39	459.5	-37.77	Deficient
5	1995	738.39	798.73	8.17	Normal
6	1996	738.39	966.35	30.87	Normal
7	1997	738.39	566.21	-23.32	Deficient
8	1998	738.39	1152	56.02	Normal
9	1999	738.39	788	6.72	Normal
10	2000	738.39	851.1	15.26	Normal
11	2001	738.39	729.7	-1.18	Normal
12	2002	738.39	612.5	-17.05	Normal
13	2003	738.39	748.1	1.32	Normal
14	2004	738.39	757.2	2.55	Normal
15	2005	738.39	1007.5	36.45	Normal
16	2006	738.39	806.7	9.25	Normal
17	2007	738.39	837.5	13.42	Normal
18	2008	738.39	709.6	-3.90	Normal
19	2009	738.39	526.4	-28.71	Deficient
20	2010	738.39	1010.4	36.84	Normal
21	2011	738.39	721.55	-2.28	Normal
22	2012	738.39	761.88	3.18	Normal
23	2013	738.39	847.48	14.77	Normal
24	2014	738.39	446.7	-39.50	Deficient
25	2015	738.39	413.48	-44.00	Deficient
26	2016	738.39	1110.92	50.45	Normal
27	2017	738.39	772.84	4.67	Normal
28	2018	738.39	515.22	-30.22	Deficient

Source: District collector office, department of revenue. Latur (2019).

The table 9shows the Latur district's annual rainfall and deficient and normal years from 1991 to 2018. In 1991, 1992, 1994, 1997, 2009, 2014, 2015, and 2018 there was a significant deficit in rainfall, and in 1996, 1998, 2005, 2010, and 2016, there was excess in rainfall. The year 2016 had the highest excess rainfall of all the years, with 1110.92 mm recorded, whereas 2015 had a substantial rainfall deficit, with 413.48 mm recorded.

Table 10: Regression result dependent and Independent variables

Variables	Coefficient	P. value
Rainfall	8.428834	0.00
Max Temp	882.0531	0.06
Min Temp	-38.93838	0.95
constant	-30951.26	0.06
No of observations	19	19

The regression results found a statistically significant impact of rainfall and average maximum temperature on foodgrain production, which are significant at 5% and 10 % significance levels. R^2 =0.73, the Durbin-Watson statistic is 1.78, and the F statistics probability is 0.000138. There is no autocorrelation in the series; a Breusch-Godfrey Serial Correlation LM Test shows the probability value is 0.79 (more than 0.5%). The data are normally distributed (Jarque-Bera probability Value is 0.48). Parthasarathy et al., (1988) reported the same result in their study; they examined the relationship between all India summer monsoon rainfall and all India annual food grain production of India. The simple regression model was applied for an estimation of Indian foodgrain production and summer monsoon rainfall. They found a significant relationship between percentage departure from all India summer monsoon rainfall and the annual foodgrain production index (significance at the 0.01 % level). Guntukula, (2020) analyzed the effect of climate change on the yields of primary food and non-food crops all over India. The study used time-series data for 58 years from 1961 to 2017. A multiple regression model was employed for examining the associations between climate variables yield of primary food and non-food crops. The analysis results found a significant effect of climatic variables such as rainfall and maximum and minimum temperatures on crop yields. However, the level of impact varies across the crops studied. The average maximum temperature has been observed a favorable effect on food and non-food crops only excluding rice. The average minimum temperature has negatively affected non-food crops but has a favorable impact on food crops.

Table 11: Annual rainfall deviations and crop production data over the Marathwada Region From 2000-01 to 2016-17

Years	Deviation	Cereals	Food grain	Pulses	Oilseeds	Cotton	Sugarcane
2000-1	4.72	26149	31162	4973	3335	4649	117974
2001-2	1.61	24279	29208	4929	3730	8122	107606
2002-3	-0.33	28455	35920	7465	8705	7461	100810
2003-4	-13.02	21964	28152	6188	7378	9148	56028
2004-5	-22.08	21744	27394	5650	6703	10316	41929
2005-6	18.26	26820	34187	7297	11371	11865	70725
2006-7	7.16	29438	36559	7121	8346	17769	250369
2007-8	-9.14	30789	40692	9903	11475	35334	238703
2008-9	-19.73	24752	30781	6031	6317	17752	136189
2009-10	17.78	24727	32132	7404	7311	20240	142145
2010-11	24.91	28461	39310	10849	16196	31251	150124
2011-12	-15.97	25265	33253	7989	15445	27715	167504
2012-13	-30.09	17844	25364	7520	17735	22751	124739
2013-14	9.37	28039	40255	12216	20579	34477	148752
2014-15	-46.85	16210	17001	5905	5758	10638	111560
2015-16	-44.33	8593	11373	2780	4453	9245	64200
2016-17	12.88	24342	43271	18929	13038	37620	46494

Source: Annual rainfall data collected Divisional commissioner office Aurangabad, Crop production data obtained from Agriculture Department Government of Maharashtra.

Table 10 illustrates theannual rainfall deviations and crop production data over the Marathwada Region From 2000-01 to 2016-17. It shows that crop production tremendously decreased in the drought years. In 2015, cereals, foodgrain, pulses, oilseeds, cotton, and sugarcane production decreased compared to other years.

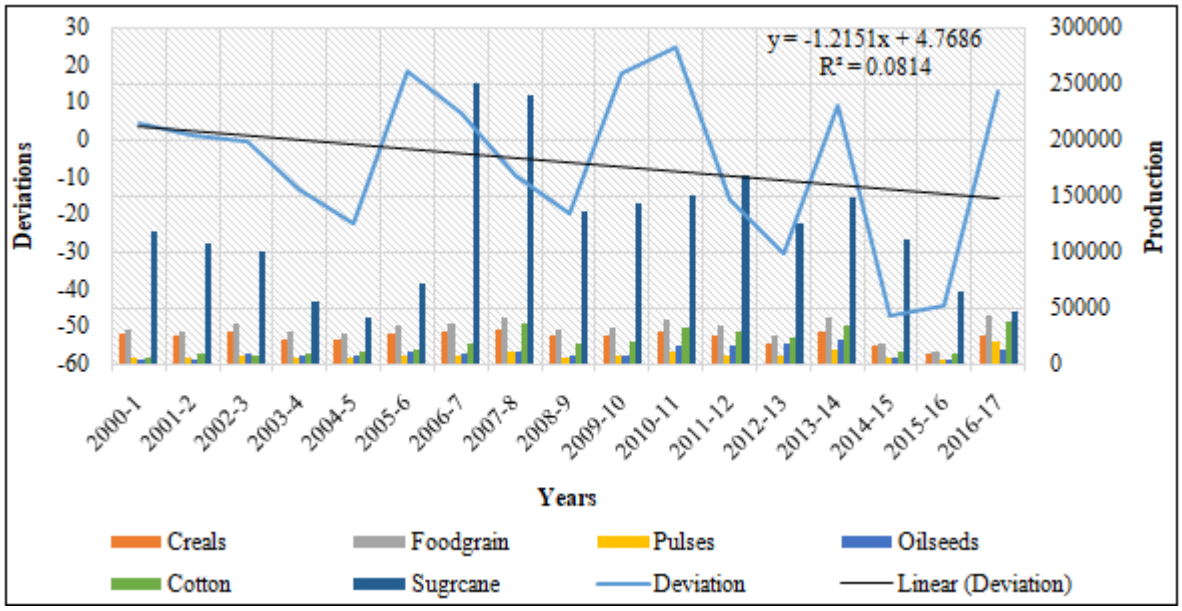


Figure 4: Annual rainfall deviations and annual crop production data over Marathwada region from 2000-01 to 2016-17
Sources: Auther's own calculations from secondary data.

Figure no. 4 depicts primary crop production and rainfall deviation all over the Marathwada region of Maharashtra. It is also shown that rainfall was low thatyear, crop production has decreased. There were three moderate drought years which were 2012-13 (-30.09 %), 2014-15 (-46.85 %), and 2015-16 (-44.33). In these three years, agricultural crop production had been decreased tremendously. Sugarcane production was reported minor after two consecutive drought years (2014-15 to 2015-16). Sugarcane production was stable in 2012-13, even though it had a deficit drought year. In 2006-07, sugarcane production was very high. Cereals, food grain, oilseeds, pulses, and cotton production decreased in 2015-16 compared to other years. The linear trendline shows a decreasing trend in rainfall (y =-1.21+ 4.76).

5. Conclusion

In conclusion, the study used multistage sampling techniques for data collection. The district and the village were selected purposively, and the 100 households were selected randomly. The village people faced severe drought problems in the last five years. The village population depends on agriculture and allied activities. Due to the failure of the monsoon, agriculture production and agriculture employment decreased. Many farm and non-farm

labor, some marginal and small cultivators, migrated from rural to urban areas (like Pune, Mumbai, and Western Maharashtra). In that village, most of the people are belong to the Hindu religion. Some Buddhists and a few Muslims family were also living there. Maratha community is dominant compare to other communities both in population and landholding size. More people engaged in agriculture-related activities, OBCs, SCs, and some landless Maratha families do not have land. They are working in the farming sector in the monsoon season and non-farm sectors in the remaining seasons. In the drought period, children were not going to school. They left their school and joined to bring water with their mother and fathers, sometimes they fetched water on their head or using a bicycle, near about 2 km from the village. In their school-going days, drinking water was not available in their schools, so the government declared holidays early in the educational, the academic year 2015-16 compared to another educational, academic year. Some college and 10^{th} class students left their educations due to financial problems. The regression results found a statistically significant impact of rainfall and average maximum temperature on foodgrain production, which are significant at 5% and 10 % significance levels. R^2 =0.73, the Durbin-Watson statistic is 1.78, and the F statistics probability is 0.000138. There is no autocorrelation in the series; a Breusch-Godfrey Serial Correlation LM Test shows the probability value is 0.79 (more than 0.5%). The data are normally distributed (Jarque-Bera probability Value is 0.48).

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