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Examine the Seasonal Fluctuations of Groundwater of Bhiwani Block, Bhiwani District, Haryana (1998-2018)

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ABSTRACT

The seasonal fluctuation of the groundwater has been one of the pressing problems of the Bhiwani district of Haryana. However, the villages, belonged to Bhiwani block of Bhiwani district is characterized with semi-arid type of climate; where the quantum of mean rainfall is far below of the mean rainfall of the Haryana state. In this paper, the author examines the pre and post monsoon ground water situation of the Bhiwani block, district Bhiwani. The study is based on secondary source of data; which have obtained from the groundwater cell, Bhiwani. The period has been taken since the year 1998 to 2018. This temporal dimension of the seasonal fluctuation shows a considerable trend of the groundwater fluctuation; as shown by the compound bar graph, which shows a growth of the groundwater, between the two points of the years, and also shows temporal disparity, across the Block Bhiwani of the Bhiwani District.

Keywords: Seasonal and temporal fluctuations, groundwater, regional disparity, semi-arid

INTRODUCTION

Groundwater is the main source of availability of fresh water available for human, cattle, agriculture and the industrial purposes across the world. The ground water is one of significant sources of fresh water and the one of the significant sources of the irrigation, industrial and the drinking water in the large parts of the world (Singh and Sharma, 2010). At the global level, the ground water supplies nearly 50 % of the current share of the water supply and nearly 20 % meets the demand for the irrigation purposes. In this context, various reports on the ground water shows that the ground water is often benefitted in a better way than that of making use of the in terms of per unit volume. It is because of the availability of the local water is easier and good quality requiring minimal treatment. The water resources is a renewable source and has the significantly distinction of being mainly dependable; which is a safe source of fresh supply of water (Singh and Singh, 2002).In the agricultural practices, the share of the ground water is the maximum which shares 52 per cent ground water is used for irrigation purposes to ensure the food security for millions of the people; living across the world.. The rest of the 48 per cent of the ground water is used for other miscellaneous purposes like domestic purposes, industrial use etc.
India, Pakistan and China share a lion share with over one third of the ground water of the world. In case of India, it was estimated that there are 55 to 60 per cent of the ground water is utilized in the agricultural and allied activities by the farmers and their livelihood depend upon the ground water for their mixed farming activities in their respective villages (Sharma, 2020).

The water, a unique renewable resource on earth, is essential for sustenance of all forms of life, food production and economic development. Both the surface water and groundwater play a major role in daily requirements of water, however, due to rapid urbanisation, population growth, global warming and deterioration in quality of surface water, the dependence on groundwater has increased. In the last few decades groundwater has been drafted with a high rate throughout the world. This over-drafting or over-exploitation of groundwater resources for the increasing demands of irrigation, domestic and industrial purposes has led to the permanent lowering in the levels of groundwater which is known as groundwater depletion (Kharb, 2017).

According to Central groundwater board (CGWB, 2011) 71 out of 116 blocks of the state including 5 blocks of **Bhiwani** district are over-exploited where stage of groundwater development is more than 100%. Groundwater levels in Bhiwani district have been depleted with a rate of 0.03 meter/year in the last four decades (Kharb, 2017). Geographical information system (GIS) technique has been widely used as an important tool for groundwater depletion assessments all over the world. So, the present study has been conducted to assess the changing scenario of groundwater levels, their rate and magnitude in different blocks of Bhiwani district by applying GIS techniques.In case of Haryana, where the problem of seasonal ground water fluctuation has been shown a considerable negative growth during various successive years; an aggravated situation in most of the blocks; particularly in the south-western parts of Haryana (Jaglan &Taj pal, 2012).The

ground water depletion has been experienced maximum in the southwestern parts of the Mohendergarh district. On the other hand, water table has been experienced maximum rise in the northern part of the region of Bawani Khera in Bhiwanidistrict (Singh, S. Jeet, 2016).Seasonal fluctuation of the ground water has been one of the pressing problems in the country. The present study is confined to Bhiwani block of the Bhiwani district which shows significant seasonal fluctuations across the 63 villages, of the Bhiwani block of the Bhiwani district of Haryana. Keeping view the various problematic areas, it becomes imperative to have a periodic review of the ground water in terms of fluctuation in quantity and the quality of the water and take preventive and curative measures accordingly, so that a judicious use of the groundwater may be utilized by the farmers to attain the position of the sustainable development (Kharb, 2018).

Statement of the problem: The seasonal fluctuation of the groundwater has been one of the pressing problems of the Bhiwani district of Haryana. However, the villages, belonged to Bhwani block of Bhiwani district is characterized with semi-arid type of climate; where the quantum of mean rainfall is far below of the mean rainfall of the Haryana state. In this paper, the author examines the pre and post monsoon ground water situation of the Bhiwani block, district Bhiwani. The study is based on secondary source of data; which have obtained from the groundwater cell, Bhiwanis. This temporal dimension of the seasonal fluctuation shows a considerable trend of the groundwater fluctuation, experienced by the farmers of the study areas. This fluctuation is partly caused by the pre and post monsoon rainfall situation and partly caused by the continuous depletion of the groundwater due to over exploitation of the groundwater by the farmers. It is therefore, it becomes imperative to take preventive and curative measures for combating steady depleting of the groundwater of the study area.

Objectives of the Study:

1. To evaluate the seasonal fluctuations of groundwater of study area,
2. To find the coefficient of variability in change in pre and post Monsoon fluctuations;

MATERIAL AND METHODS

The study is based on the secondary data, obtained from the groundwater cell, Bhiwani, The data is relating to the period within the (1998-2018). In order to analysis the trend of pre and post monsoon groundwater fluctuation the secretive method has been used to get the desired objective of the study. In this context, the data were collected, analyzed and interrelated the data to draw the inferences accordingly. Further, to work out the coefficient of variability of the groundwater fluctuations, the coefficient of variability formula was applied to get the desired results.

The Study Area: The block is one of the significant blocks of the Bhiwani district. There are 82 villages are located within the Bhiwani block. According to census 2011, there are 107432 households in the Bhiwani block. The total population of this block is 553698; with its total area is 960 square KM, whereas 53.88 % are male and 46.12 % are female, shows a considerable gender inequality in the block. The sex ratio is 875 female per 1000 males, again shows a considerable gender inequality in the sex ratio. The density of population is 577 persons. The share of urban population is 64.59 percent; whereas the share of rural population is 35.41 per cent. The share of SC population in the blocks is 20.13 per cent. The main crop of the block is wheat, mustard are the main Rabi crops; whereas sugarcane, cotton and Jowar and Bajra are some of Kharif crops of the Bhiwani block. Further, Bhiwani block is well connected with the rail and roads with the state and the national capital, as well as other districts of Haryana and neibouring states. In the block Bhiwani, the infrastructure related to agricultural marking is well developed through good net work of grain market. There is 63 per cent of the work force, engaged in agriculture, whereas 12 per cent work force in the manufacturing sector and rest of 25 per cent of the work force in the tertiary sector which include services in the army, transport, police, banking and other services.

RESULTS & DISCUSSION

Keeping in view the block wise seasonal fluctuations; as indicated by Tables and the line graphs on the seasonal fluctuations of the ground water of the all the blocks of the Bhiwani district which shows a significant fluctuations during the year 1998 to 2018. It has observed from the tabulated figures which show a significant fall in the ground water level, even after the rainy season of the Monsoon which shows a significant depletion of the ground water in some of the blocks of Bhiwani district of Haryana.

The ground water levels during the pre and the post Monsoon periods in Bhiwani block of the Bhiwani districts is tabulated as follows:

Table-1: Periodic Pre -Monsoon fluctuation of Groundwater in Bhiwani Block, Bhiwani district, Haryana (1998-2018) (In meters)

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Pre-monsoon	4.90	4.45	4.76	5.25	5.32	5.82	5.23	4.99	5.23	5.23
Post-monsoon	4.31	4.75	4.50	5.04	5.44	5.02	5.06	5.53	4.43	5.18
Groundwater fluctuation	-0.59	+0.30	+0.26	-0.21	+0.12	-0.80	-0.17	+0.54	-0.08	-0.05

Source: Groundwater Cell, Bhiwan……

Table-2: Periodic Pre -Monsoon fluctuation of Groundwater in Bhiwani Block, Bhiwani district, Haryana (2008-2018)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Pre-monsoon	6.68	5.34	5.60	4.50	5.51	5.65	5.68	5.02	4.62	4.55	4.77
Post-monsoon	4.99	4.97	4.82	4.26	4.36	4.69	4.75	4.91	4.80	4.64	4.88
Groundwater Fluctuation	-1.6	+0.37	+0.78	+0.24	+1.15	+0.96	+0.93	+0.22	-0.18	-0.09	-0.11

Source: Groundwater Cell, Bhiwanis

In the Bhiwani block, the fluctuating situation of the pre-Monsoon period (1998 to 2018) shows a significant fluctuation; as shown by the table-3.5 and 3.6. It is quite obvious that the tabulated data of pre -Monsoon situations of the ground water situation of the Bhiwani Block shows a significant fluctuation in the water table of the block during 1998 to 2018.

However, the observed data shown a slow fall in the water table 3.1 and subsequently, the rate of decreasing of the water table tend to show declining in this corresponding period. It has been observed that during the pre-Monsoon, the levels of the ground water of the Bhiwani Block shows more or less same level in the initial and the last period. Within the period since 2001 to 2015, it shows a significant fall in the water tables, as indicated by the tables 3.1 and 3.2. Meaning thereby, there has been steady depletion of the ground water during this period.

In case of post-Monsoon situation, it was observed that: In the Bhiwani block, the fluctuating situation of the pre-Monsoon period (1998 to 2018) shows a significant fluctuation; as shown by the table- 3.5 and 3.6. It is quite obvious that the tabulated data of post Monsoon situations of the ground water situation of the Bhiwani Block shows a significant growth in the ground water table, but at a slow rate during 1998 to 2018. However, the observed data shown a slow fall in the water table 2 and subsequently, the rate of decreasing of the water table tend to show declining in this corresponding period. It has been observed that during the pre-Monsoon, the levels of the ground water of the Bhiwani Block show a significant fluctuation, as indicated by the tables 1 and 2. Meaning thereby, there has been steady depletion of the ground water during the later period. The average fluctuating figures of the pre and post Monsoon situation have experienced during different successive periods. Thus, the fluctuation of the ground waters of the Bhiwani Block of the Bhiwani district shows a significant change during the pre and the post Monsoon situation which is shown in compound bar graph as follows:
The periodic fluctuations in the groundwater is determined by various periodic factors which directly or indirectly affect the level of groundwater fluctuations, depends upon the prevailing local conditions like level of periodic recharging of the groundwater through percolation of rainwater, level of depletion of the groundwater due to exploiting the groundwater by the farmers and seasonal evaporation of the withdrawal water by the farmers. Further, the co-efficient of variability in the pre and post monsoon groundwater variability has been worked out by applying the formula; as follows:

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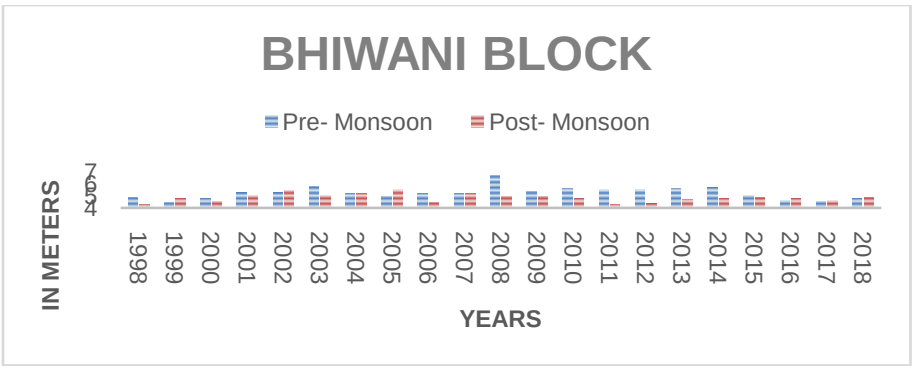

Source: Groundwater Cell, Bhiwani

Fig. 1.Periodic fluctuation of Ground water of Bhiwani Block of District Bhiwani, Haryana (1998-2018)

The coefficient of variability is worked out as follows:

Where S.D is is 4.02 and $\bar{X}$ =0.20

$$C.V. = 100 \times \frac{\sigma}{\bar{X}}$$

$$= 100 \times \frac{4.02}{0.20} = 0.22 \times 100 = 22\ \%$$

Thus Coefficient of Variability in the pre and post Monsoon groundwater fluctuation is 22% in the Bhiwani block of Bhiwani district of Haryana. This seasonal change in the groundwater is also shown in the map as follows:

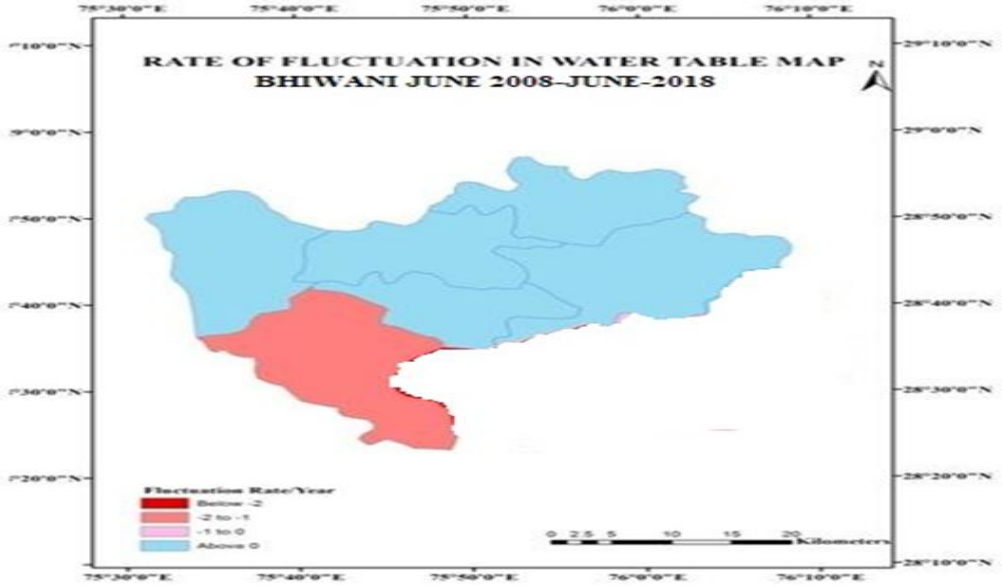

Fig: 2
Periodic Rate of change in Distribution in pre and post Monsoon Groundwater Fluctuation in Bhiwani Block of Bhiwani district, Haryana

CONCLUSION

The study in terms of pre and post Monsoon situation of the 80 villages, belonged to Bhiwani block, shows sconsiderable seasonal fluctuations, as indicated in the study, carried out for the period (1998 to 2018). It is because of the excessive annual rainfall and least tendency the ground water bodies, whereas in the some of the locations which tend to fall in the fluctuation shows relatively excessive withdrawal of the ground water as compared with the recharging of the ground water with the rain water. The fall in the levels of the groundwater during the from December month to May, which is closely linked with the abstraction of ground water for the irrigation purposes, particularly, for the Rabi crops. Though during monsoon the groundwater during the Monsoon period, which tends to abstraction; resulted in reduces due to rain.

The levels of the groundwater in the Western and the Southwestern region of the district which lies relatively lesser to the Northern and the central part of the district.. The soil in this region is characterized with sandy clay characteristics, which allows sufficiently the infiltration. As a result, an appreciable quantity of the water percolates down to earth and stored as groundwater. The Bhiwani block is characterized with long dry season with scanty rainfall and percolation from the surface as a component of recharge. On the other hand, thecomponents of the discharge are excessive irrigation withdrawal, making the domestic industrial water, evaporation, etc. The northern region of the Western located block like Bhiwani is facing very critical conditions, as compared with rest of the blocks which requires to take some of the effective preventive and curative measures in accordance with prevailing local conditions so that a sustainability may be maintained in the demand and supply of the ground water to minimize the ground water fluctuation in the 80 villages, belonged to Bhiwani block of Haryana..

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