Problem of Ground Water Depletion in Dhule District, Maharashtra (India)

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Abstract

Water is utmost important for the survival of man and other living organisms. Man uses freshwater for many purposes such as drinking, domestic, agriculture, industrial processes, etc. Freshwater is available in the form of surface water or groundwater. Groundwater is providing up to 40% of freshwater in the world. In India, Green Revolution started in 1970s and it contributed greatly in increasing food production through the development of groundwater based irrigation. It resulted in an expansion of irrigated area and a rapid increase in the number of electric and diesel pumps. With ever increasing population, development in agriculture and industrial sectors and modernization the use of groundwater increased with exponential rate. It resulted into serious problem of depletion of groundwater in various parts of the country. Both natural and anthropogenic factors cause groundwater depletion. In the present paper an attempt has been made to study the problem of depletion of groundwater in Dhule district of Maharashtra State, India. The present study is based on secondary data collected from CGWB, Government of India, Department of Geology, Zilha Parishad, Dhule and GSDA. Study reveals that during post monsoon season, in major parts of the district water level ranges between 5 and 10 mbgl. The moderate to deeper water level of 10-20 mgbl is observed in the parts of Shirpur and Shindkheda tahsils. Seasonal water fluctuation greater than 4 mbgl is observed in southern part of Shirpur tahsil where predominant lithology is alluvium. Also water level fluctuation greater than 4 mgbl is seen in the central and north-west parts of Dhule and north-west part of Sakri tahsil. Study also reveals that the artificial recharge and water conservations structures need to be prioritised in the study region.

Keywords: *green revolution, surface water, groundwater.*

Introduction

Water is the fundamental natural resource available on the earth's surface. It is the life blood of the ecosphere. For survival of all living organisms water is essential. It is essential for the growth and various processes and reactions occur in living organisms. The existence and population of plants and animals depends on the availability of water. It also plays an important role in natural processes, and nutrient cycling. Water is used on a large scale by man for various purposes such as drinking, domestic, agriculture, animal husbandry, industrial processes, power generation, transportation, fishing and fire fighting.

Water is abundant on the earth. About 71 per cent area of the earth surface is covered by water. But, very small amount i.e. only 0.9 percent water is directly useful for man. It is present in the rivers, lakes and ponds as surface water and in the interior parts of the earth as a ground water. Their distribution is also highly uneven. On the land surface, water is available through the natural water cycle. But the rainfall distribution is highly uneven. Due to ever increasing population, industrialization and modernization, the utilization of water has been increased and pressure is continuously increasing on this valuable resource. As the water table is depleting rapidly, there is urgent need to take efforts for water conservation.

With ever increasing population, development in agriculture and industrial sectors and modernization the use of groundwater increased with exponential rate. It resulted into serious problem of depletion of groundwater level in various parts of the country. Both natural and anthropogenic factors cause groundwater depletion. As the water table is depleting rapidly there is urgent need to take efforts for water conservation. Keeping this view in mind the present paper attempts study the problem of depletion of groundwater in Dhule district of Maharashtra State, India.

Study Region

For the present study Dhule district has been selected as a study region. It is situated in the northern parts of Maharashtra State in the valley of Tapi River. It comprises of four tahsils namely Dhule, Shirpur, Shindkheda and Sakri. It is extended over an area of 8,063 sq km between latitudes 20^0 38’ N to 21^0 39’ N and longitudes 73^0 50’ E to 75^0 13’ E (Figure 1).

It represents great variation in physiography and most of the part of it experiences semiarid climate. About 58 percent area of the district is identified as ‘Drought Prone Area’ (Sukhtankar Committee Report). Northern parts of Shirpur tahsil and south and southwestern parts of Sakri tahsil are dominated by tribal population. They are lagged behind in socio-economic development. Remaining extensive part is economically developing and very limited part is developed one.

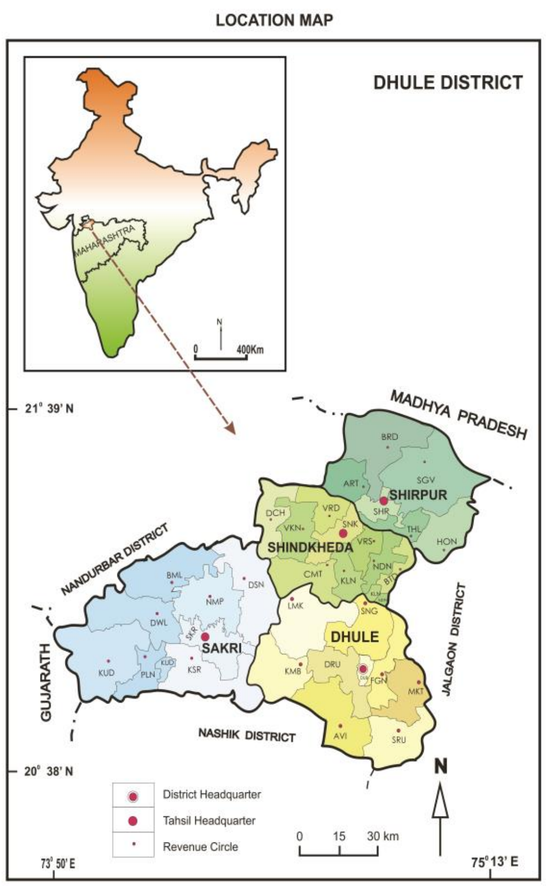


FIG 1

Dhule district receives about 599.4mm normal annual rainfall from south-west monsoon. Over 90% of rainfall in the district occurs in the months of June to September by South-West monsoon. Rainfall is the most important climatic variables affecting surface and ground water resources and subsequently to agricultural practices. The distribution of rainfall in the study region is uneven in respect of time and the space. In general, the study region has been facing problem of drought conditions in every three to four years. The impact of drought conditions on water resources and food production in the central part of scanty rainfall region is more pronounced than in the Shirpur tahsil and western part of Sakri tahsil. There is close association of rainfall regime with ground water level. Other factors are also responsible for the fluctuation of ground water levels, such as, rock structure, slope, local terrain, land use and land cover, utilization of ground water resources etc.

Objectives

The main aim of the present research work is to study the problem of groundwater depletion in Dhule district of Maharashtra State, India. To achieve this aim of the study the specific objectives may be outlined as follows:

- To know the physical set up of study region.
- To study the groundwater level status during pre and post monsoon season.
- To find out the causes of depletion of groundwater level in the district.

Data Used And Mthodology

For the present study, data regarding ground water level for the period 2011 and 2013 to 2017 and 2018 have been collected from Central Ground Water Board (CGWB), Government of India, Department of Geology, Zilha Parishad, Dhule and GSDA (Groundwater Survey and Development Agency). The data have been depicted with the help of choropleth and distribution maps and analyzed.

Results And Discussion

- **Ground Water Scenario**

The major part of the district occupying northern parts of Shirpur, southern parts of Shindkheda and entire Dhule and Sakri tahsil is covered by basaltic flows commonly known as ‘Deccan traps’ intruded by dykes. Tapi alluvial deposits are observed along Tapi river valley occupying northern part of Shindkheda and southern part of Shirpur tahsil. The ground water occurs in the near surface strata down to the depth of 20 metres under unconfined conditions in the weathered zone. The water bearing strata occurring below 30 metres depth, beneath the red bole and dense massive basalt exhibited semi-confined to confined conditions. On the elevated plateau tops having good areal extent, local water table develops in top most layer and the wells in such areas show rapid decline water levels in post- monsoon season and become dry during peak summer. In the foothills zone, the water table is relatively shallow near the water courses and deep away from it and near the water divides. In the valleys and plains of river basins, the water table aquifer occurs at shallow depth and the wells in such areas do not become dry and sustain perennial yield except in extreme summer or drought conditions.

- **Depth to Water Level- Pre monsoon (May-2011)**

The depth to water level in the district during May 2011, ranges between 2.51 and 19.00 mbgl (Metres Below Ground Level). Depth to water level during pre-monsoon (May-2011) has been depicted in shallow water levels within 2-5 mbgl are observed in small isolated patches in south eastern parts of Dhule and Shindkheda tahsil and also in minor part of Sakri tahsil. The water level between 5 and 10 mbgl is observed in major parts of the district, particularly in southern , central and extreme north-western parts. The moderate deeper water levels of 10 to 20 mbgl are observed in north eastern to south- western part of the district, occupying major parts of Shirpur and some parts of Sakri, Dhule and Shindkheda tahsil in very small patches fig. 2.

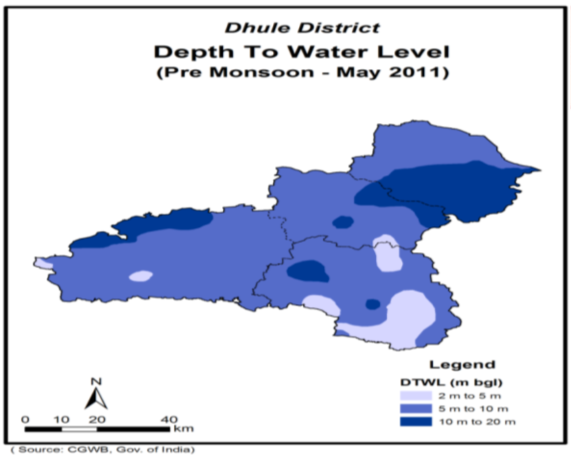


Fig: 2

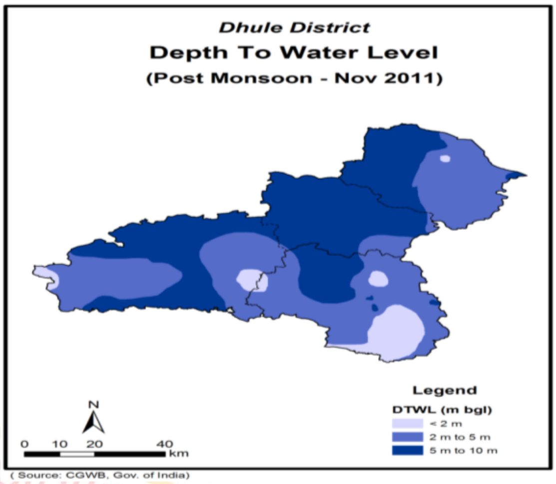


Fig: 3

- **Depth to water level –post monsoon (Nov-2011)**

The Depth to water level during post-monsoon (Nov-2011) ranges between 0.14 mbgl and 8.15 mbgl. Spatial variation in post-monsoon depth to water level is shown in fig 3. In major parts of the district water level ranges between 5 and 10 mbgl. Shallow water levels within 2-5 mbgl are seen south-eastern, north-eastern and south-western parts of the district, particularly in Shirpur, Dhule and Sakri tahsil. Some patches having water levels less than 2 mbgl were observed in southern parts of the district.

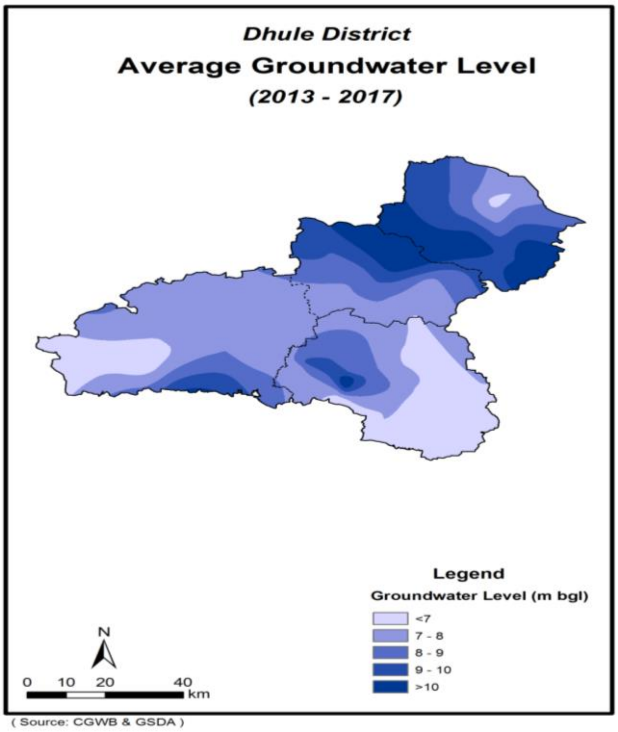
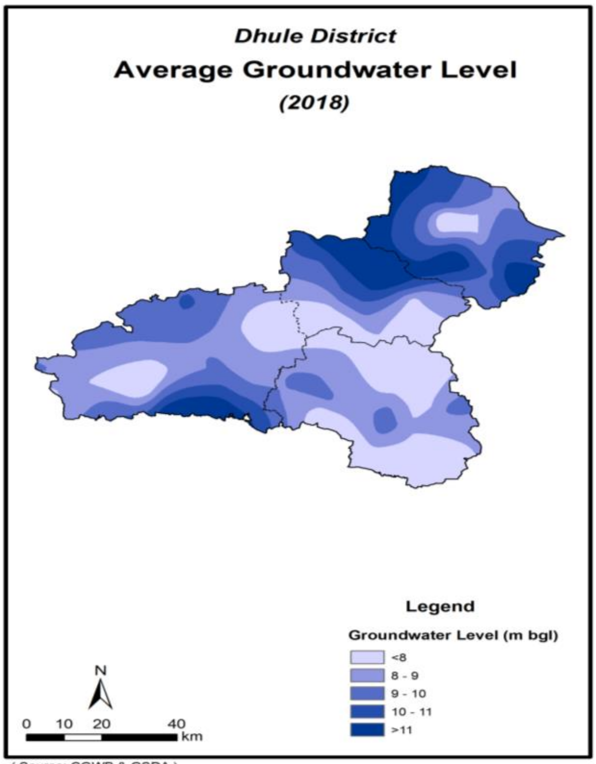


Fig: 4



(Source: CGWB & GSDA)

Fig: 5

- **Seasonal Water level fluctuation (May-November- 2011)**

Water level fluctuation of below 2 mbgl is observed in south- east part of Shindkheda tahsil and parts of Dhule tahsil. In major parts, particularly, Dhule, northern part of Shindkheda, southern part of Shirpur, south-west and north-east parts of Sakri tahsil, water level fluctuation is within the range of 2-4 mbgl. Seasonal water fluctuation greater than 4 mbgl is observed in southern part of Shirpur tahsil where predominant lithology is alluvium. Also water level fluctuation greater than 4 mgbl is seen in the central and north-west parts of Dhule and north-west part of Sakri tahsil.

The drought-prone area has been observed in western, central and southern parts of the district except Shirpur tahsil. The moderate to deeper water level of 10-20 mgbl is observed in the parts of Shirpur and Shindkheda tahsils. The following water level trends are observed in most parts of the district. Thus, artificial recharge and water conservations structures need to be prioritised in these areas.

- **Average Ground Water level (2013-2017)**

The data regarding ground water levels from the period 2013 to 2017 have been obtained from department of Geology, Zilha Parishad, Dhule. With the help of these data, average ground water levels are calculated and depicted in the fig 4 for the present study. The map indicates that the average ground water level during the period from 2013-2017 in the district ranges between less than 7 to more than 10 mbgl. The shallow water levels are observed on southern part of Dhule tahsil, north-central part of Shirpur tahsil and southern part of Shindkheda tahsil. In these parts, average ground water level is observed below 8 mbgl. Therefore, during summer season, due to the decrease of ground water level, wells become dry and water scarcity is experienced. Moderate ground water level is noticed in central part of Shindkheda tahsil and northern parts of Shirpur tahsil and also some small pockets are observed in Dhule and Sakri Tahsil. On the other hand, deep ground water level is noticed in Shirpur and Shindkheda tahsil particularly, in alluvium belt. In these parts, during summer season, the scarcity of ground water is not witnessed. It means there is perennial source of ground water available

- **Ground Water Depletion**

Over exploitative water based agriculture and inadequate rainfall received from south-west monsoon that by and large, have resulted in ground water depletion in the study area by varying degrees depending upon the hydrological and geological setup of the region. The considerable increase in Sugarcane cultivated area during eighties and from the last two decades, the area under cotton cultivation has been increased tremendously. Subsequently, draft of ground from tube wells during winter and summer season has been increased. This has resulted in over burdening on ground water regime.

The study region receives normal annual rainfall of 599.4 mm. However, in some areas of the district, it is below 400 mm rainfall. The uneven distribution and erratic nature of rain further affected unavailability of water. The recharge to ground water from rainfall in central and southern part of the district is, therefore, much less and even negligible and hence, in these parts acute scarcity of ground water is observed. As a result, agricultural practices are hampered.

From the figure 5, it is noticed that by and large, the maximum area of the district suffers from depletion of ground water in the year of 2018. Low to very low ground water depletion is observed in central, eastern and north-central part of the district. In these areas, ground water depletion is about less than 0.75 meter. These areas occupy one fourth of the district. Moderate level of ground water depletion ranges from0.75 to 1.00 meter. It is observed in central and eastern parts of Sakri tahsil, southern part of Dhule tahsil, central part of Shindkheda tahsil and southern and north-eastern part of Shirpur tahsil and accounts about 23% area of the district. High ground water depletion is noticed in most part of the district which occupies about 35% area. About 80% area of Sakri tahsil reported high ground water depletion. The south-eastern part of the Dhule tahsil, central part of Shindkheda tahsil and foothills zone of Satpuda ranges in Shirpur tahsil have also noticed high ground water depletion. There are five small pockets of very high depletion of ground water observed in Sakri, Dhule and Shirpur tahsils, Sakri tahsil has three small pockets of very high ground water depletion located at north-central, western and southern part. Very high ground water depletion (i.e. > 1.25meter) is also noticed in south-eastern part of Dhule tahsil and northern tip of Shirpur tahsil. These parts cover about 17% area of the district. Overall, depletion of ground water level is witnessed more or less in the entire study region. It is also proved by the fact that about one third area of the district suffers from severe drinking water scarcity. About 206 villages having acute drinking water scarcity and hence, the government agencies provide drinking water to those villages. About 94 villages of Sakri tahsil, 77 Villages of Dhule tahsil and 35 villages of Shindkheda tahsil have reported acute drinking water scarcity (figure 6).

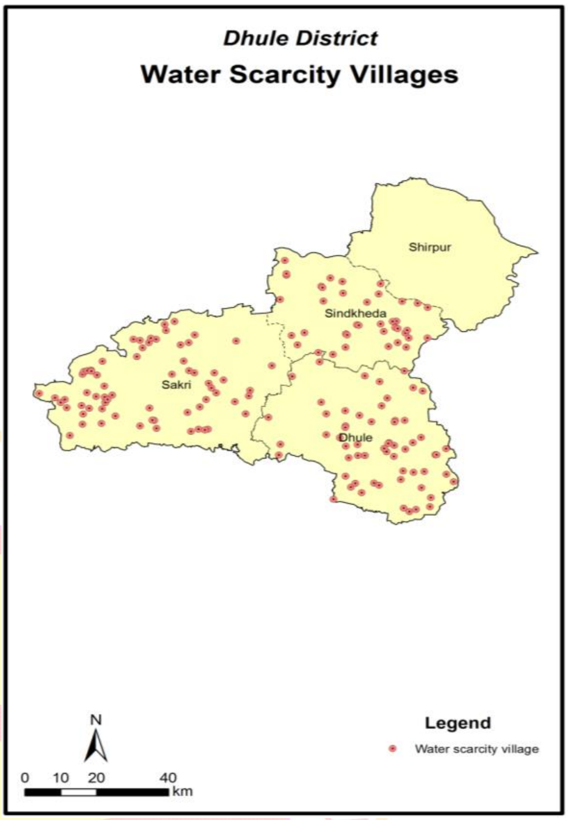


Fig: 6

Conclusion

From the present study it can be concluded that the average ground water level during the period from 2013-2017 in the district ranges between less than 7 to more than 10 mbgl. Over exploitative water based agriculture and inadequate rainfall received from south-west monsoon that by and large, have resulted in ground water depletion in the study area by varying degrees depending upon the hydrological and geological setup of the region. Depletion of ground water level is witnessed more or less in the entire study region. It is also proved by the fact that about one third area of the district suffers from severe drinking water scarcity. About 206 villages having acute drinking water scarcity and hence, the government agencies provide drinking water to those villages.

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