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THE GROUNDWATER MANAGEMENT AND SUSTAINABLE DEVELOPMENT: A GEOGRAPHICAL STUDY

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Abstract:

The groundwater asset is one of the key components in making the nation self-sufficient in nourishment generation. Groundwater-irrigated farming plays an critical part in destitution mitigation and has significantly expanded nourishment generation. Until presently, accessibility of groundwater has not been a limitation to rural improvement. But this asset is progressively confronting different issues counting quality risks in numerous regions where the presentation to contamination from agribusiness, urbanized regions and mechanical destinations as well as arsenic defilement in shallower groundwater aquifers makes the water unfit for human utilization and in a few cases indeed for water system purposes.

High rates of pumping for water system and other employments from the shallow aquifers in coastal regions may result in broad saltwater interruption, descending spillage of arsenic concentrations and the common debasement of water assets. Other than, utilize of agrochemicals may cause defilement of shallow groundwater and silt. Nonstop decay of groundwater tables due to over-withdrawal has too been detailed from a few ranges. In this way, the by and large circumstance calls for pressing groundwater administration for economic improvement. Groundwater administration must embrace an coordinates approach considering a wide extend of biological, socio-economic, and logical components and needs.

The water level of Rohtak district has been studied and mapped in twice a year 2010, i.e., Pre-monsoon (June), and Post-monsoon (October) period using Inverse Distance Weighted (IDW) method of Spatial Interpolation (Geospatial Techniques).

Keywords: Groundwater, Poverty Alleviation, Resource, IDW; and Interpolation.

Introduction:

Groundwater is the foremost valuable normal asset of the soil and is of most extreme significance in each feature of human life. Although, it may be a more energetic renewable common asset, its accessibility with great quality and appropriate quantity is noteworthy. Groundwater asset comprises of two parts- energetic assets within the zone of water table change, which reflects regular revive, and release of aquifers and inactive asset underneath this zone (Das, 2006). The energetic groundwater asset, which is energized every year, is misused for water system, residential and mechanical purposes. Precipitation is the central source of energize, in spite of the fact that in a few ranges canal leakage, return stream from water system and leakage from water collecting structures too contribute altogether to the groundwater revive (Chatterjee and Purohit, 2009). As a result of burgeoning populace, urbanization and deforestation, weight is ceaselessly expanding on this important valuable asset of nature. It has been watched over a period of time that Haryana is confronting two sorts of issues related to exploitation and utilization of groundwater assets i.e. rising as well as declining patterns. Rising patterns within the ranges of destitute groundwater quality though declining patterns within the regions where groundwater quality is new coming about into overexploitation by agriculturists.

The utilize of Geographic Data Framework isn't unused in groundwater studies. Distinctive Analysts (Chaudhary, 1996 and Central Groundwater Board, 2013) have effectively used GIS innovation for examining different angles of groundwater (quality, accessibility, possibility etc.) completely different parts of Haryana state. These studies reveal that in a few ranges, there's nonstop decay of groundwater over a period. These are the ranges where the quality of groundwater is new. Central portion of Haryana is seeing rise within the water table driving to water logging and salinization. These regions are overwhelmed by destitute quality of groundwater. Within the light of the over dialog, show article portrays the groundwater situation of Haryana state as in 2011 almost the volumetric appraisal of accessibility and draft. It too surveys the spatial varieties in per unit accessibility, draft, and organize of groundwater improvement with the assistance of GIS innovation.

Study Area

Rohtak district of Haryana lies between 28° 40' to 29 ° 05' North latitudes and 76 ° 13' to 76 ° 51' East longitudes (Fig 1.1). Total geographical area of the district is 1745 sq.km. Rohtak district is one of the 22 districts of Haryana State in Northern India. Rohtak district is in southeastern part of Haryana State and constitutes a major part of eastern Haryana plain. Rohtak District, a part of eastern Haryana plain is bordered by Sonipat in northeast and Jind districts in the north, Jhajjar District in the South, Hissar district in the North West and Bhiwani in the West.

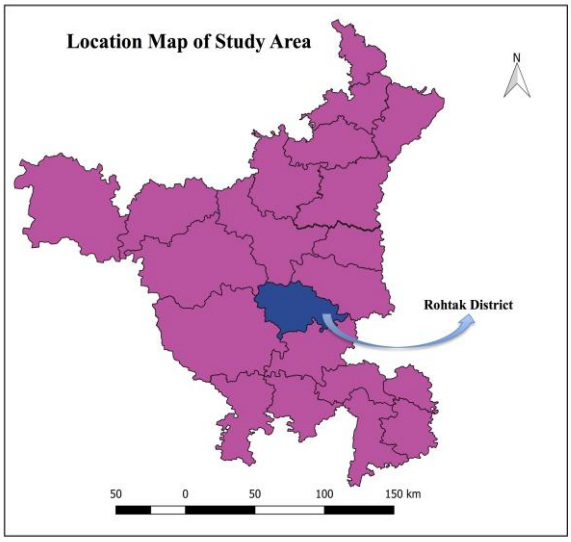


Fig 1.1

Review of Literature

Ground water is a vital natural resource available in the planet earth. Depending on its usage and consumption it can be a renewable or a non-renewable resource. It is estimated that approximately one third of the world's population use ground water for drinking (Nickson et al. 2005). Ground water is the major source of water supply for domestic purposes in urban as well as rural parts of India. Among the various reasons, the most important are non-availability of potable surface water and a general belief that ground water is purer and safer than surface water due to the protective qualities of the soil cover (Mishra et al. 2005). In the

present report, the application of remote sensing and GIS techniques has been used to study the level and changes of ground water over the decade of Rohtak District.

Sitender and Chaudhary (2015) studied that groundwater is the most precious natural resource of the earth and is of great importance in every facet of human life. As a result of burgeoning population, urbanization and deforestation, pressure is continuously increasing on this valuable resource of nature. Amarjeet et al. (2015) was carried out to assess the suitability of Meham Block ground water for domestic and agriculture purpose. Parmar et al. (2015) examined that water logging is one or the major environment issue and hurdle in development of the area. The study was carried out to identify the water-logged area in Rohtak District, Haryana. Rani and Chaudhary (2015) have made attempt to understand the spatial distribution pattern of suitability of groundwater quality for domestic use in Hisar district of Haryana state, India by using Geographical Information System (GIS) techniques.

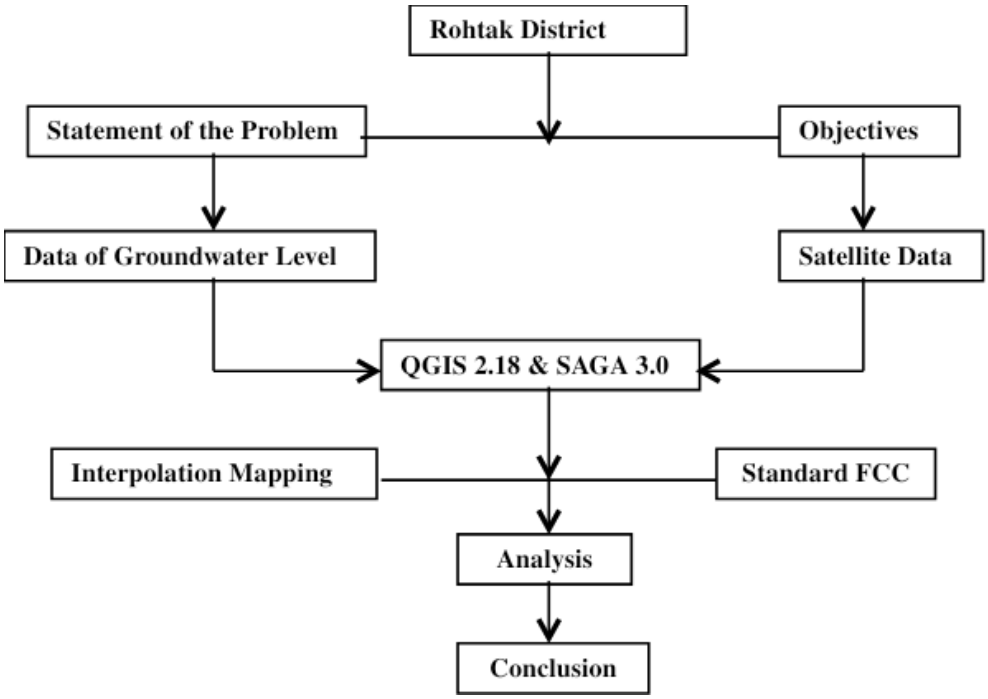
Paudyal et al. (2016) specified that waterlogging is one of the major problems of land degradation processes. GIS environment was used to prepare and overlay different thematic maps and to extract the desired information. Based on satellite imagery, about one per cent of the study area was affected by surface waterlogging during the pre-monsoon period of 2010. Management strategies were suggested depending on the nature of the problem i.e., surface, or sub-surface waterlogging as well as depth and quality of groundwater.

Objective

Modern techniques like remote sensing and GIS are increasingly becoming important day by day in all real-life problems, which are geo-spatial in nature. Field of hydrology and water resources development is also the area having extensive scope of deriving benefits from these tools of geo-informatics. Therefore, this study will fulfill the specific objectives by utilization GIS method. The main objective of the study area is to analysis the groundwater level and examines the leading problems of the Rohtak district.

Methodology

The methodology used for the study of groundwater level in Rohtak district is following:



Data source

The LANDSAT 8 (ETM+) satellite data acquired on 19 October 2016 was used for the study of the groundwater level of the Rohtak district. The village wise data of the groundwater level were collected from the Groundwater Cell, Directorate of Agriculture, Panchkula. Village wise spatial distribution of groundwater level was mapped using QGIS 2.18 and SAGA 3.0 software's and final maps of the study area, FCC and interpolation maps were prepared. These maps were then analyzed to explain the leading problems of the study area.

Groundwater Level of Rohtak District, 2010

The study of the groundwater data, exact interpolation method of spatial interpolation has been used. Further, groundwater data has been interpolated with the help of Inverse distance weighted (IDW) method. IDW is a local exact interpolation technique, which is based on standard geographic assumption that the unknown value of point is influenced more by its neighboring points than those further away. The weight/degree of influence is expressed by the inverse of the distance between points raised to a power i.e. as the distance increases the influence decreases over the unknown points. The weight/degree of influence is expressed by the inverse of the distance between points raised to a power. The power of 1.0 means constant rate of change. The power of 2.0 suggests that the rate of change in values is higher near a known point and level off away from it.

The equation for IDW method is:

$$Z_o = \frac{\sum_{i=1}^{s} Zi. \frac{1}{d_j^k}}{\sum_{i=1}^{s} \frac{1}{d_j^k}}$$

Where
Z_0 *= estimated value at point 0*
Z_i *= Z value at control point i,*
d_j *= distance between control point i and point o*
s *= the number of control points used in estimation*
k *= specified power.*

Groundwater Level of Rohtak District, 2010

The water level of Rohtak district has been studied and mapped (Fig 1.2 & 1.3) in twice a year, i.e., Pre -monsoon (June), and Post monsoon (October) period. In the month of June water level (Fig 1.2) is 1.8 meter whereas in October it increases 0.4 meter (Fig 1.3). The ground water level is high in the Northern parts of the study area where villages comprise Nandal, Guga Heri, Lakhan Majra, Bainsi, Kharainti and Ajaib, Girawar, Central (Madina Korsan, Nidana, Kharkara, Madina Gidhran, Bahu Akbarpur, Mokhra Khheri Roz, Mokhra Khas, Sampal, Lahli), East (Rithal Narwal, Kiloi Dopana, Kiloi Khas, Rurki) and in the Southern parts of the Rohtak, where villages are Kanheli, Pehrawar, Shimli, Karontha, Baland, Ritauli.

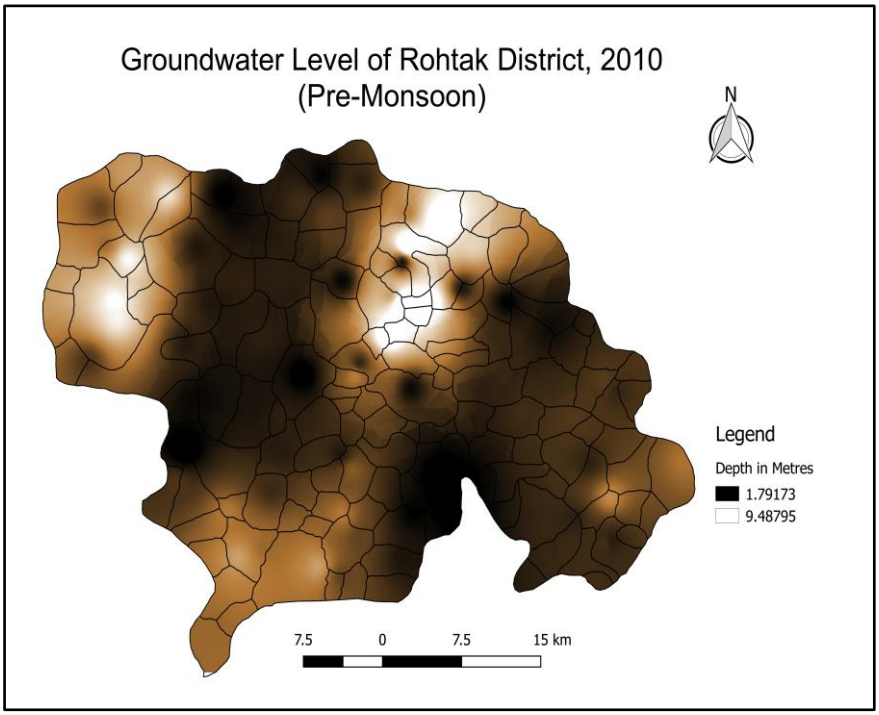


Fig 1.2

The continuous rising of ground water level it leads to waterlogging and salinity problems of the study area. This occurs due to poor irrigation practices and more uses of fertilizers in agriculture. Salinity has adverse effect on soil and reduces soil fertility and further leads to degrade of agricultural activities. Drinking water also affected this problem so people face many health problems. The groundwater problem in Rohtak district has two dimensions. The first is that of rising groundwater level in the areas with low quality aquifers, leading to secondary salinization and waterlogging. The second is that of declining water level due to over-pumping of groundwater in fresh water quality aquifer zones.

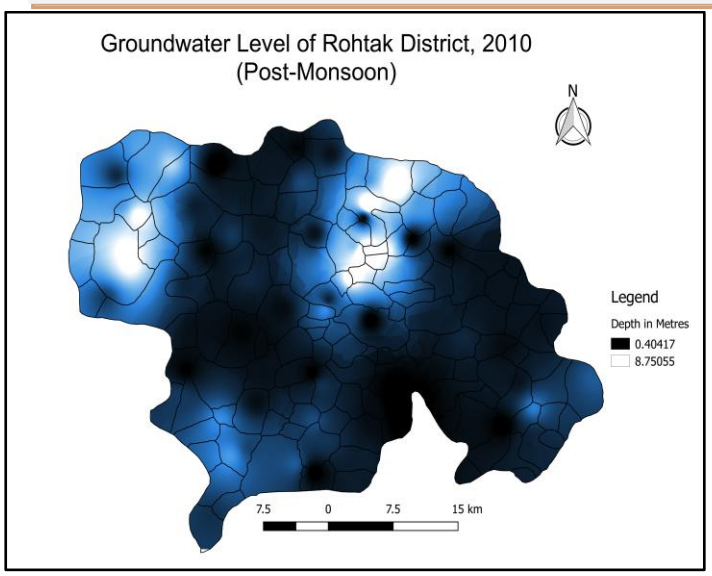


Fig 1.3

The visual interpretation of the standard false colour composition (Fig 1.4) of the study area also supports the findings from the interpolation analysis (Fig 1.2 & 1.3) as we can see that regions in the district having more agricultural activities (red colour) have higher problem of water logging. On the other hand, inhabitant areas have relatively lesser water logging problems (light grey colour).

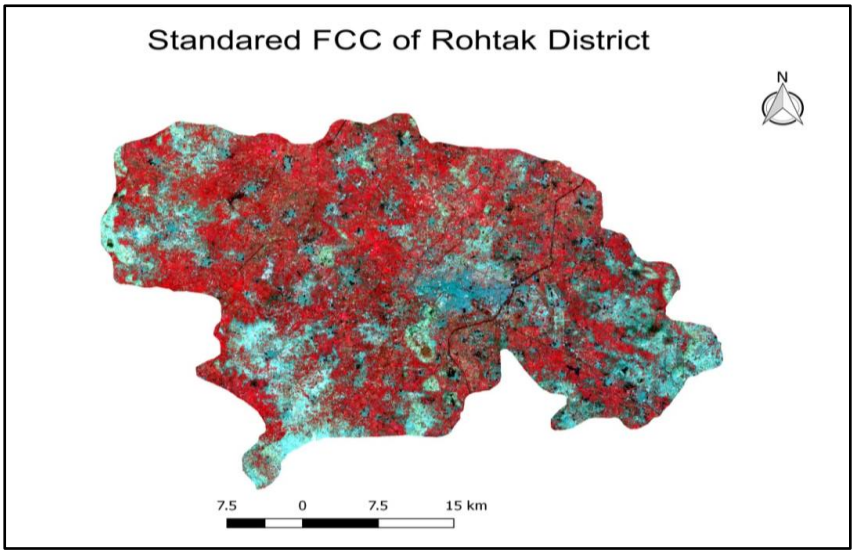


Fig 1.4

Conclusion

The water level of Rohtak area has been examined and mapped in twice a year 2010. The nonstop rising of ground water level it leads to waterlogging and saltiness issues in Rohtak locale. It happened due to destitute water system hones and more employments of fertilizers in agribusiness. The primary is that of rising groundwater level within the regions with moo quality aquifers, driving to auxiliary salinization and waterlogging. The moment is that of declining water level due to over-pumping of groundwater in new water quality aquifer zones. To play down the groundwater issue in ponder zone there ought to be opportune accessibility of cultivate inputs such as great- quality water, salt-tolerant germplasm, and presentation of groundwater reflection controls and advancement of saline agribusiness through trim broadening alternatives such as salt- tolerant therapeutic and fragrant plant species can progress the capacity of person ranchers to be beneficial.

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