

Spatio-Temporal Variation of Groundwater Table in the Palghar and Thane Districts of the North Konkan Region

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Abstract

Water, often called the elixir of life, is vital for sustainable development. However, industrialization and population growth have significantly increased the demand for groundwater. This study evaluates changes in water table levels in Palghar and Thane districts, located in the North Konkan region of Maharashtra, India. Using groundwater data collected over 30 years (1994–2023) from 56 wells in Palghar and 36 wells in Thane, provided by Maharashtra's Groundwater Survey Development Authority, the study employed remote sensing and GIS techniques to analyze pre- and post-monsoon water table fluctuations across six half-decades (HFD1–HFD6). Statistical parameters like mean and standard deviation were used to assess variations, while GIS-based contour mapping highlighted spatial groundwater depth distributions. In Palghar district, pre-monsoon groundwater levels ranged from 0.1 m below ground level (m bgl) to 12.0 m bgl, with an average depth of 5.05 m bgl and a standard deviation of 2.16 m. post-monsoon depths varied between 0.1 m bgl and 2.0 m bgl, averaging 1.42 m bgl with a standard deviation of 1.14 m. Over six half-decades, the minimum pre-monsoon depths ranged from 0.93 to 1.86 m bgl, while maximum depths varied between 11.45 and 12.58 m bgl. Post-monsoon, minimum depths ranged from 0.24 to 0.44 m bgl, and maximum depths ranged from 5.11 to 7.99 m bgl. In Thane district, pre-monsoon groundwater depths ranged from 0.1 to 9.0 m bgl, with an average depth of 3.68 m bgl and a standard deviation of 1.98 m. post-monsoon depths varied from 0.1 to 3.0 m bgl, with an average depth of 0.8 m bgl and a standard deviation of 0.64 m. The minimum pre-monsoon water table depth ranged from 0.79 to 1.6 m bgl, while post-monsoon depths ranged from 0.24 to 0.41 m bgl. Maximum pre- and post-monsoon depths varied between 6.10–8.84 m bgl and 1.51–3.00 m bgl, respectively. GIS contour analysis revealed significant groundwater depletion in both districts over the 30 years. This decline underscores the urgent need for sustainable groundwater management strategies to mitigate the impacts of rapid industrialization and population growth, ensuring long-term water security and sustainable development.

Key words : Konkan, Groundwater Fluctuation, Water Table, Water Resources, RS and GIS, Pre-Monsoon, Post-Monsoon.

Groundwater is a critical component of the hydrological cycle, is indispensable in sustaining the ecosystem, water, and food security. Ground water has steadily emerged as the backbone of India's agriculture and drinking water security. According to Central Groundwater Board (CGWB) 2023 the contribution of ground water is nearly 62% in irrigation, 85% in rural water supply and 50% in urban water supply. Groundwater is a resource that is replenished

annually; however, its availability varies unevenly across different regions and periods. The groundwater found within the fluctuating water level zone is replenished each year, primarily through rainfall. Therefore, the sustainable use of groundwater resources requires an accurate quantitative evaluation of its availability in this zone, grounded in scientifically sound principles. The excessive groundwater usage has led to significant depletion and lowered water levels in various regions of India. In 2023, 241.34 bcm of groundwater was extracted out of a total extractable groundwater recharge of 407.21

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bcm, with 87% primarily used for irrigation (CGWB 2023).

The increasing demand for groundwater in the Indian agriculture system helps to drop water levels by more than 8 m on average for the last 30 decades (Aeschbach-Hertig and Gleeson, 2012; Sekhri, 2013). Both deep and very shallow groundwater levels will affect agricultural production (Mukherji *et al.*, 2013). Reducing groundwater levels can be depriving the water availability to crops; also, this would be reducing the soil moisture condition and thus the cost of production will defiantly increase due to pumping expenses (Balasubramani *et al.*, 2019). On the other hand, a very shallow water level almost near to the surface can create an over-saturation condition in the agriculture field and leads to a water logging situation (Chowdary *et al.*, 2008). So, in both conditions crop production can be hampered. Therefore, it is always significant to know the groundwater fluctuation of any particular region to understand the variability of crop production, cost of production, the demand for irrigation, etc. (Jain *et al.*, 2021).

Groundwater is essential for fulfilling the water needs of Maharashtra, a state in western India, supporting its population, agriculture, and industries. The state's diverse geological makeup includes hard rock regions, alluvial plains, and basaltic formations, which impact the distribution and availability of groundwater through various types of aquifers. Maharashtra frequently faces water scarcity, especially during dry seasons and droughts. Due to insufficient rainfall and limited surface water sources, there is a significant dependence on groundwater to meet agricultural and domestic demands. However, excessive and unregulated groundwater extraction has led to the depletion of aquifers in many areas across the state.

The state's projected annual groundwater recharge is 32.76 BCM, whereas its annual

extractable groundwater resources are 30.95 BCM. The total yearly extraction of ground water is 16.66 BCM, of which 15.28 BCM is removed for irrigation, 0.03 BCM for industrial use and 1.36 BCM for domestic use, and the extraction stage is 53.83%. The Annual Ground Water Recharge and Annual Extractable Ground Water Resources in 2023 have slightly increased from 32.29 BCM to 32.76 BCM and from 30.45 to 30.95 BCM, respectively, in comparison to the 2022 assessment. The Annual Ground Water Extraction has remained relatively unchanged. There has been a little decline in the Stage of Ground Water Extraction from 54.68% to 53.83%. (CGWB, 2023). A major part of the Konkan region is found about 44.19% in moderate groundwater potential zones followed by poor groundwater potential zones 27.23%. The good zones also contribute 19.82% area of the region, as well as the very poor zones contributes 4.43% area of the region. Least area found in the very good potential zones which is about 4.33% (Kale *et al.*, 2024).

The Palghar and Thane districts forms part of western slope of Sahyadri hill range. This hill range passes through the eastern part of the districts. Major part constitutes rugged and uneven topography, characterized by high hills and steep valleys with average annual rainfall about 2000 to 2500 mm. The total yearly extraction of groundwater in the Palghar district is 205.35 MCM, out of which 38.66 MCM is removed for irrigation, 9.66 MCM for domestic use and for industrial use, and the extraction stage is 22.83%. Thane district has about 163.69 MCM yearly extractable groundwater resources out of which 23.95 MCM is removed for irrigation, 7.13 MCM for domestic and industrial use and the extraction stage of the Thane district is 24.63% (CGWB, 2022).

As a consequence, water scarcity and over-exploitation of groundwater resources are common in several parts of India. Also, Palghar

and Thane districts of the Konkan region faces water scarcity during the months of summer season. This research work focuses on assessment of the spatio-temporal variation of the groundwater table for the sustainable development of the groundwater resources. Long term measurements are essential for identifying any significant deviations from mean water level and tracking the rate of increase or decrease over decades from initial static water levels. Monitoring groundwater levels is crucial for sustainable water management. In this study, fluctuations in the districts were analysed using pre-monsoon (measurements during April – May) and post-monsoon (measurements during October–November) groundwater depth data.

2. Study area : The Palghar and Thane districts are located in the northern part of the Konkan region of Maharashtra, bordered by the Arabian Sea to the west and the Sahyadri hills to the east. A significant portion of these districts lies within the Western Ghats. The total geographical area is approximately 5,272 km² for Palghar and 4,274 km² for Thane, characterized agroclimatically by hilly terrain in the eastern parts, with annual rainfall ranging from 2,000 to 2,500 mm. The districts predominantly have medium black soils with low infiltration rates. Geographically, they are situated in the eastern part of Maharashtra between 9° 41' 49.5852" North Latitude and 72° 45' to 73° 48' East Longitude (shown in Fig. 1). The climate in these districts is marked by high humidity throughout the year, with an oppressive summer followed by well-distributed heavy rainfall during the southwest monsoon. The cold season spans from December to February, summer lasts from March to May, the southwest monsoon season occurs from June to September, and the post-monsoon period covers October and November. July experiences the highest relative humidity at 89.00%, while March has the lowest at 53.05%.

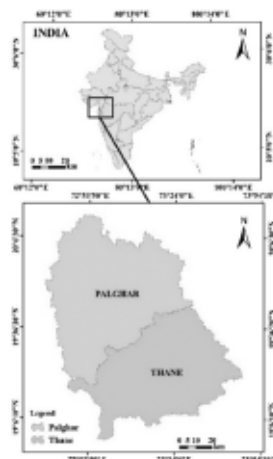


Fig. 1. Location map of study area

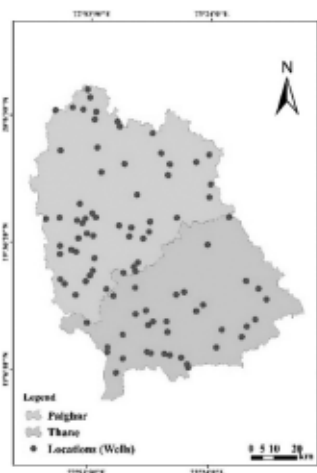


Fig. 2. Location map of spread of observation wells across Palghar and Thane district

3. Database and methodology

3.1. Data Availability : The present study is mainly based on secondary data collected for the period 1994 to 2023 (30 years). A total of 92 observation wells are distributed across the study area, managed and monitored by GSDA (Groundwater Surveys and Development Agency) of Maharashtra state. The locations (latitudes and longitudes) and long-term water level data for last 30 years (1994–2023) were procured from GSDA to create groundwater

depth maps and assess the changes in water level over time. Location map of the 92 observation wells is shown in Fig. 2. Administrative boundary of the districts was procured from the Survey of India portal for preparation of groundwater depth maps for the respective districts.

3.2. Methodology

3.2.1. Arrangement of the collected data

1. First step involved organizing the collected groundwater level data during April-May and October-November of each year from 92 observation wells spread across each district.
2. Subsequently, the data was sorted according to pre-monsoon and post-monsoon periods at across each district.
3. The arranged pre-monsoon and post-monsoon water level data of respective wells was averaged separately in half decadal groundwater depths (HFD) and named as HFD1 (1994-1998), HFD2 (1999-2003), HFD3 (2004-2008), HFD4 (2009-2013), HFD5 (2014-2018) and HFD6 (2019-2023) and converted into CSV file with the coordinates of the wells. These files formatted in a way compatible with ArcGIS such as CSV, Excel, or geodatabase formats. Flow chart of arrangement of the collected water table data is shown in Fig.3.

3.2.2. Preparation of groundwater level map

1. The compatible format data, represented by CSV files for both pre-monsoon and post-monsoon periods, was imported into the ArcGIS software. Groundwater level maps were then generated using the 'Interpolation' tool available within the software's toolbox.
2. The resulting groundwater level maps for

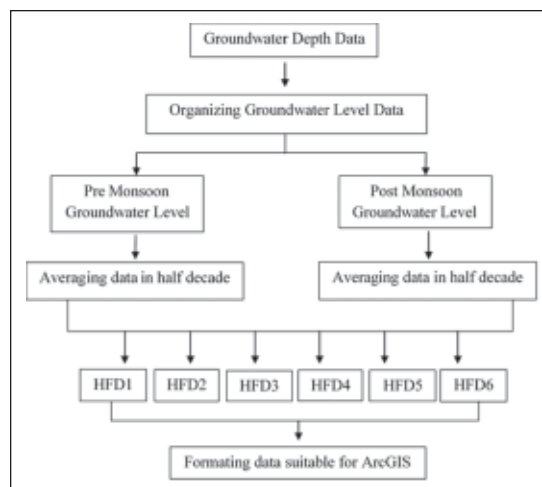


Fig. 3. Flowchart for arranging and grouping the groundwater level data

both pre-monsoon and post-monsoon periods were subjected to classification into distinct classes to enhance the analytical aspects of the data.

3.2.3. Preparation of groundwater contours map

1. To determine the extent of each seasonal groundwater level depth, contour maps derived from the generated groundwater level maps were formulated.
2. Resulting area of the groundwater level were analysed for the assessing the seasonal groundwater level fluctuation across each district.

4. Result and Discussion

4.1. Spatiotemporal distribution of groundwater fluctuation in North Konkan region : As many researchers indicated that the water table fluctuation method (Groundwater depth) can be very well adopted for the groundwater recharge, due to its simplicity and authenticity of data, this method was employed for the study (Healy and Cook, 2002, Zang *et al.* 2011). The groundwater fluctuation data

before (April-May) and after monsoon season (October-November) was used. The data of observation wells spread over all the districts of the North region from period 1994 to 2023 was collected from Groundwater Survey and Development Agencies, Konkan Bhavan, Navi Mumbai. The groundwater depth observations from observation wells were sorted out as per the location and distributed in each district. For the analysis of temporal fluctuation of groundwater, the data from each observation well before and after monsoon season was rearranged in half-decades. The spatiotemporal fluctuation of groundwater before and after monsoon season in each district was analysed and the results are discussed in the following sections.

4.2. Transient water table fluctuation

(district wise) : Total 92 observation wells are available in the North Konkan region. Among them, Palghar district has 56 observation wells and Thane district has 36 observation wells. The half decadal pre and post monsoon average water levels of these wells are presented in Fig 3 to Fig. 6.

4.2.1. Palghar district

4.2.1.1. Water table fluctuation and its area distribution before monsoon season (April - May) in Palghar district : Water table fluctuation data from 56 observation wells covering total geographical area of 5272.30

km² in Palghar district was grouped in half decade (HFD) data and the area occupied under each depth range of observation well was determined by interpolation method. The average annual rainfall in Palghar district during last 30 years 2669 mm. Results of area distribution of water table depth in the district before monsoon season over six half-decades (HFD1 to HFD6) is presented in Table 1 along with the mean groundwater depth and its standard deviation.

The results in Table 1 indicate that water table in 56 observation wells across Palghar district ranged from 0.1 m below ground level (bgl) to 12.0 m bgl. Before the monsoon season, the minimum and maximum water table levels across all observation wells during each half-decade were between 0.93 to 1.86 m bgl and 11.45 to 12.00 m bgl, respectively. The mean water table depth across all locations during all half-decades was 5.05 m, with the standard deviation of 2.16 m bgl. The area with a water table between 5.1 to 6.0 m bgl occupied 7.86% of district's total geographical area during the first half-decade (HFD1) and 6.90% during the sixth half-decade (HFD6), indicating a reduction in area at that depth. The area with a water table depth ranging from 1.1 to 5.0 m bgl varied between 89.6% and 91.4% of the total district area, with an increase in this range from HFD1 to HFD6. Similarly, the area with a water table depth greater than 6.0 m bgl was 2.5% during

Table 1. Area spread in Palghar district with water table fluctuation before the monsoon season

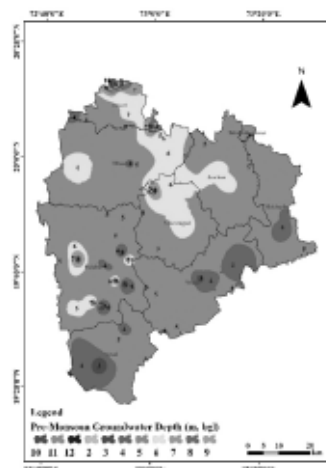
Depth (m bgl)	HFD1 Area (km ²)	HFD2 Area (km ²)	HFD3 Area (km ²)	HFD4 Area (km ²)	HFD5 Area (km ²)	HFD6 Area (km ²)
Mean depth - 5.05 m						
Standard deviation - 2.16 m						
0.1 To 5	4724.06	4691.17	4395.30	4837.17	4763.61	4817.17
5.1 To 6	414.52	448.23	743.27	355.47	420.81	363.89
6.1 To 12	133.73	132.91	133.74	79.67	87.88	91.25

HFD1, which decreased to 1.7% during HFD6. The increase in area with water table below 5.0 m bgl before monsoon confirms the availability of groundwater within 5.0 m depth in most of parts of Palghar district.

A critical analysis of temporal variation in water table fluctuation between first three half-decades (HFD1 to HFD3) and following three half-decades (HDF4 to HDF6) reveals that the depth in the second period improved from 11.1 to 12.0 m bgl to 10.1 and 11.0 m bgl. Additionally, the area across the district with water table depths below the mean during HDF4 to HDF6 increased by more than threefold compared to the HFD1 to HFD3 period. The area at the mean water table depth decreased by about 26%, while the area with water table depths below this level in the second period reduced by more than 39% compared to the first period. This clearly reflects that the water conservation efforts in the district have had a significant positive impact on groundwater recharge, increasing groundwater availability during water-scarce summer season in Palghar district.

The spread of area under different groundwater depths before and after the monsoon season across the district is given in Fig. 3 and Fig. 4 to visualize and understand the areas with higher water table depths and initiate the recharge works accordingly to the priority. Fig 3 reveals that a critical analysis of water table across each taluka in the district shows some of the deepest groundwater levels (8 m bgl to 12 m bgl) in the northern part of Palghar near Talasari during the HFD3. Additionally, the central regions around Vikramgad and the southern regions near Palghar exhibit a significant deepening of groundwater levels over time. The southern region, particularly around Palghar, remains a critical area with consistently deep groundwater levels, reaching 8 m bgl to 9 m bgl by the sixth half-decade (HFD6), indicating

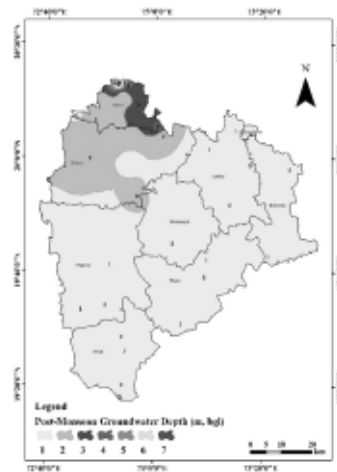
severe depletion in these areas. The results also suggest good groundwater recharge levels given the current extraction rate and water conservation practices being implemented in Palghar district. However, the groundwater extraction rate was not determined.



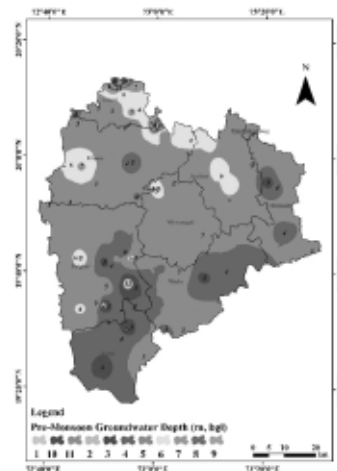
is 2684.7 mm majorly concentrated during monsoon season. To evaluate the aquifer's activeness in groundwater recharge under different geomorphological and land uses, the observations taken during October-November were analysed. The water table depth data for the post-rainy season across all half-decades was examined to determine the area occupied under each depth range, with the results are presented in Table 2, including the mean and standard deviation of water table depth below ground level. A visual representation of the area occupied under different depth range after monsoon season is provided in Fig. 4.

Table 2 reveals that the majority of Palghar district had a water table ranging from 0.1 to 2.0 m bgl. However, water table fluctuation after the rainy season varied between 0.1 to 8 m bgl. The minimum and maximum post-precipitation water table depths were between 0.24 and 0.44 m bgl and 5.11 and 7.99 m bgl, respectively. During the study period, the water table fluctuation in observation wells below 2 m encompassed 92.9 % to 99.96 % of the district's total area. The comparison of area occupied below average depth during first three half-decade with the area during second three half-decade reveals increase in area by about 3 per cent and respective decrease in area with depth below the mean depth.

Fig. 4 visualizes the spatial distribution of the water table depth across district during the post-



(HFD1-HFD3)



(HFD4-HFD6)

Fig. 4. Post-monsoon groundwater level depth Palghar district (HFD1-HFD6)

Table 2. Area distribution in Palghar district with water table fluctuation after monsoon season

Depth (m bgl)	HFD1 Area (km ²)	HFD2 Area (km ²)	HFD3 Area (km ²)	HFD4 Area (km ²)	HFD5 Area (km ²)	HFD6 Area (km ²)
Mean depth - 1.42 m						
Standard deviation - 1.14 m						
0.1 To 1	4419.02	3520.15	4329.55	5081.54	5002.84	5018.53
1.1 To 2	799.38	1378.69	796.45	160.30	233.37	232.64
2.1 To 8	53.91	373.47	146.30	30.46	36.09	21.13

monsoon season. It indicates that from the first three half-decade (HFD1) period, small patches of areas under different water table depth ranges (0.1 to 7.0m bgl) were scattered across the district. The number of small patches of areas is reduced and patches with shallow water depths are expanded and smoothened during the second three half-decade period. This is the indicator of accelerated recharge during the second three half-decade period as compared to the first one.

4.2.2. Thane District

4.2.2.1. Water table fluctuation and its area distribution during pre-monsoon season (April-May) in Thane district : The average annual rainfall in thane district during last 30 years 2617 mm. The water table fluctuation observations taken from 36 observation wells covering total geographical area of 4274.26 km² of Thane district were analyzed for groundwater availability during the water scarce period (pre-monsoon) across the district. The post-monsoon data of water table depth was analyzed to understand the aquifer behaviour for groundwater recharge due to the precipitation. The water table fluctuation observations before monsoon season from 36 wells were grouped in half decadal data to understand the spatiotemporal variation in Thane district. The results of analysis of water table variation and the extent of the variation in the district are depicted in Table 3.

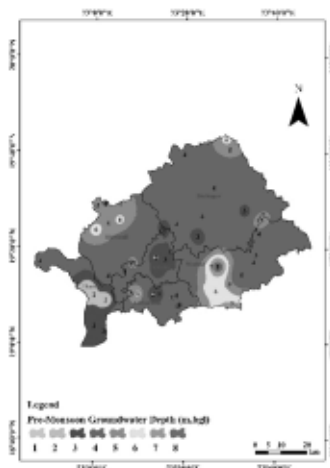
The results in Table 3 show that the water table fluctuation across all observation points during last 30 years varied between 0.1 and 9.0 m bgl. The minimum water table depth varied from 0.79 m bgl to 1.6 m bgl, while the maximum depth ranged between 6.10 m bgl to 8.84 m bgl. The average water table depth before monsoon season in the district was 3.68 m below ground level with the standard deviation of 1.98 m. The area under mean depth range of 3.1 to 4 m bgl varied in the range of 25.0 to 72.1% of the total district area during last sixth half-decades. The significant variation in area distribution over past 30 years may be due to fluctuations in groundwater extraction and utilization, which can be attributed to the sharp increase in human population, human interference with nature, and the growth of small-scale industries in the district (Anonymous, 2018).

The steady increase in the area with a water table depth of 1.0 to 3.0 m bgl from 8.1% in first half-decade (HFD1) to 24.1% in fifth half-decade (HFD5), highlights the progress in water conservation efforts in the district (Anonymous, 2019). The further sharp rise in this area to 36.1% during 2019-2023 (HFD6) may be attributed to the drastic variation in floating population in the district due to widespread impact of COVID-19 pandemic. Additionally, the marked decrease in the area with water table depths below 4.1 m bgl, from 66.9% (HFD1) to 12.3% (HFD6), is largely due to effective water

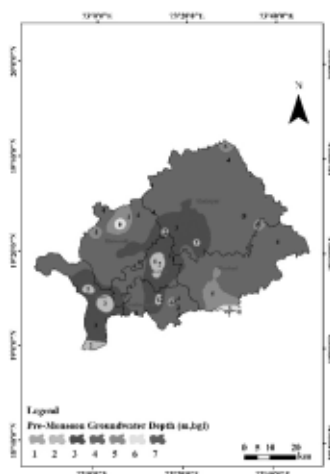
Table 3. Area distribution of water table fluctuation in Thane district during pre-monsoon season

Depth (m bgl)	HFD1 Area (km ²)	HFD2 Area (km ²)	HFD3 Area (km ²)	HFD4 Area (km ²)	HFD5 Area (km ²)	HFD6 Area (km ²)
Mean depth - 3.68 m						
Standard deviation - 1.89 m						
0.1 To 3	344.61	686.10	491.54	777.96	1030.41	1544.47
3.1 To 4	1069.74	2623.40	3079.83	2786.28	2957.93	2204.74
4.1 To 9	2859.91	964.76	702.89	710.02	285.93	525.06

conservation measures and the favourable aquifer properties that enhance recharge.



(HFD1-HFD3)



(HFD4-HFD6)

Fig. 5. Pre-monsoon groundwater level depth Thane district (HFD1-HFD6)

Fig. 5 illustrates the spatial distribution of the water table depth across the district prior to the monsoon season. During the first three half-decades, the lowest average water table depths were observed in the central part of Murbad taluka, followed by the western areas of Ambarnath taluka, northern part of Shahapur taluka and northern and southern parts of

Bhiwandi taluka. Murbad taluka, in particular, experienced a wider spread of areas with depths below 6.0 m bgl, leading to greater water scarcity during the summer. However, during the subsequent three half-decades, groundwater conditions in Murbad taluka improved significantly, with most areas showing water levels around 5 m bgl, and very few areas remaining in the 6 to 7 m bgl depth range. Currently, the groundwater situation in this taluka appears much improved. In Ambarnath taluka, the area with water table depths of 5 to 6 m bgl shifted eastward during the later three half-decades. Additionally, the water-scarce zones in Bhiwandi and Shahapur talukas also decreased during this period.

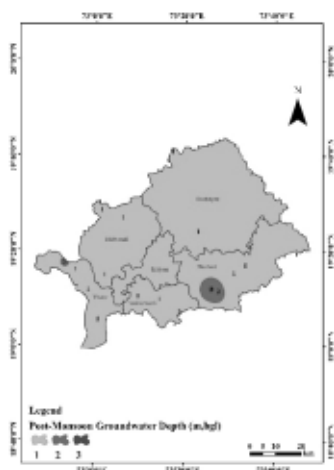
4.2.2.2. Groundwater table fluctuation and its area distribution post monsoon season (Oct-Nov) in Thane district :

Understanding the recharge behaviour of aquifers across different geomorphological settings and land uses is essential. To evaluate this, water table fluctuations in 36 observation wells located in different areas were analysed after the monsoon season. The post-monsoon water table depth data was examined for each half-decade to determine the extent of coverage within each water table depth range. The results, including the mean and standard deviation of water table depth below ground level, are shown in Table 4.

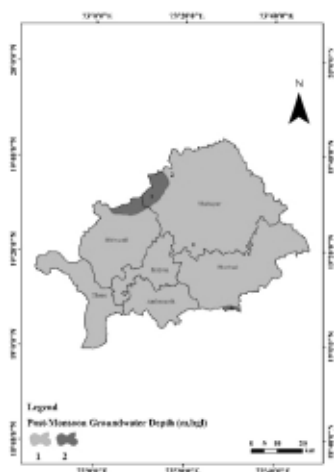
Table 4 shows that the water table minimum and maximum fluctuation in water table ranged from 0.24 and 0.41 m bgl and 1.51 and 3.00 m bgl, respectively. After the monsoon season, most of Thane district exhibits a mean water table depth between 0.1 to 1 m below ground level (m bgl) with the standard deviation of 0.64 m. However, within the district's total area of 4274 km², a specific area of 10.4 km² in Murbad taluka has a water table depth between 2 to 3m bgl (Fig. 6). A comparison of area under 0.1 to 1.0 m depth range from the first half-

Table 4. The extent of water table fluctuation after rainy season in the Thane district

Depth (m bgl)	HFD1 Area (km ²)	HFD2 Area (km ²)	HFD3 Area (km ²)	HFD4 Area (km ²)	HFD5 Area (km ²)	HFD6 Area (km ²)
Mean depth - 0.8 m						
Standard deviation - 0.64 m						
0.1 To 1	3291.75	4059.11	4190.68	3979.22	3915.52	4119.54
1.1 To 3	982.51	215.15	83.58	295.04	358.75	154.72



(HFD1-HFD3)



(HFD4-HFD6)

Fig. 6. Post-monsoon groundwater level depth Thane district (HFD1-HFD6)

decade to sixth half-decade shows an about 25% increase in sixth half-decade as compared to the first. Conversely, there was a significant reduction in the area under the 1.0 to 2.0 m depth range over the same period. This indicates that aquifers in Thane district recharge effectively, regardless of the area's topography, land use, or geological formations.

4.3. Before and after monsoon rate of groundwater depth in the critical talukas of both district

4.3.1. Rate of groundwater depletion before and after monsoon season in the Palghar district : Figure 7 illustrates the complex groundwater dynamics in critical areas of Palghar district over the past 30 years, focusing on pre-monsoon trends. Assessing the rate of groundwater depth variation is crucial for understanding the region's groundwater situation and for planning effective recharge activities.

In Palghar district, several talukas exhibit moderate increases in groundwater depth before the monsoon season. Specifically, Palghar, Talsari, and Vikramgad show rates of rise of 0.049 m, 0.017 m, and 0.097 m below ground level (bgl), respectively. Conversely, Dahanu and Jawhar experience groundwater depletion, with rate of decline recorded at 0.028 m and 0.016 m bgl, respectively.

Post-monsoon groundwater dynamics, depicted in Figure 8, reveal significant variations across the district. In Jawhar taluka, groundwater depth continues to decline, with a depletion rate of 0.015 m bgl. However, other talukas, including Dahanu, Palghar, Talsari, and Vikramgad, show increases in groundwater levels. The rates of rise in these talukas are 0.055 m, 0.025 m, 0.021 m, and 0.021 m bgl, respectively.

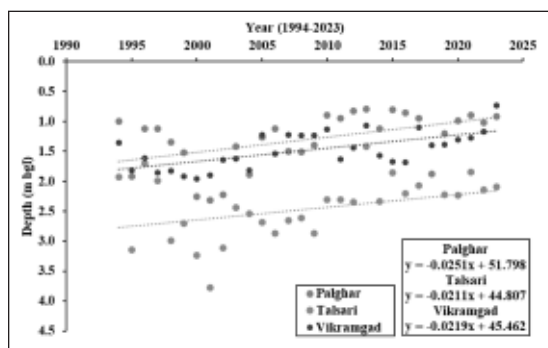
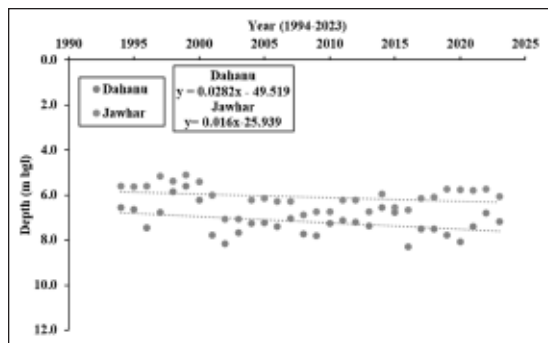


Fig. 7. Rate of groundwater depletion before monsoon season in the Palghar district

4.3.2. Before and after monsoon rate of groundwater depletion in the critical areas of Thane district : Figure 9 and 10 provides an in-depth representation of the groundwater dynamics in key areas of Thane district over the past 30 years, with a specific focus on pre-monsoon and post monsoon trends.

During the pre-monsoon season, critical

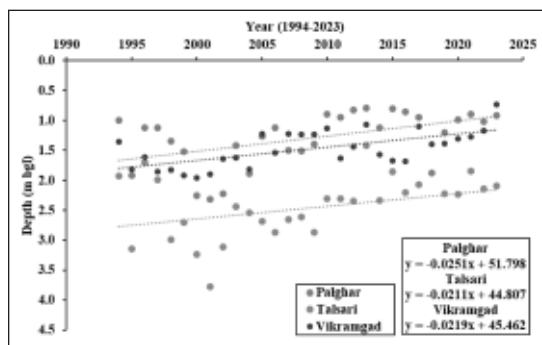
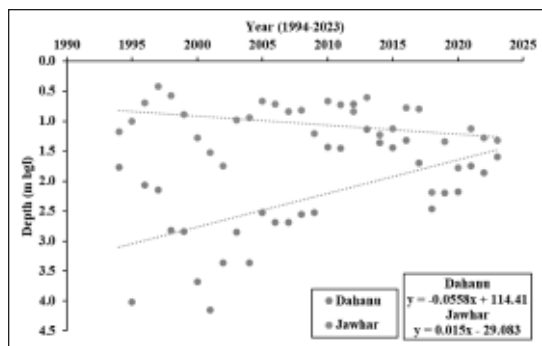


Fig. 8. Rate of groundwater depletion after monsoon season in the Palghar district

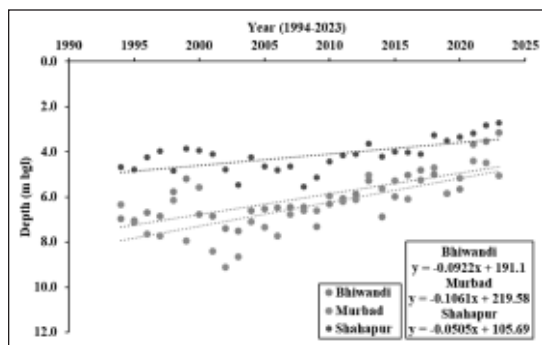


Fig. 9. Pre monsoon rate of groundwater table in the Thane district

areas of Thane district, including Bhiwandi, Murbad, and Shahapur, exhibit an increase in groundwater depth at rates of 0.09 m, 0.10 m, and 0.05 m below ground level (bgl), respectively. However, groundwater depths in these talukas were recorded up to 9.0 m bgl, indicating a generally stable or improving

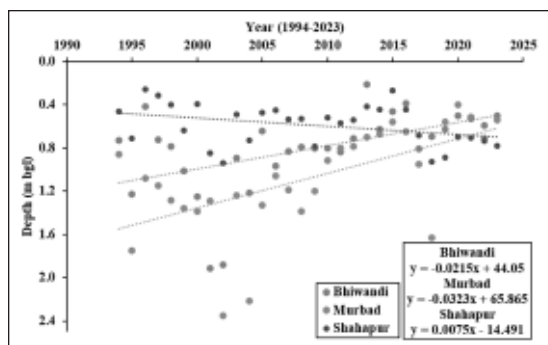


Fig. 10. Post monsoon rate of groundwater table in the Thane district

groundwater situation. This trend may be attributed to limited extraction or reduced demand on groundwater resources in these regions.

Post-monsoon observations reveal further increases in groundwater levels in Bhiwandi, Murbad, and Shahapur, with depths recorded up to 2.4 m bgl. In Bhiwandi and Murbad, the rates of increase were 0.02 m bgl and 0.03 m bgl, respectively. However, Shahapur taluka exhibited a moderately declining trend in groundwater levels, with a depletion rate of 0.0075 m bgl. This decline in Shahapur may be linked to overextraction for industrial, domestic, and agricultural purposes (Anonymous, 2018).

5. Conclusion

The overall observation of water scarcity in the North Konkan region is that it occurs only for a short period, typically up to 100 days during the summer season, despite the region's heavy precipitation. Due to the low moisture-holding capacity of the soils, afforestation is crucial. Without it, most of the precipitation will lead to runoff, exacerbating water scarcity.

The highest pre-monsoon water table depths suggest increased groundwater extraction in certain areas, highlighting the need for judicious groundwater use. This calls for intensified efforts

to raise awareness about sustainable ground water management during the non-monsoon season across both districts in the North Konkan region. Reducing groundwater extraction is essential for ensuring sustainable water resources, protecting agriculture and preserving the environment.

These findings underscore the importance of targeted groundwater management and recharge interventions tailored to the distinct hydrological conditions of each taluka.

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