IDENTIFICATION AND CATEGORIZATION OF WATER SCARCITY ZONES IN PURANDHAR TALUKA IN PUNE DISTRICT BY USING 'QGIS'

[1]Mr. Prashant Nawale, [2]Mr. Akshay Kulkarni, [3]Mr. Niraj Jadhav. [4]Mrs.Kamini Bagad

[1]Asst. Professor, [2]BE Civil (pursuing), [3]BE Civil (pursuing). [4]BE Civil (pursuing).
[1]Department of Civil Engineering,
[1]Zeal College of Engineering and Research, Pune, India.

Abstract: Due to the changing climate, uneven rainfall, varying topographical conditions, rapid growth of population and increase in water demand has led to a scarcity of water. The problem is much serious in rural areas where lack of infrastructure has made water a topmost priority issue. The rural part of India is directly dependent on groundwater as no adequate provisions are being made for a sustainable supply of water. Excessive utilization of groundwater has led to a decrease in the groundwater levels. Most of the year open wells, farm ponds, tanks, are found to be empty due to low groundwater level, less infiltration and haphazard use of groundwater.

For improving the groundwater level, percolation is an important factor. Percolation is dependant on various parameters such as the slope of the terrain, nature of the soil, temperature, humidity, the rate of evaporation, vegetation, rate and intensity of rainfall, etc.

The objective of this paper is to prioritize and categorize water scarcity zones using global weather and soil data with the help of QGIS software. These water scarcity zones will be divided on the basis of groundwater availability which then, will be divided into high, medium and low scarcity zones.

These zones will be helpful for providing remedial measures to improve groundwater level in the study area.

I. Introduction

Agriculture is the most important sector of Indian economy. In most regions, agriculture is totally dependent on rainwater, which is stored in dug wells, borewells, open wells and tanks. But due to uneven rainfall & uncertain climatic conditions groundwater levels are depleting.

(Krairapanond & Atkinson,1998), have presented, methodology for river basin management on regional and local basis in thailand and robust methodology for watershed management. (Batchelor,2013), have analysed the severity of water scarcity and its impact on local communities using GIS software. (Pujari & Bhosale**.**2017), have developed a delineation model and rainfall-runoff model for watershed protection and management using QGIS. (Thomas & Duraisamy,2017), have identified groundwater scarsity zones based on different influencing thematic layer and provide robust methodology to prioritize areas vulnerable to groundwater unavailability, by categorizing the study area into different vulnerable class types such as extreme high,moderate and low. (Mello.et.al.,2018), have investgated impacts of tropical forest cover on water quality in agricultural watershed in southern brazil. (Fedorov et.al., 2018), have developed a method to justify a site selection of self regulated dam which provides minimum impacts on environment.

The present study conducted in the year 2018-2019 comprised of purandhar taluka of pune district, some villages from Bhor,Velhe,Indapur,Baramati,Shirur and Khed are also considered.

In Purandhar taluka and some villages of Bhor, Indapur, Velhe, Shirur & Khed of Pune district the major income source of this area is the agriculture, this area is suffering from uneven rainfall and no infrastructure facilities are available to store the water and to increase groundwater table. Due to the exploitation of groundwater through deep bore wells where the water table has depleted. Due to lack of efforts for rainwater harvesting and recharge, water sources get depleted which in turn makes agriculture practices more difficult. Most open wells in study area dries up within short period of time also no provision are made to improve groundwater table and effective utilization of groundwater resources.

The current study involves a field hydrological mapping that was integrated with QGIS software to delineate watershed area. Global soil and weather data was used to identify, prioritize and categorize water scarcity zones which were divided into three categories (high,medium,low) based on severity and scarcity of water.

II. Study Area

The concerned study area is Purandhar and some villages of Bhor, Velhe, Indapur, Baramati, Shirur, Khed. These locations lie in the coordinates 18° 17' 0" North, 73° 59' 0" east, covers the total area 1,605 km^2 and having density of 2,35,659 of which 1,19,906 are males and 1,15,753 are females (as per the census India 2011). The two catchments of Bhima and Karha river basins receive a median annual rainfall of the 696.34 mm of the total annual average. The annual maximum temperature of Purandhar is 28.31°C and the minimum temperature is about 23°C.

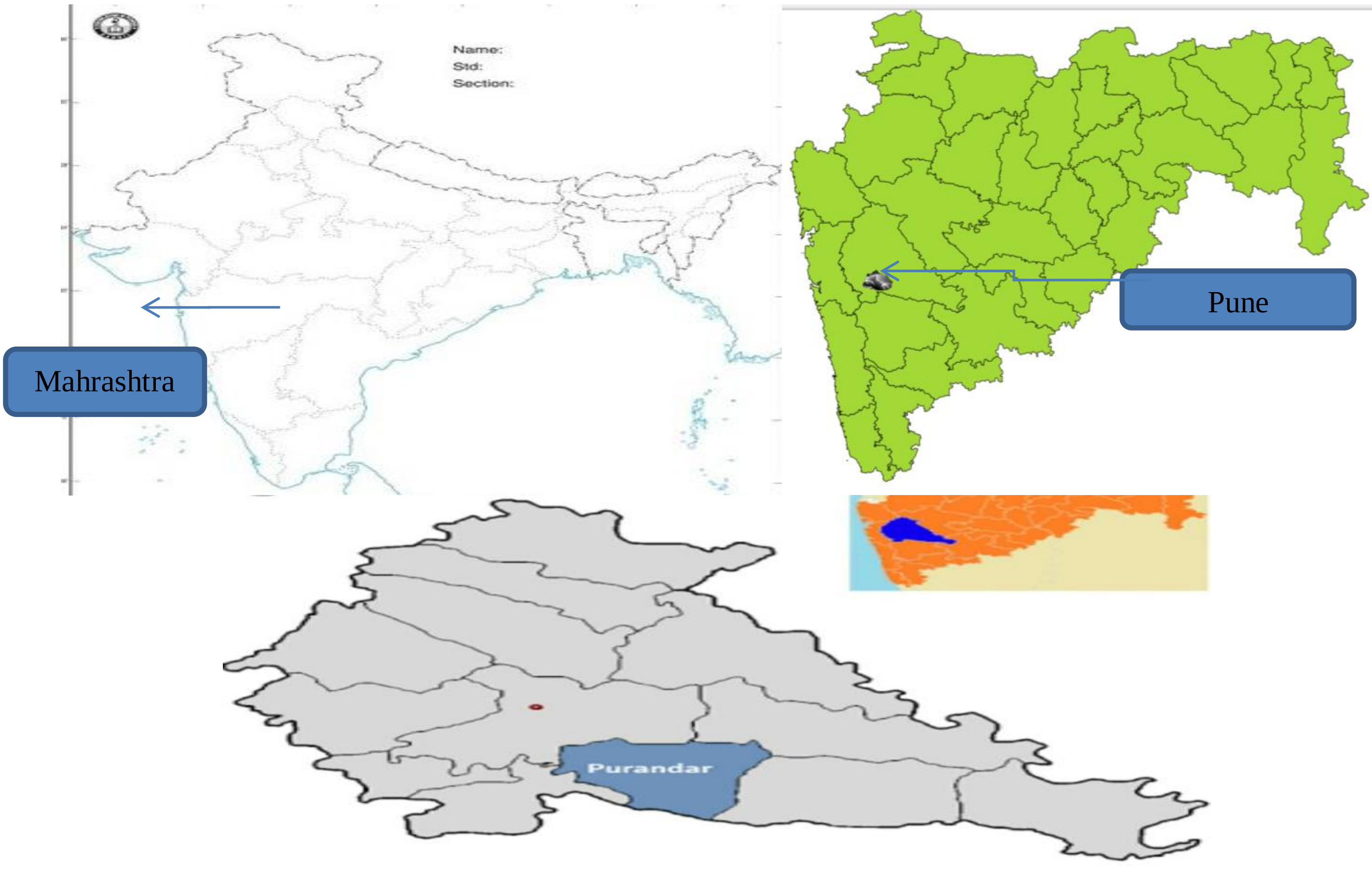


Fig.1 : Study area

III. METHODOLOGY

The approach adopted for the present study area has been presented in the form of flowchart. The inputs required to identify the scarcity zones are rainfall data, KML file of study area from Google Earth and soil and LULC map of concern area. These input are provided in QSWAT model which then delinate the watershed of study area. Hydrological Response Unit were generated after watershed delination and rainfall runoff model was created. With the help of rainfall runoff model, water scaracity zones were identified and categorized according to their severity.

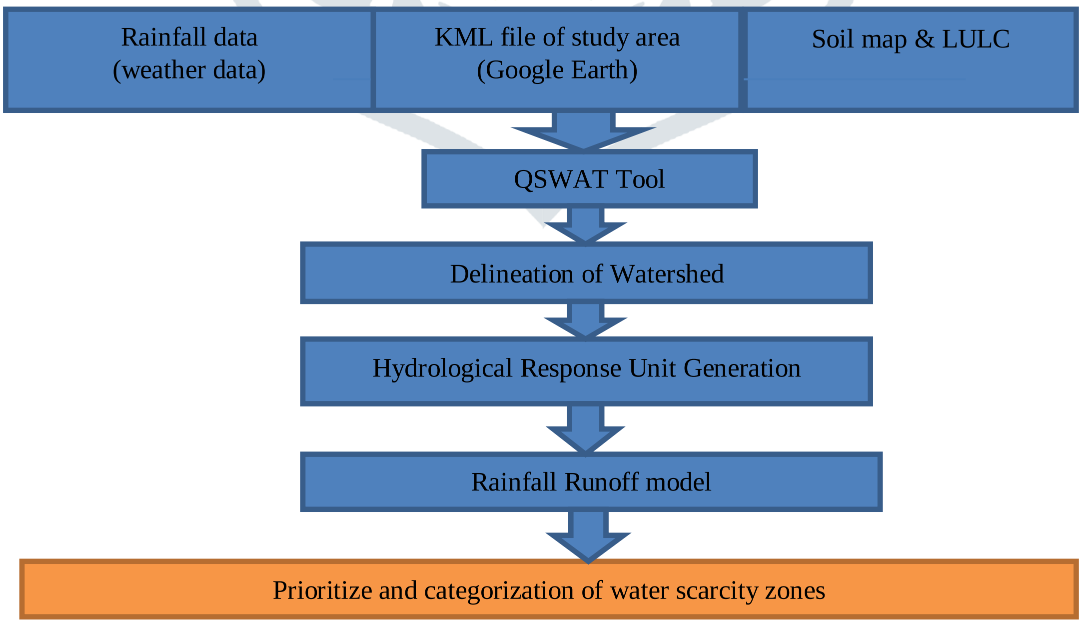


Fig.2 : Flowchart of Methodology

IV. Results And Discussion

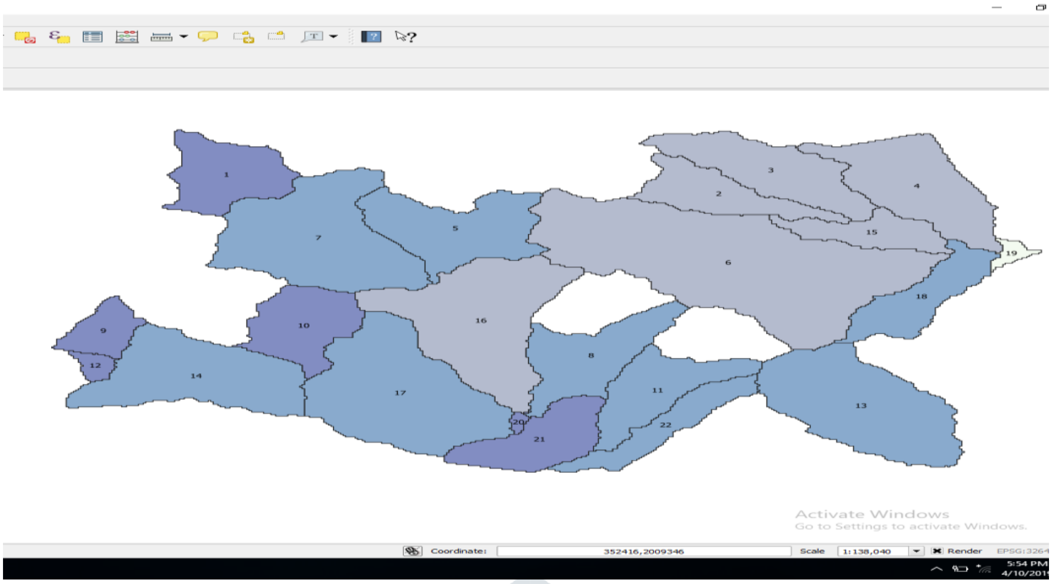
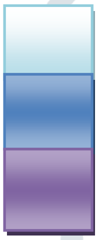


Fig. No. 3 Scarcity of Zones.



Low Scarcity Zones

Medium Scarcity Zones

High Scarcity Zones

Table 1. Zone Wise WATB_SOL mm and SURQ_mm

Subbasin Number	WATB_SOL mm	SURQ_mm	Total area (Sq.Km)
16,6,2,15,3,4,19	38500 - 38525	4451 - 4615	179.19
12,9,10,1,21,20	38525 - 40500	4615 - 4766	62.974
14,17,7,5,8,11,13,22,18	40500 - 41763	4766 - 4913	235.94

WATB_SOL:- Water table depth from the bottom of the soil surface (mm) (daily output only; not used in tile flow equations)

SURQ_mm :- Total Surface runoff contribution to stream flow

- **High scarcity zones-** The zone in which groundwater level is low and runoff is high.
- **Medium scarcity zones-** The zone in which groundwater level is average and runoff is moderate.
- **Low scarcity zones-** The zone in which groundwater level is high and runoff is low.

From above information following provisions and recommendations are made:

Table 2. Zone Wise Provision And Recommendations

Zones	Provisions	Recommendations
High scarcity zones	Check dams, digging pits, subsurface dams	Permission for digging open wells and borewells should be strictly prohibited.
Medium scarcity zones	Ditches, Recharge pits and shafts	Permission for digging open wells and borewells should be permitted to certain extent.
Low scarcity zones	Recharge wells. open wells and dug wells	Permission for digging open wells and borewells should be permitted.

Field mapping of various hydrological parameters such as water level in dug wells and bore wells in different seasons was correlated with the analysis done in QGIS software. The analysis done on QGIS software was found to be synonymous with the actual conditions in study area.

V. Conclusion

From the above study, dividing the scarcity zones into three classes (i.e. high, medium, low) resulted in identifying the locations of high priority which also resulted in deciding the robust methodology for ground water recharging which proved helpful for recommending remedial measures to be taken in that area.

VI. Acknowledgment

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