Abstract ID-ISRSNS2020_ABS_E6535

Impact of Land use/land cover change on groundwater quality of Purba Bardhaman District using applied remote sensing and GIS technique

Subhasish Sutradhar [1] , Prolay Mondal [2*]

1. Junior Research Fellow, Department of Geography, Raiganj University,

2. Assistant Professor, Department of Geography, Raiganj University

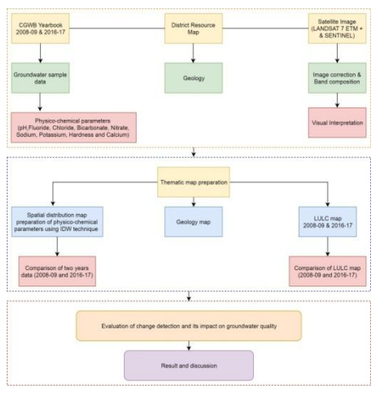
Corresponding Author email address- mon.prolay@gmail.com

Introduction or Motivation

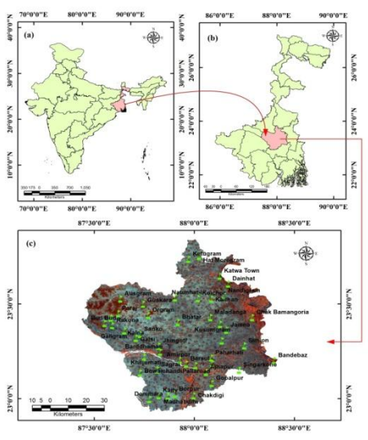
Water is the primary natural resource without which existence of life is impossible. Groundwater is considered as one of the vital source of water supply as it plays a significant role in the development of human society (Magesh et al. 2012). It is also one of the largest sources of fresh water. With the march of civilization, various fields like agriculture, industry and urbanization have been seeing rapid development in developing countries like India, increasing the demand of water (Venkateswaran and Ayyandurai, 2015). Excessive increase in use of fertilizers in agriculture, urbanization and industrialization leads in to deterioration in groundwater quality. Land-use changes are one of the main anthropogenic activities and its long term impacts are felt more on groundwater than surface water. Changes in landuse and landcover can easily be detected by multi spectral satellite images. Using GIS techniques, we can use known values at sample points to estimate the values of unsurveyed areas in between. Inverse Distance Weighted (IDW) method have been implied for analysis.

Methodology and Study Area

Different chemical properties of groundwater has been analyzed separately with the help of Inverse Distance Weighted (IDW) method in ArcGIS 10.5 environment. Supervised Landuse/Landcover (LULC) maps has been prepared from LANDSAT 7 ETM+ and LANDSAT 8 OLI images. Temporal change of groundwater quality (2008-09 to 2016-17) has been assessed in spatial scale. Change of LULC has also been assessed with accuracy assessment. It is tried to investigate how lulc change affect groundwater quality.



Purba Bardhaman district is a newly formed district of West Bengal, divided from previous Bardhaman district. This district extends from 22°56'00"N to 23°51'00"N latitude and from 87°26'00"E to 88°25'00"E longitude, occupying 5416 km^2 area and contains 23 Community Development (C.D.) blocks .



Results

Spatial distribution of chemical parameters

pH: Areal coverage of the study area of pH value ranging from less than 7.96 decreased by 58.4% on the other hand areal coverage of pH value ranging from 7.96-8.08 and more than 8.08 increased by 19.95% and 38.45%.

Nitrate: In 2008-09, maximum concentration of nitrate was 76 mg/liter but in 2016-17 it was increased by 160 mg/liter in the study area. On the other hand change in areal coverage between 2008-09 and 2016-17 is quite negligible.

Conclusions

Groundwater is very much essential as a life-supporting component. The quality of groundwater is continuously deteriorating with the increase of urbanization and concretization. It is found that where the rate of concretization is more, the deterioration of groundwater quality is more. Therefore, with sustainable development, proper planning of groundwater recharge must be done.

Objective

- This study aims to investigate how groundwater quality is changing over time with the change of landuse and landcover of the study area.

Results

Calcium: The maximum admissible limit for calcium is 200 mg/L (WHO). In the study area calcium content varies from 10 to 74 mg/liter in the year 2008-09 and 10-136 mg/liter in 2016-17.

Fluorides: In the study area maximum concentration of fluoride is about 3.60 mg/liter . On the other hand fluoride concentration has increased remarkably from 2008-09 year to 2016-17 year throughout the district.

Chlorides: If the chloride concentration exceeds the tolerance limit of the crop, various injuries develop such as leaf burn or drying of leaf tissue (FAO). Chloride concentration has increased from 2008-09 to 2016-17.

Total Hardness: The total hardness is varying from 60 to 830 mg/liter in 2008-09 and 85.07 to 580.28 mg/liter. The analytical result indicates the hardness of the water in the study area is increased.

Sodium: Excessive sodium consumption may cause hypertension, heart and kidney trouble (Magesh et al. 2012 and Bhunia et al. 2018). In the study area only few samples exceeds the permissible limit.

Potassium: In the study area potassium concentration has increased from 2008-09 to 2016-17. Some samples are beyond permissible limit prescribed by WHO.

Bicarbonate: Bicarbonate in ground water is generally found less than 500 mg/l (Todd et al., 2005, Khan and Jhariya 2018). Excessive concentration of bicarbonate may increase the alkalinity of groundwater. It is observed that bicarbonate concentration is increasing in the study area.

Evaluation of LULC Map: There is significant changes has been found in land use and land cover from 2008-09 to 2016-17. As area of built up area is increasing groundwater quality is degrading because of the unplanned draining system. On the other hand agricultural land is decreasing therefore demand from less farms is increasing, which leads to application of huge utilization of chemical fertilizer which degrading the groundwater quality often it crossing the permissible limit.

Accuracy assessment of land use and land cover map has been done to assess how effectively the pixels were sampled into the correct land cover classes.

Validation: Due to deforestation and huge growth of settlement concentration of nitrate in groundwater is increasing day by day. Physico-chemical parameters of groundwater for 2008-09 and 2016-17 were analyzed and found that nitrate concentration in the year 2008-09 was confined between 0.02-76 mg/l while in year 2016 nitrate concentration is stretched to 0.00 to 160 mg/l.

Acknowledgemnts & References

Acknowledgemnts The authors express their thanks to the Central Groundwater Board and USGS EarthExplorar for providing the necessary data.

References

Magesh, N., Chandrasekar, N., & Soundranayagam, J. (2012) Delineation of groundwater potential zones in Theni district, Tamil Nadu, using remote sensing, GIS and MIF techniques. *Geoscience Frontiers*, v. *3*(2), pp. 189-196. doi: 10.1016/j.gsf.2011.10.007

Venkateswaran, S., & Ayyandurai, R. (2015) Groundwater Potential Zoning in Upper Gadilam River Basin Tamil Nadu. *Aquatic Procedia*,v. *4*, pp. 1275-1282. doi: 10.1016/j.aqpro.2015.02.166