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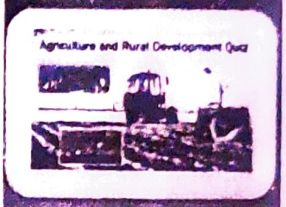

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[illegible] Rainfall Instability And Drought Prone Zones In Nashik District (1980-2021)

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Abstract:
Indian climate primarily Monsoon Rainfall and temperature is speculate for the Indian cultivators and the strategy makers in terms of variability. Temperature and Rainfall is a key responsibility performer in the Indian financial system & agricultural output. Irregular unpredictability of rainfall and temperature is the major reason behind the deficient economical situation of Indian cultivators moreover that it is also the challenge prior to the leading power to plan for the provincial imbalance. In the present section the Temperature and Rainfall Trend of the Nashik District from 1980 to 2021 is identified from this research by examining the trend over district. The district controlled by the SW Monsoon Season meanwhile followed by post monsoon season rainfall circulation is generally from western regions had surplus rainfall while centre region of the district having modest rainfall and eastern and south eastern region having shortage of rainfall. Nashik District is having vibrant geographical characteristics. Famine is the occurrence which affects the cropping pattern and agricultural development in study region.Climate is a main role player in economic development of the country especially rainfall matters must in the Agricultural development and the rural and Urban areas basic water needs .Now a day's Earth is facing unevenness of the overall rainfall pattern due to some physical and human made interruptions and wrong agricultural and industrial practices. In Maharashtra most of the area having rainfall scarcity, most of the Tahasils are affecting badly in the vicious circle of the drought and its dangerously connected with the Crime,Unemployment,Low living of Standard ,Slums ,Migration, unhealthy environment etc.We are trying to identify the problem and try to give some suggestion for betterment of Societies Well Being.

Key Words: Drought, Susceptible, Rainfall Fluctuation, Well-Being, Monsoon, Variability.

Introduction:

Drought Susceptible areas in Nashik District are identified from this research paper by examining the rainfall trend over district about 37 years; we have got maximum temporal data to analyze the character of the rainfall. The district influenced by the South-West Monsoon Season meanwhile followed by post monsoon season rainfall distribution is mainly from western parts having excess rainfall while middle part of the district having moderate rainfall and eastern and south eastern part having scarcity of rainfall. Nashik District is not regular, consistent, or equal natural relief and other geographical features. As well as District is located on the Deccan trap of the Maharashtra, Godavari, Tapi, and Girna River Basins are part of the district. Having all the natural wealth over here but due to some manmade calamities District faced some Environmental Challenges like increasing drought Prone Areas.The indecisive climate low rainfall and the poor sources of the irrigation in those region farmers are grown more than a few crops. In the conventional hurdle of farming system farmers grown more crops for gathering their family need in such areas elevated scale of crop diversification was seen. Environmental loss of land, soil is also one of the causes of the high crop diversification.

Study Region: Nasik district lying between 19°35'18" North latitude to 20°53'07" North latitude and [illegible] East longitude to 74°56'27" East longitude, with an area 15530 sq.km. and population of [illegible] as per the 2011 census. There are 15 Tahasil and 66 revenue circles are in the Nashik district. Nashik district is situated in the Deccan trap of Maharashtra which is partly in the Tapi Basin and partly in the upper Godavari Basin. The main stream of hills in the Sahyadri which is runs North-South in the western proportion of the district. Ajanta range which runs right across the district. It acts as a watershed between the Girna and its tributaries which drain towards the Tapi to the north and the Godavari and its tributaries to the south. More area of this region is in the rain shadow zone which is called as rain fed area. Drought is the phenomenon which affects the cropping pattern and agricultural development. So we are interested to find out some concrete solution for the agricultural development of this region.

Objectives:

1. To find out South-West Monsoon Trend of the Nashik District from 1980 to 2021
2. To evaluate spatial and temporal change in Rainfall

3) To Identify Drought susceptible Tahsils in Nashik District

Methodology: This study is depending upon last 37 years data of rainfall which is obtained from 'India Meteorological Department, Pune and Hydrological Department, Nashik. We are using following Statistical methods for analysis of Drought prone areas of the District.

1. Mean is calculated by using the following formula

$$\bar{x} = \frac{\sum x}{n}$$

Where, $\bar{x}$ = mean Σx = is the sum of the rainfall value
n = total number of values.

2. Trend Analysis by Statistical Technique
3. Geoinformatics (Arc-GIS) for Mapping Drought Susceptible Areas

Connotation: Drought is the result of Variability of Climate. Climatology is the scientific study of Spatio-temporal characteristics and variation of climatic elements like rainfall, temperature, evapotranspiration, humidity, pressure, winds and air masses. The climate is the average study of weather. The standard average periods for climatic analysis are 30 years defined by the World Meteorological organization (WMO). Here we are Concern with the Rainfall as a one major component of the Climate and directly connected with the droughts.

A.South-West Monsoon Rainfall Characteristics

Here we are discussing the South-West Rainfall Characteristics of Study Area Mainly for Monthly and seasonally for better understanding of Rainfall fluctuations during the 37 Years.

Sr. No.	Tahsil	Months											
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	Surgana	5.14	3.14	15.34	35.68	57.36	678.14	800.74	832.14	512.36	166.32	89.12	6.32
2	Peth	4.25	3.25	20.14	41.23	62.35	704.15	936.14	879.41	402.36	145.32	78.1	7.14
3	Trimbak	6.32	4.25	29.36	52.31	57.64	806.25	1100.14	976.14	415.37	198.65	73.56	5.69
4	Igatpuri	9.32	5.69	21.03	78.36	64.25	945.17	1324.56	1000.23	391.25	276.35	92.36	12.36
5	Nashik	3.56	3.14	14.68	41.23	40.12	547.36	700.14	568.94	287.36	198.32	66.32	7.31
6	Dindori	3.01	2.14	15.36	34.12	41.25	541.02	600.25	501.23	275.63	178.24	54.36	6.32
7	Satana	3.14	2.36	17.36	24.31	32.14	438.12	546.23	500.69	300.1	145.36	56.17	2.36
8	Kalvan	2.14	2.47	17.69	20.14	25.1	406.58	547.90	481.23	278.36	166.33	42.37	3.01
9	Niphad	2.69	2.14	14.2	21.03	28.34	400.12	412.35	469.36	398.65	145.26	47.65	2.13
10	Sinner	2.00	1.56	9.36	15.36	25.36	356.12	314.17	457.16	298.21	110.02	43.27	3.01
11	Yeola	1.12	1.02	10.24	18.36	21.03	304.25	356.21	354.12	201.54	98.36	28.64	2
12	Chandvad	0.46	0.7	10.23	16.35	21.48	289.36	300.14	289.65	233.66	87.32	30.14	2.14
13	Nandgaon	0.78	0.8	11.25	17.25	18.23	450.17	278.65	247.36	146.35	84.21	28.36	1.24
14	Malegaon	0.49	0.45	6.35	17.36	17.12	301.47	307.69	268.14	200.01	79.36	22	0.98
15	Deola	0.14	0.36	7.32	12.14	14.23	248.32	294.15	276.35	188.66	66.32	17.24	0.76
Nashik District		**2.97**	**2.24**	**14.67**	**29.69**	**35.08**	**494.4**	**588**	**540.1**	**288.7**	**143.1**	**51.32**	**4.189**

Table: 1 Monthly Average Rainfall (in mm) Nashik District Year: 1980-2021

Above table (**Table: 1**) shows the monthly rainfall characteristics of the rainfall for the period from 1980 to 2021 .Mainly the distribution of rainfall is uneven in all the Tahsils in the month of December, January and February rainfall is very less for all the Tahsils During March, April and May having Moderate and During October and November it was normal. During June, July, August and September that is South West Monsoon Period Rainfall is Excess to Normal in The District.If we are considering rainfall During June, July, August and September that is South West Monsoon Period Surgana, Peth, Trimbak and Igatpuri Tahsils having more than average rainfall among them Igatpuri Tahsil having excess rainfall .While Nashik, Dindori, Satana, Kalvan and Niphad having normal rainfall but Sinner, Yeola, Chandwad, Nandgaon, Malegaon and Deola Tahsils are having Scarcity of Rainfall compare to others .That's why they are more susceptible for Drought in the Study region.

Sr.No.	Tahsil	South -West Monsoon Season Average Rainfall in MM (June-Sept.)
1	Surgana	705.849
2	Peth	640.8895
3	Trimbak	824.48025
4	Igatpuri	915.30925
5	Nashik	525.9555
6	Dindori	479.535
7	Satana	446.2935
8	Kalvan	428.52325
9	Niphad	420.12475
10	Sinner	356.4215
11	Yeola	304.0355
12	Chandvad	278.20775
13	Nandgaon	280.6395
14	Malegaon	269.330475
15	Deola	251.87325
Total Average		471.8311983

Table: 2 South -West Monsoon Season Average Rainfall Nashik District Years: 1980-2021

Above table(**Table: 2**) shows the South-West Monsoon rainfall characteristics for the period from 1980 to 2021 rainfall During June, July, August and September Surgana (705.849mm), Peth (640.8895mm), Trimbak (824.48025mm) and Igatpuri (915.30925mm)Tahsils having more than average rainfall among them Igatpuri Tahsil having excess rainfall .While Nashik, Dindori, Satana, Kalvan and Niphad having normal rainfall but Sinner (356.4215mm), Yeola (304.0355mm), Chandwad (278.20775mm), Nandgaon (280.6395mm), Malegaon (269.330475mm) and Deola (251.87325mm) Tahsils are having Scarcity of Rainfall compare to others .That's why they are more susceptible for Drought in the Study region.The trend of temperature and rainfall will be trending unfavorable direction in the future also; it portrayed the decreasing trend line. The fall in average rainfall and fall in the area under different crops and rise in the temperature and fall in the area under different crops is difficult for the forth coming years; it would be reflected in the agricultural outcomes and in the well beings of the farmers as well as it would be reflected in the scarcity of the water.Trend Graph **(Fig.: 1)** also shows the clear picture of the uneven distribution of the rainfall over the study region during whole period average. Igatpuri Tahsil SW region of Study area having high Rainfall while Deola Tahsil having low Rainfall which is situating North Eastern of study region. Following Malegaon NE region, while Nandgaon, Yeola and Sinner SE region of study region having low trend of rainfall.Remaing Tahsils namely Nashik, Dindori, Satana, Kalvan and Niphad having Moderate Trend of rainfall distribution over the study region during the Year 1980 to Year 2021.

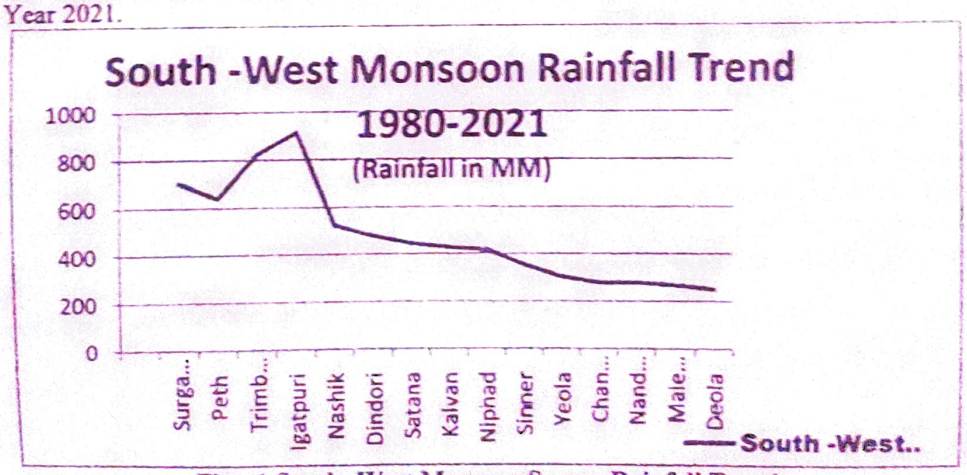

Fig.: 1 South -West Monsoon Season Rainfall Trend

Climate is constantly altering, and dynamic in temperament it is altering because of lot of factors included Physical, Chemical, Human made & Socio-Economic .Climate is a set of all weather elements and

represents the summation or performance of these element for long period of time that is more than three decades. Climate transformation is alteration in middling condition of the Weather essentials over a long period of time particularly the change in arithmetical allocation of the weather conditions. Climate alteration substantiations are seen in the study area in the form of change and deviation in the rainfall, intensifying temperature level, repeatedly incidence of famines, dryness or low down intensities of moisture had observed in the region. Trend of average mean temperature demonstrates the increasing trend for the district for computed period. The trend of the temperature shows the ever-increasing still from the beginning, the low average mean temperature was recorded in the year 1980 it was $23.64^{0}{}_{c}$ and the high average mean temperature was seen in the year 2013 it was $25.01^{0}{}_{c}$ and from the year 1980 to the year 1992 the temperature trend was had around the $23^{0}{}_{c}$ and change around the $0.64^{0}{}_{c}$ to the $0.99^{0}{}_{c}$ the constant average temperature The trend of the average rainfall shows the decreasing still from the beginning, the low average rainfall was recorded in the year 1996 it was 245.79mm and the high average rainfall was seen in the year 1980 it was 941.22 mm and from the year 1980 to the year 2016 the rainfall trend was had the uneven trend. Sometimes it shows the drastic rise or some years it shows the drastic fall in the levels of average rainfall.

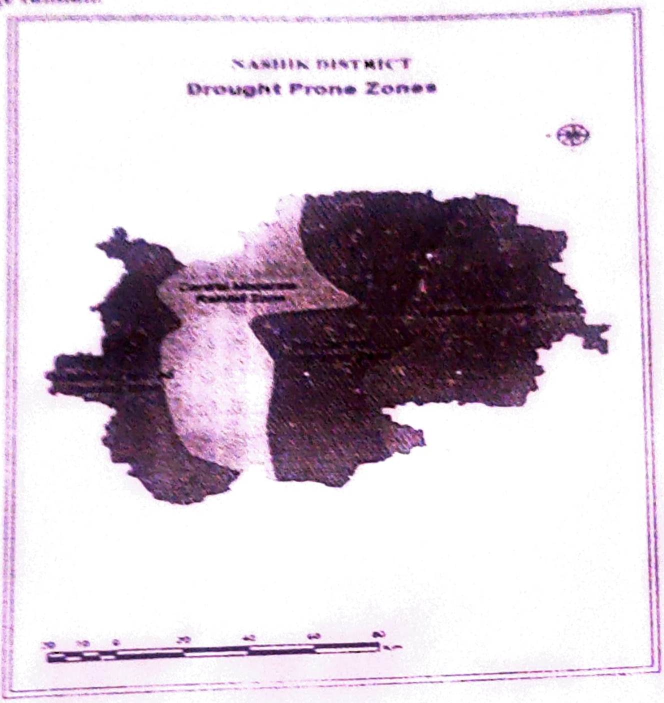

Fig-2 Drought Susceptible Tahsils in Nashik District

B. Drought Susceptible Tahsils in Nashik District

Map (Fig.:2) showes the drought prone/Susceptible Tahsils in Nashik District Mainly North East,South West and Eastern Part of the District having more valnurable to the drought because of unfavarable physical setting of the area and wrong industrial and agricultural practices .Also this part belongs to the Rainfed area .The main stream of hills in the Sahyadri which is runs North-South in the western proportion of the district. Ajanta range which runs right across the district. It acts as a watershed between the Girna and its tributaries which drain towards the Tapi to the north and the Godavari and its tributaries to the south.Mainly because of Ajanta and Sahyadri ranges Western part of district have more than avearage rainfall but apposit of the Sahyadri ranges and Monsoon wind the area not get proper condensed clouds that's why this area belongs to drought prone area.

Conclusion:

More area of this region is in the rain shadow zone which is called as rain fed area. Drought is the phenomenon which affects the cropping pattern and agricultural development. The present study will help to understand the relationship between Droughts and Rainfall Pattern, the influences of other factors, like Soil, water supply and technology, represented by mechanization, pest and disease control, and the other agricultural management aspects. Although these factors are crucial in agriculture and crop yield. Scientific crop planning is possible through an understanding of Agroclimatic potential of the Study Region. The region is facing problems of the Deforestation, wild life is becoming rare, soil erosion is common, water level is very deep, and soil fertility has been reduced in some of the Drought Prone Tahsils

in Nashik. Most of the region having uneven Climatic and Physiographic Condition. There is regional imbalance in water resource and management. Some parts of Region having wrong Agricultural Practices. Lack of Awareness within the farmers and civilians is on climate change issues for further adaptation and mitigation. There is a Scope for Sustainable Development of the Region.

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