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Identification of Probable Water Scarcity Zones
in Marathwada Region of Maharashtra.

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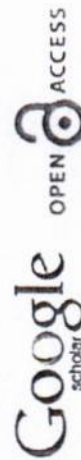
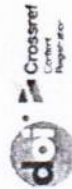
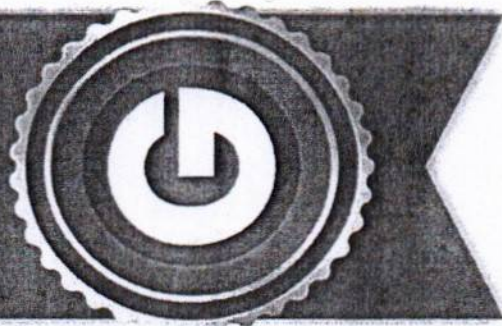
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Identification of Probable Water Scarcity Zones in Marathwada Region of Maharashtra.

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Abstract-

The drought and water scarcity problem varies significantly from one region to another and also from one year to another. Recurring drought is a major challenge in the drought and water scarcity prone area of Maharashtra state in India. Agriculture is the main source of capitals in this region, the near about 64.14 % population depend on this sector. [7] The objectives of this study to identify and demarcate probable water scarcity zones in Marathwada region. This study is based on primary and secondary dataset.

Groundwater is major source of water which is used for different purposes. Such as agriculture, domestic use and industrial sector etc. but the level of groundwater is depending on precipitation. We conclude the water scarcity probability on basis of comparative analysis between average rainfall and groundwater level fluctuation in this region. This research redicts the probable water scarcity zones in Marathwada region.

Keyword- Rainfall, Water Scarcity, Drought, Zone, Groundwater

Introduction-

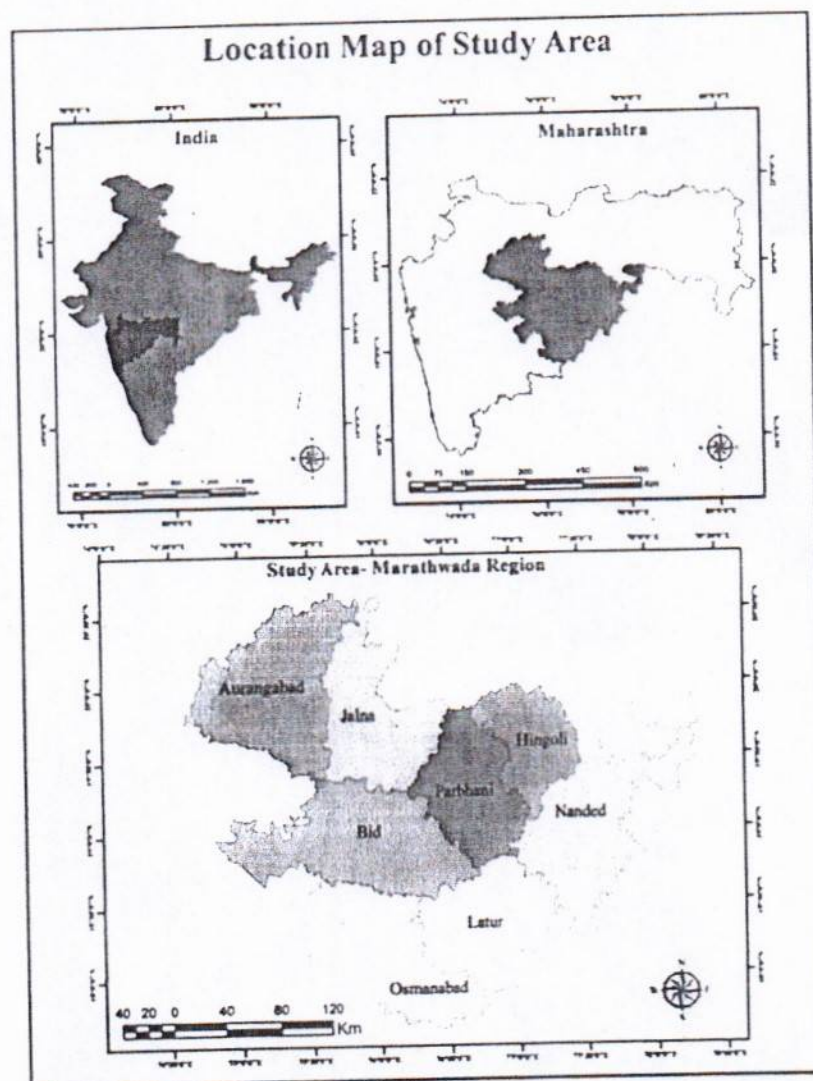
Water is one of the crucial vital elements of the environment. [7] Drought is creeping phenomenon; difficult to understand and define due to differences in hydro-meteorological variables and socio-economic factors along with the stochastic nature of water demand in various region of the world. [8] The semi-arid experienced frequently water scarcity and drought condition. The demand of water is increases in various sectors day by day but availability of water is decreased. Controversial ratio between rainfall and water demand is found in Marathwada region due to this area experienced water scarcity from last few decades.

The various research work had been done during and post-drought period in the region by the researcher, organization and government agencies for the identification of

drought and analysis of rainfall. [10] The present research work is denoting the probable water scarcity zone in Marathwada region.

Study area –

The Marathwada region is comes under the rain shadow zone of Sahyadri range in the Maharashtra state. The geographical extension of the study area is $17^{\circ}38'49.2''N$ to $20^{\circ}40'22.8''N$ latitude and $74^{\circ}35'49.2''E$ to $78^{\circ}22'04.8''E$ Longitude. The total area of study area is 389.29 Sq. Kms.



The Marathwada has covered 64590 Sq. Km. total geographical areas; it is 21% of Maharashtra state. The Marathwada division is administratively comprises of 8 districts. (Osmanabad, Latur, Bid, Aurangabad, Jalana, Hingoli, Parbhani and Nanded) According to

2011 census total population of Marathwada is 1,87,31,872. The annual average rainfall of the Marathwada division is 822 mm. The climatic condition of Marathwada division is dry and hot. The three fourth area of Marathwada division is covered by agriculture. Hence, drought is having a significant impact on the life of farmers. The severe and extreme drought conditions have frequently experience in major portion of Marathwada in the last few decades. The Godavari is Main River of this area which is play vital role in economic development of Marathwada.

Objectives-

The present study has undertaken with following objectives-

1. To assess the distribution of rainfall in Marathwada division.
2. To evaluate groundwater level in study region.
3. To identify probable water scarcity zones in Marathwada division.

Database and methodology-

The present study we are used secondary data; it is mainly based on rainfall data which is collected from Agricultural department of Maharashtra and Indian Meteorological department, Pune for current year. Groundwater data was gathered from different well and bore well by GSDA, Nagpur. The choropleth cartographic method used for representation of variation in monsoon rainfall up to September and October. These all maps are prepared by using Arc GIS 10.1 software. The different statistical data shows through the tables.

Result and discussion-

The data of rainfall was collected from revenue department, Agriculture department of Maharashtra and Indian meteorological Department, Pune and used this data for comparative analysis between both months.

1. Comparative analysis of rainfall in September-

Generally the groundwater level is totally depending on rainfall intensity in particular region. Monthly precipitation data for Marathwada region for the period June to end of September 2019 have been taken from government data sources. The Increase or decrease in rainfall at the end of month September is shows in table no.-1, this table indicates districtwise deficit tehsils numbers. This classification is done on the basis of IMD norms. According to

Table No. - 1 Increase or decrease in rainfall at the end of month September 2019

Sr. No.	District	Total No. of Tehsils	Rainfall Deficit Tehsils				No Rainfall Deficit Tehsils
			0 - 20 %	20 - 30 %	30 - 50 %	> -50 %	
1	Aurangahad	9	3	1	1	0	4
2	Bid	11	1	1	7	2	0
3	Jalna	8	3	1	3	0	1
4	Parbhani	9	6	0	3	0	0
5	Nanded	16	12	2	0	0	2
6	Osmanabad	8	3	0	4	1	0
7	Latur	10	2	2	5	1	0
8	Hingoli	5	4	1	0	0	0
	Subtotal	76	34	8	23	4	7

Note - As per IMD norms, 0 to 20 % rainfall deficit is considered as normal rainfall, hence 35 Tehsils are considered to be the rainfall deficit Tehsils

Source- Groundwater Survey & Development Agency, Govt. of Maharashtra

IMD norms the current rainfall is compare with average rainfall of this month and form different categories. 0 to 20% rainfall is considered as normal rainfall, when the precipitation rate is decrease the scarcity of water is increases. In September month near about 35 tehsils are comes under the rainfall deficit tehsils. The Bid and Latur districts are highly deficit up September month.

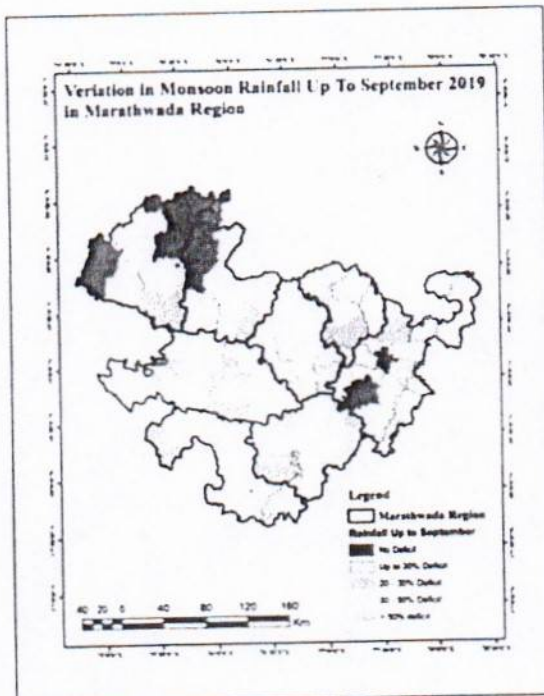


Figure No.- 1, Variation in monsoon Rainfall up to September

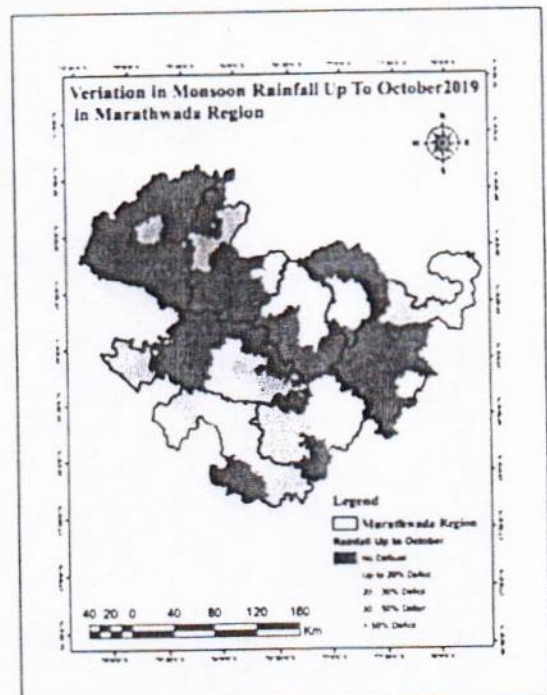


Figure No.- 2, Variation in monsoon Rainfall up to October

The figure No.1. choropleth map is represents the variation in monsoon up to September 2019. The southern and middle part of Marathwada region has 20 to above 50% deficit; these areas was covered by Osmanabad, latur and bid Districts. Some part Jalna and Parbhani district is deficit up to 50%. Near about 50% area is comes under no deficit and normal rainfall range precipitation.

2. Comparative analysis of rainfall in October-

Table No. 2 is shows Increasing or decreasing rate in rainfall at the end of month October 2019. In this month the study area receive rainfall from return monsoon, the receiving rate is normal comparatively average rainfall. Due to return monsoon water availability of water is inclined. In this month 6 deficit tehsils are found in Marathwada.

Figure no.2 is expressing the variation in monsoon rainfall up to October month. The choropleth map shows deficit tehsils in study region. In this month out of total 76 tehsils the 45 tehsils are comes under no deficit categories, six tehsils are in 20 to 50% deficit and remaining 25 tehsils are fall in normal range (0 to 20%) category.

Table No. 2 Increase or decrease in rainfall at the end of month October 2019

Increase or decrease in rainfall at the end of month October 2019 compared to average							
Sr. No.	District	Total No. of Tehsils	Rainfall Deficit Tehsils				No Rainfall Deficit Tehsils
			0 - 20 %	20 - 30 %	30 - 50 %	> -50 %	
1	Aurangabad	9	1	0	0	0	8
2	Beed	11	5	0	0	0	6
3	Jalna	8	2	0	0	0	6
4	Parbhani	9	2	1	0	0	6
5	Nanded	16	5	0	0	0	11
6	Osmanabad	8	5	1	1	0	1
7	Latur	10	3	3	0	0	4
8	Hingoli	5	2	0	0	0	3
	Subtotal	76	25	5	1	0	45

Note - As per IMD norms, 0 to 20 % rainfall deficit is considered as normal rainfall, hence 6 Tehsils are considered to be the rainfall deficit Tehsils.

Source- Groundwater Survey & Development Agency, Govt. of Maharashtra

3. Groundwater level analysis of Marathwada-

The groundwater level of October month is compare with last five years average groundwater level. This groundwater level was measured from new and old wells in study area. Marathwada region has 76 tehsils, belong of these 74 tehsils has decreased groundwater level

Table No.- 3 Average Groundwater Level in Marathwada.

Number of districtwise villages showing more than 1 meters decrease in average groundwater level							
Sr. No.	District	Total No. of Tehsils	No. of Tehsils showing Depletion	No. of Villages showing Groundwater level depletion			
				>3 m	2 to 3 m	1 to 2 m	Total (> 1 m)
1	Aurangabad	9	9	397	103	139	639
2	Beed	11	11	397	218	252	867
3	Jalna	8	8	415	137	123	675
4	Parbhani	9	9	65	62	85	212
5	Nanded	16	15	247	195	233	675
6	Osmanabad	8	8	409	88	56	553
7	Latur	10	10	486	83	99	668
8	Hingoli	5	4	0	6	10	16
	Subtotal	76	74	2416	892	997	4305

Source- Groundwater Survey & Development Agency, Govt. of Maharashtra

Hingoli and Nanded both district have one tehsils which under normal groundwater level. The study region has total 8610 villages. After the compared with the average of groundwater

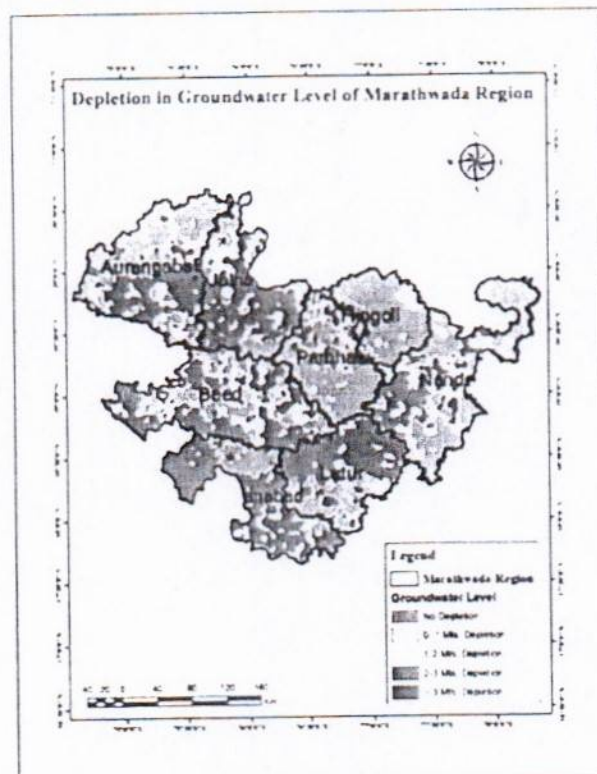


Figure No.- 3. Groundwater level depletion map

level 2416 villages has decrease above 3 meter groundwater level in different villages, 892, 997, 4305 villages decrease 2 to 3 meters, 1 to 2 meters, and below 1 meters respectively.

4. Rainfall and Groundwater Level Analysis for probability of water scarcity-

Groundwater and rainfall these two elements are closely related to the each other and the both factors was effect on water scarcity and drought condition table no. 4 show the depletion in groundwater, the groundwater level is fluctuated in six tehsils they belong from Parbhani, Osmanabad and Latur. Highest water depleted villages are found in Osmanabad district. Near about 455 villages has low groundwater level. Generally the groundwater level was fluctuated up to 3 meters. In 306 villages comes under 2 to 3 meter groundwater level depletion. It means the villages will be experience water scarcity from January to June month.

Table No.- 4 Average Groundwater Level in Marathwada

Number of district wise villages having possibility of water scarcity by comparative study of rainfall and groundwater level							
Rainfall area	Sr. No.	District	No. of Tehsils GW depletion	No. of villages having Groundwater level depletion >1 m			
				> 3 m	2 to 3 m	1 to 2 m	Total
DPAP and Assured Rainfall (> 20% Deficit)	1	Aurangabad	0	0	0	0	0
	2	Beed	0	0	0	0	0
	3	Jalna	0	0	0	0	0
	4	Parbhani	1	0	14	62	76
	5	Nanded	0	0	0	0	0
	6	Osmanabad	2	0	173	19	192
	7	Latur	3	0	119	68	187
	8	Hingoli	0	0	0	0	0
		Total	6	0	306	149	455

Source- Groundwater Survey & Development Agency, Govt. of Maharashtra

5. Identification of probable water scarcity zone-

Table no.- 5 are indicate the Number of Tehsilwise villages having possibility of water scarcity in next few month and figure no. 4 has shown probable water scarcity tehsilwise villages they will experience drought prone condition and water scarcity in this area.

The possibility of water scarcity it will be coming in Latur, Osmanabad and Parbhani district from January to May. The probable water scarcity zone represents two categories 1. January Onwards and 2. April Onwards. These areas have shown with help of brown and yellow colour. The brown colour indicate the water probability it will coming from April month and yellow colour shows the scarcity of water will be start from January month. The

Chakur, Devani, and Udgir from Latur, Bhum and Paranda from Osmanabad and lastaly Parbhani from Jintur this tehshil will be suffer water scarcity problem.

Table No.- 5 Tehshilwise villages having possibility of water scarcity

Number of Tehshilwise villages having possibility of water scarcity by comparative study of rainfall and groundwater level							
Rainfall area	S. N.	District	Name of Tehsil	No. of villages having Groundwater level			
				> 3 m	2 to 3 m	1 to 2 m	Total
DPAP and Assured Rainfall (> 20% Deficit)	1	Latur	Chakur	0	61	19	80
	2	Latur	Devani	0	5	17	22
	3	Latur	Udgir	0	53	32	85
	4	Osmanabad	Bhum	0	80	17	97
	5	Osmanabad	Paranda	0	93	2	95
	6	Parbhani	Jintur	0	14	62	76
					306	149	455
High Rainfall (> 50% Deficit)	1	-	0	0	0	0	0
	2	-	0	0	0	0	0
		Sub Total	0	0	0	0	0
		Grand Total	0	0	306	149	455

Source- Groundwater Survey & Development Agency, Govt. of Maharashtra

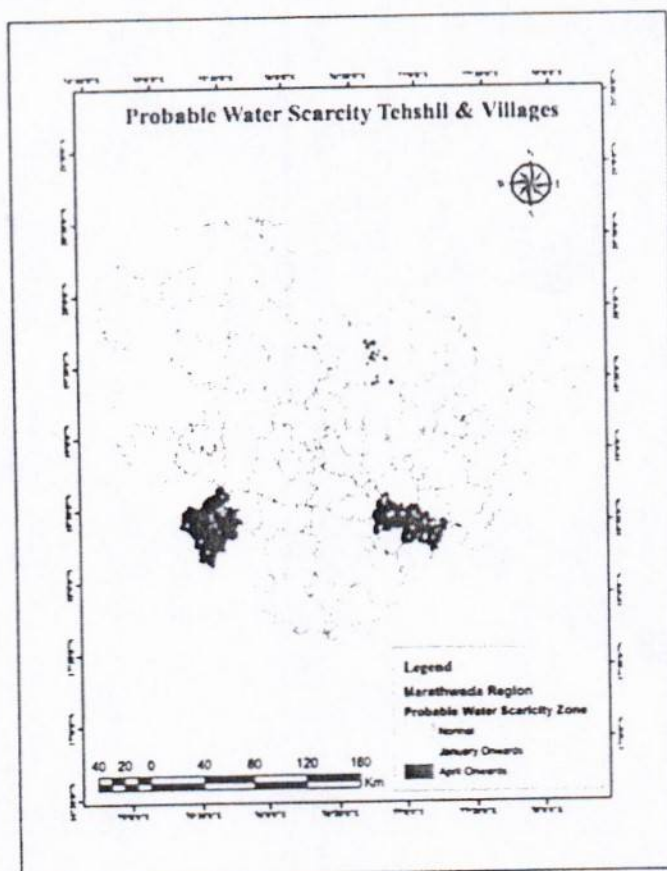


Figure No.- 4. Probable Water Scarcity Tehsils and villages

Conclusion-

The present study concluded that in the year 2019, the rainfall decreased in Bhum and Paranda of Osmanabad, Chakur, Udgir and Devani in Latur District, Jintur is one of the in Prabhani tehsil they has low rainfall. As the result of availability of groundwater is deployed in the Marathwada region, due to high water extraction for agriculture and domestic purpose. The groundwater level has been decline from 1 meter to 3 meter in several tehsil of Osmanbad, Latur and Parbhani district. In the analysis we have compered rainfall with groundwater level and identify probable water scarcity zone in study region. As the scarcity of water is an increase from January and April month. On the basis these analysis water scarcities threaten in Bhum, Paranda, Chakur Udgir and Devani tehsil from January and in Jitur some part of Latur and Osmanabad in from April month.

The present study leads to certain recommendation which can recover the water scarcity in Marathwada region. They can increase groundwater level by adopting water conservation strategies and proper planning and they have use different irrigation technique for agriculture production. The management and budgets water is essential at all level.

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