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Rainfall Analysis of Latur Region for Groundwater Recharge

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Abstract - *The paper consists of a factual estimation of rainfall including its magnitude, duration, and intensity, and is a fundamental requirement for the planning and design of various hydraulic structures.*
The main objective of this study is to accumulate information and predict the possible solution to counter the crisis in that region.

***Key Words*: Rainfall Intensity, Watershed Management, Hydraulic structures, Aquifer**

1. INTRODUCTION

India is situated in Southeast Asia and the tropic of cancer passes through it. The climatic conditions are very diverse and unique in their own way. All the eastern states have abundant annual rainfall due to its geographical condition and the forest area whereas states like Rajasthan, Madhya Pradesh, and Maharashtra do not have suitable conditions for rainfall, and annual rainfall in these regions is quite less. Less rainfall in the eastern part of Maharashtra is due Sahyadri range; this acts as a natural wall-like projection that does not allow the winds coming from the Arabian ocean to reach all parts of Marathwada. Our study would focus on those regions which are deficient in watershed management, and if there is a need for artificial water recharge. Water is one of the most important resources on Earth hence it is necessary to save and recycle it for a sustainable future. It can be done by using environment-friendly development practices and proper establishment of watershed management. The water which reaches the ground does not get stored as groundwater and gets drained off due to the unfavorable conditions of strata (Deccan Plateau).

2. NEED OF STUDY

2.1 To determine the water-deficient area and to provide a possible solution.

According to the Composite Water Management Index (CWMI) report presented by the Niti Aayog in 2018, 21 major cities (Delhi, Bengaluru, Chennai, Hyderabad, and others) are racing to zero groundwater levels by 2020, affecting access for 100 million people. However, 12% of India's population is already living the 'Day Zero' scenario, due to excessive groundwater pumping, an ineffective and wasteful water management system, and years of insufficient rains.
The map clearly shows that the Marathwada region is water deficient, and our prime focus will be on that region especially Latur district.

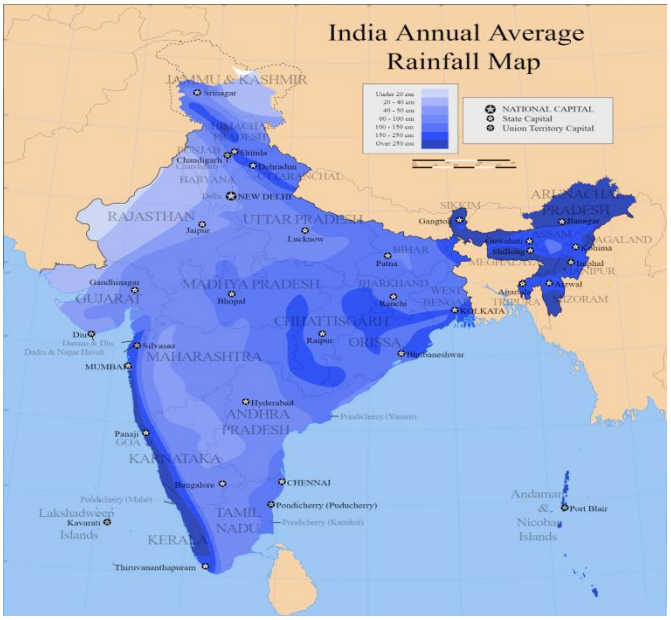

Fig -1: India Annual Rainfall Map

2.2 Promote watershed management practices

Rational utilization of land and water sources for optimum production causing minimum damage to natural resources is the main purpose of watershed management. The main goal of Watershed Management is to implant the sustainable management of natural resources to improve the quality of living for the people.

2.3 To promote sustainable use of water resources

Sustainable water management means the ability to meet the water needs of the present without compromising the ability of future generations to do the same.

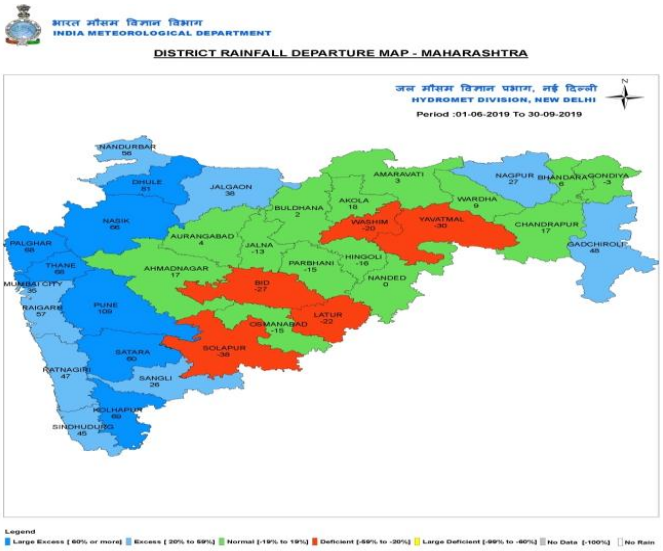

Fig -2: Maharashtra rainfall departure Map

3. OBJECTIVE

To collect rainfall data of that region including surface runoff and groundwater seepage, and analyzing the need for groundwater recharge.

4. AREA UNDER CONSIDERATION

The area considered for this research is Latur which is the Marathwada region of Maharashtra. It is geographically located between 17°52′ North to 18°50′ North and 76°18′ East to 79°12′ East in the Deccan plateau. It has an average elevation of 631 meters (2,070 ft) above mean sea level. The entire district is on the Balaghat plateau, 540 to 638 meters from the mean sea level.

The climate of the study region classified semi-arid, is usually hot, potential evaporation of which is far excess of the precipitation.

In general, hot and dry summers and moderately cold winters characterize the climate of the region. The region has a tropical monsoonal type of climate. About 894 mm / 35.2 inches of precipitation falls annually.

5. DATA COLLECTION

Various types of data are needed to collect regarding monsoon duration, rainfall frequency, and rainfall intensity. The sources of data are the National climate data center (NCDC), global agricultural information network, regional meteorological department, etc.

Marathwada is the only region in the Central and South India where the region had below normal rainfall, the deficit being 12%. Bid (-27%) and Latur (-22%) were in Deficit rainfall category districts.

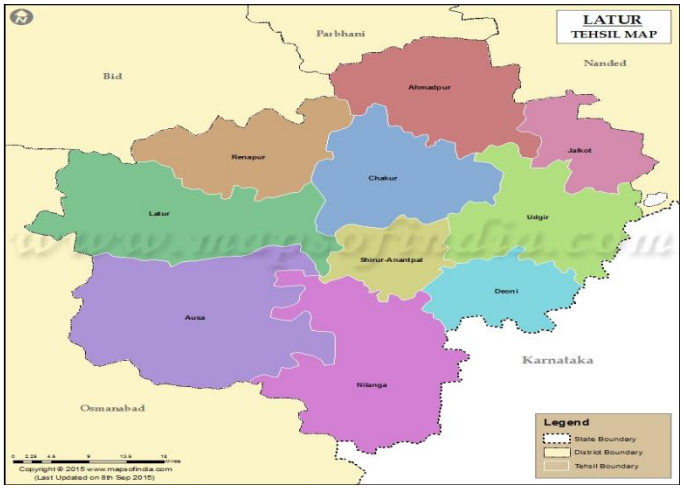

Fig -3: Latur District Map

5.1 RAINFALL AND CLIMATE DATA

The normal annual rainfall over the district varies from 650 to 800mm and it increases from southwest to northeast. It is minimal in the southern part of the district around Nilanga and increases towards the northeast and reaches a maximum around Udgir. The average annual rainfall for 2008-2011 is about 761 mm.

Most of the rainfall occurs in the monsoon season from June to September. Rainfall varies from 9.0 to 693 mm/month. Temperatures in Latur range from 13 to 41 °C (55 to 106 °F), The highest temperature ever recorded was 45.6 °C (114.1 °F). The lowest recorded temperature was 2.2 °C (36.0 °F).

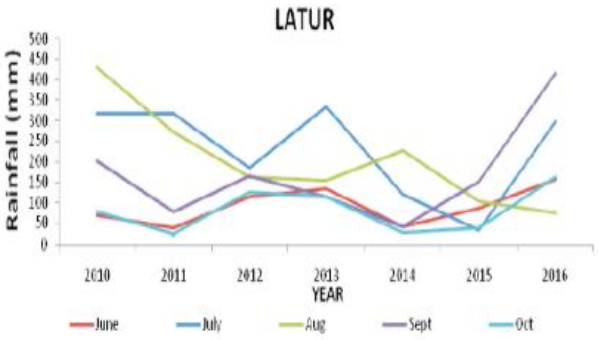

Fig -4: Average Monthly Rainfall of Monsoon Season

Sr no	Taluka	Average rainfall(mm)
1	Latur city	821.53
2	Renapur	754.38
3	Ahmedpur	696.22
4	Chakur	757.82

In the cold season, the district is sometimes affected by cold waves in association with the eastward passage of western disturbances across north India, when the minimum temperature may drop down to about 2 to 4 °C (36 to 39 °F).

5.2 Moisture map

The respective maps represent the amount of wetness of soil in the state of Maharashtra before and after the monsoon season.

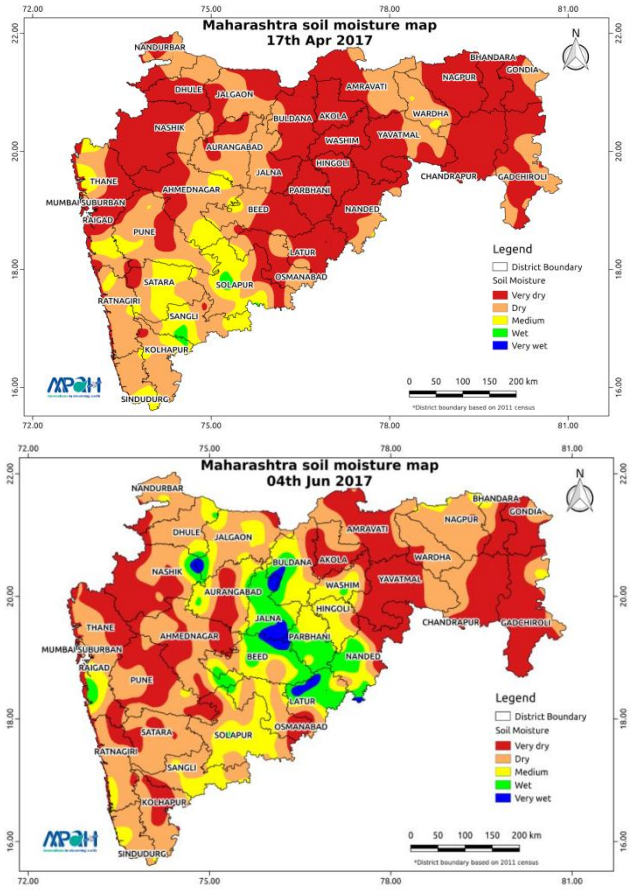

Fig -5: Moisture map before and during monsoon

5.3 GROUNDWATER DATA

The discharge of the wells varies between traces and 12.24 liters per second (lps). Out of 35 exploratory wells drilled in the district, 13 exploratory wells (about 40%) are high yielding with the discharge of more than 3 lbs whereas some are totally dry. The depth to water level varies from 1.48 m bgl (Kajal Hipparpa) to 100.00 m bgl (Belkund).

During the pre-monsoon period of May, in most parts of the district, depth to water levels is less than 20 m below ground level. Groundwater level between 5 and 10 m is observed in Renapur, Ahmedpur, Latur, Ausa, Nilanga, Udgir, Shirur, and Deoni tehsils. Deeper water levels between 10 to 20 m is observed in almost all the talukas of the district.

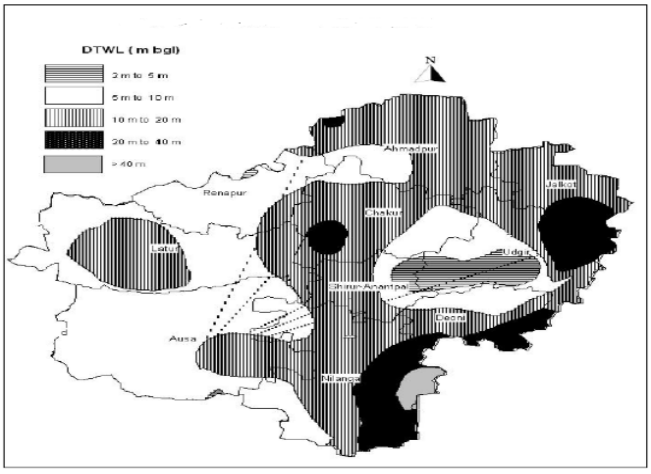

Fig -6: Pre-Monsoon Depth of Water level

During the post-monsoon period, depth to water level observed in major parts of the district is less than 10 m bgl. A deeper water level between 20 to 40 m bgl is observed in Nilanga taluka of the district.

A very shallow water level of less than 2 m bgl is observed in parts of Udgir, Shirur, Deoni, Latur, Chakur, and Renapur talukas.

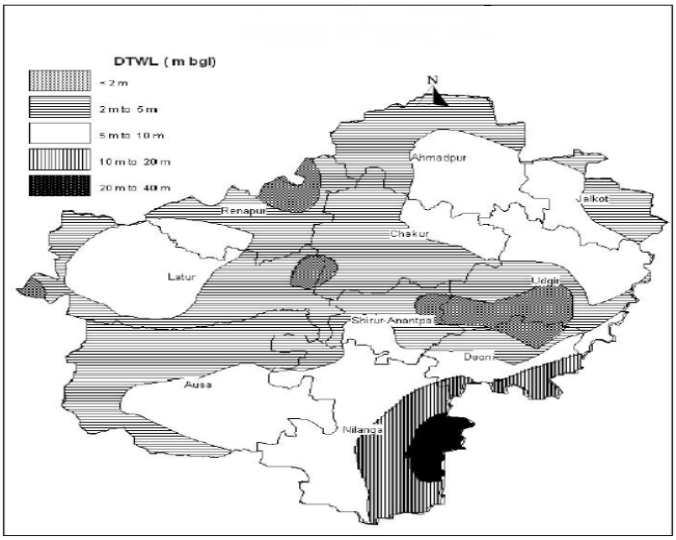

Fig -7: Post Monsoon Depth of Water level

6. Deficit of rainfall in Latur

The Marathwada region lacks rainfall due to its poor geographical condition and the Sahyadri range and the ground condition of the Deccan plateau does not let the water to recharge the groundwater table. Lack of watershed management practices leads to unnecessary wastage of water which leads to water scarcity in summers.

After a detailed study, we noticed that the strata lying below the surface of the region is in a downward slope and also has

heavy infiltration value, because of which the infiltrated water fails to recharge the groundwater and flows down as runoff water. The underground runoff is an unavoidable natural phenomenon therefore the natural aquifer system of the region fails to provide the necessary water requirement in the region of Marathwada.

The localities use underground water as the main water source for livelihood but due to the inability of natural recharge of water and excessive use of it causes water deficiency in the groundwater table.

7. Conclusion

A possible solution to defeat this problem is to provide artificial aquifers which help to recharge the underground water table artificially. Artificial recharging is the planned activity of extending the amount of groundwater available through construction works designed to increase the natural recharging into groundwater aquifers. The most important concern in determining the utility of this technology is that it has not been adequately addressed and needs further studies. It would be an underground storage place which would be 100% eco friendly. These aquifers connect the entire city which could be used for agriculture and other domestic purposes as well with the help of a fabricated pipeline system, thus serving the entire city and fulfilling its water demand.

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