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A Study on Analysis of Parameters of Climate Change on Temporal Dimensions

P Sanjeevi* and K Mahandra kumar

¹Agricultural Extension, RVS Agricultural College, Thanjavur, Tamil Nadu, India

²Departments of Agricultural Extension and Rural Sociology, Agricultural College and Research Institute, Tamil Nadu Agricultural University (TNAU) Madurai, Tamil Nadu, India

Corresponding Author: P Sanjeevi, Assistant Professor (Agricultural Extension) RVS Agricultural College, Thanjavur, Tamil Nadu, India, E-Mail: sanjeevipalanivel@gmail.com

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Abstract

Monsoon failure is experienced in many parts of the country almost every year. The study was conducted in Namakkal district of Tamil Nadu state, with the objective to analyze the parameters of climate change such as amount of rainfall and number of rainy days in temporal dimensions during drought in Namakkal district. The secondary data were collected from research station and the data were analyzed using percentage analysis. The findings revealed that 6 years out of 10 years the total rainfall received in this district was below normal. Moreover, in four years (2009, 2012, 2013 and 2016) deficit of rainfall to the extent of more than 25 per cent was observed. And those years can be counted as drought years. There is also depletion in number of rainy days also observed from the data.

Keywords: Drought; Rainfall; Rainy days; Temporal and spatial dimensions

Introduction

India Meteorological Department (IMD) reported that approximately 16 per cent of India's geographic area, mostly arid, semi-arid and sub-humid is drought-prone [1]. Due to high temporal and spatial variability in rainfall and wide variations in physiographic and climatic conditions in the country, droughts are experienced in varying intensities (moderate or severe) almost every year irrespective of a good monsoon.

Priyan studied the spatial and temporal variability of rainfall in Anand district of Gujarat state, Long-term annual and monthly rainfall data (Monsoon months) are considered from 1901 to 2014 [2]. It was found out that spatial and temporal variability is high in the District for the last five years from 2010 to 2014.

Indicated that the mean annual rainfall for Bagepalli block of Karnataka over the 11-year period between 2001 and 2011 was observed as 598 mm [3]. Five (2001 to 2004 and 2006) of these 11-years received annual rainfall below the 11-year mean of 598 mm, with consequent years having a deviation of -33% to -66% from the 11th year mean, indicating significant decrease in rainfall.

Since 2001, the country has experienced Six major droughts, in the years of 2002, 2004, 2009, 2012, 2013 and 2016 severely affecting the various sectors and overall economic development of the country, the capacity to cope with the adverse impacts is steadily increasing due to improved technology, irrigation practices and partly due to diversification of rural economic activities away from pure farm activity. In order to assess the present study entitled as study to analyze the parameters of climate change in temporal dimensions during drought situations in Namakkal district with one of the objective to identify and analyses the parameters of climate change such as amount of rainfall and number of rainy days in temporal dimensions.

METHODOLOGY

Namakkal district of Tamil Nadu was purposively selected for this study, as it received normal rainfall only 2 years out of the past five years [4]. Since this study is focused on the parameters of climate change in temporal dimensions during drought in Namakkal district. Secondary data was collected from agro-automatic Weather Station from veterinary college and research institute, TANUVAS, Namakkal and joint directorate of agriculture, Namakkal. Here in this study, past 10 years (2008-2017) rainfall and rainy days data was collected and analyzed using percentage analysis.

RESULTS AND DISCUSSION

Parameters of climate change in temporal dimensions

The secondary data regarding the parameters of climate such as rainfall and rainy days for the past 10 years were collected from [5,6] agro-automatic weather station from veterinary college and research institute, Tanuvas, Namakkal and also from joint directorate of agriculture office, Namakkal. The results are discussed below.

Temporal analysis of rainfall

Agriculture in India is said to be a gamble on the monsoon. It is dominated mainly by nature, especially by rainfall. In farming business, nature is the master who proposes or disposes. The amount of rainfall is greatly influencing the cropping pattern of the area. The Namakkal district receives rainfall from both south west monsoon which starts from May to September, and north east monsoon brings the rainfall during October-November. The levels of rainfall received in the district for the past ten years are presented in the Table 1.

TABLE 1. Distribution of actual rainfall in Namakkal district for past 10 years.

S. No	Year	Total	South west monsoon		North east monsoon		Winter season		Summer season	
		Actual	Actual	%	Actual	%	Actual	%	Actual	%
1	2008	998	376	37.68	381	38.18	7	0.7	234	23.45
2	2009	537	245	45.62	223	41.53	1	0.19	68	12.66
3	2010	983	377	38.35	513	52.19	0	0	93	9.46
4	2011	837	289	34.53	338	40.38	23	2.75	187	22.34
5	2012	504	161	31.94	260	51.59	0	0	83	16.47
6	2013	517	225	43.52	228	44.1	13	2.51	51	9.86
7	2014	657	338	51.45	202	30.75	0	0	117	17.81
8	2015	732	281	38.39	248	33.88	28	3.83	175	23.91
9	2016	324	175	54.01	40	12.35	0	0	109	33.64
10	2017	911	472	51.81	310	34.03	3	0.33	126	13.83
Average	700	293.9	42.73	274.3	37.9	7.5	1.03	124.3	18.34	

Source: Agro-automatic weather station, veterinary college and research institute, TANUVAS, Namakkal [5].

According to the state meteorological department the average mean annual rainfall of Namakkal district is 776 mm. However, an average rainfall of 700 mm for the past 10 years is received in this district. Nearly 80 per cent of the rainfall was received during the south west and north east monsoon. Because of this bi-modal nature of rainfall distribution, Farmers could able to raise the crop from the month of June to December. In these rainy months farmers used to go for two seasonal crops like maize and groundnut or one annual crop like tapioca in rain fed area or turmeric in irrigated area with a help of supplementary irrigation through well. Where there is plenty of water resource is available in block like Kabilarmalai, farmers used to go for sugarcane and normally planting takes place in the month of December to January.

Since, a meager amount of rainfall (approximately 100 mm per month) was received in seven months of monsoon season, the farmers heavily rely upon drought tolerant crops and varieties. Moreover, this pattern of rainfall resulted in garden land situation in which majority of farmers exploit the groundwater through bore wells to protect their crops. As a result, heavy depletion of water table to the extent of 200 to 300 meters occurred in many places. Through the continuous use of ground water the water becomes salty with the PH of above 7.5 and EC of above 25°C (dS/m).

It could be observed from the (TABLE 2) that, 6 years out of 10 years the total rainfall received in this district was below normal. Moreover, in four years (2009, 2012, 2013 and 2016) deficit of rainfall to the extent of more than 25 per cent was observed. And those years can be counted as drought years. Except in the year 2014, the remaining five drought period out of 10 years less precipitation was observed in both south west monsoon and north east monsoon. A severe form of drought was observed in the year 2016 in which the precipitation was only 40 per cent of total normal rainfall. Because of these vagaries in rainfall, agriculture in the district was severely affected. Farmers are switching over to short duration crops and less water intensive crops. Migration of agricultural labourers to other places and

diversification from agriculture to other activities is also happening in rapid phase. This might be the important reason that in this district, animal husbandry in general poultry and egg production in particular are flourishing well compare to any other districts of Tamilnadu [7].

TABLE 2. Comparison of normal rainfall with actual rainfall for the past 10 years.

S. No	Year	South west monsoon		North East Monsoon		Winter season		Summer season		Total		Deviation (+ or - or =) from normal	Deviation %
		Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual		
1	2008	310.3	376	314.9	381	10.2	7	140.6	234	776	998	222	28.6
2	2009	310.3	245	314.9	223	10.2	1	140.6	68	776	537	-239	-30.8
3	2010	310.3	377	314.9	513	10.2	0	140.6	93	776	983	207	26.68
4	2011	310.3	289	314.9	338	10.2	23	140.6	187	776	837	61	7.86
5	2012	310.3	161	314.9	260	10.2	0	140.6	83	776	504	-272	-35.05
6	2013	310.3	225	314.9	228	10.2	13	140.6	51	776	517	-259	-33.38
7	2014	310.3	338	314.9	202	10.2	0	140.6	117	776	657	-119	-15.34
8	2015	310.3	281	314.9	248	10.2	28	140.6	175	776	732	-44	-5.67
9	2016	310.3	175	314.9	40	10.2	0	140.6	109	776	324	-452	-58.25
10	2017	310.3	472	314.9	310	10.2	3	140.6	126	776	911	135	17.4

Temporal analysis of rainy days

Not only the quantum of rainfall but also the numbers of rainy days are one of the important factors that decide the drought. Hence, the data pertaining to the number of rainy days was collected and tabulated in (TABLE 3).

TABLE 3. Time series analysis rainy days for the past 10 years.

S. No	Year	South west monsoon		North East Monsoon		Winter season		Summer season		Total		Deviation (+ or - or =) from normal	Deviation%
		Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual	Normal	Actual		
1	2008	25	19	21	24	2	2	12	15	60	60	0	0
2	2009	25	5	21	24	2	1	12	9	60	39	-21	-35
3	2010	25	25	21	40	2	0	12	8	60	73	13	21.67
4	2011	25	16	21	29	2	1	12	7	60	53	-7	-11.67
5	2012	25	18	21	14	2	0	12	8	60	40	-20	-33.33
6	2013	25	25	21	18	2	1	12	6	60	50	-10	-16.67
7	2014	25	24	21	29	2	0	12	11	60	64	4	6.67
8	2015	25	23	21	29	2	1	12	19	60	72	12	20
9	2016	25	28	21	7	2	0	12	7	60	42	-18	-30
10	2017	25	34	21	24	2	3	12	15	60	76	16	26.67

From the table it can be observed that the negative deviation of 12 to 33 per cent in rainy days was observed during drought years. This district received rain only for five days in south west monsoon in the year 2009 and seven days in north east monsoon in the year 2016 have resulted in severe drought in those period.

CONCLUSION

As a result, heavy depletion of water table to the extent of 200 to 300 meters occurred in many places. Through the continuous use of ground water the water becomes salty with the PH of above 7.5 and EC of above 25 °C (dS/m). Animal husbandry in general poultry and egg production in particular are flourishing well compare to any other districts of Tamilnadu, There is also depletion in number of rainy days also observed from the data.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between all authors. Author Mr. P. Sanjeevi is the student researcher who conducted the research, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author Dr. K. Mahandra kumar is the chairman of the advisory committee who laid out the plan of the research and managed the analyses of the study. All authors read and approved the final manuscript.

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