ABSTRACT

Spatial analysis of various parameters including terrain and climate, employing remote sensing satellite data and GIS is very useful and significant in understanding the hydrogeological and groundwater condition of an area. In the present study, integrated approach using remote sensing and GIS was carried out in upper Noyil basin, Coimbatore district, Tamilnadu, south India to understand the hydrogeological and groundwater condition of the basin.

GIS integrated approach using thematic information from remote sensing satellite data (Landsat ETM) and other field collateral data has helped to derive following conclusions of the study area, upper Noyyil basin. The objectives of the study are to delineate groundwater probable zones, to study the seasonal changes in groundwater fluctuations and to understand the role of certain terrain parameters on groundwater environment. This study also attempts to understand the relationship between groundwater condition and land use practice of the upper Noyyil basin. Many of the previous studies have not related the terrain and groundwater condition with the existing landuse and delineated varying spatial trend of landuse pattern and groundwater fluctuations.

Remote sensing data helped to delineate various lithological and landform units of the study area. It has also helped to prepare landuse map of the study area, with limited field check, in conjunction with the information obtained through digital image analysis of the study area. Image analysis of the study area using different image processing techniques such edge enhancement, textural analysis, PCA, NDVI and clustering has contributed enormously to the study. Various enhancement techniques including clustering technique using color index have brought out significant information on the geological, structural,
geomorphological and land use/land cover features of the study area. They helped to appreciate the intrinsic differences among various units within a thematic layer.

Groundwater probable (GWP) zones such as very high, high, moderate and poor were demarcated by integrating remote sensing and GIS techniques and studied for their association with terrain and climate parameters. The resultant GIS derived GWP zone map showed an intrinsic relation with lithological parameter and showed significant influence of landforms. The spatial extent of these zones are also estimated using GIS techniques. The spatial extent of very high probable zone, high, moderate and poor probable zones showed 12.4%, 39.55%, 34.92% and 13.99% respectively. The spatial trend thus derived from the integration clearly amplified the significance of landforms in controlling the groundwater occurrence.

The seasonal groundwater level fluctuations indicated an increase in areal extent in low fluctuation zone during the northeast monsoon when compared with summer season in the study area. Moderate zone seemed to be almost static implying a geological and geomorphic control; high and very high oscillating zones are mostly confined at the northeastern and northwestern parts, implying a geological control in the study area. Spatial pattern of low degree fluctuation at the western part of the study area implied geomorphic control and also amplified the influence of climate on the groundwater oscillation.

The analysis has significantly brought out the relation between the spatial patterns of various land use categories and GIS derived groundwater probable (GWP) zones as well as groundwater fluctuation (GWF) zones. Groundwater level fluctuation (GWF) zones showed remarkable similarity with the existing land use pattern showing intense agricultural activities in the low fluctuation zones whereas it was less in the case of very high fluctuating zones.
Spatially comparing the area of various GWF zones and landuse categories has highlighted an intrinsic relationship between the groundwater and landuse condition of the study area.

Thus, this study concludes that the analysis using GIS techniques was very meaningful in understanding the inherent and intrinsic relationship among various parameters such as lithology, landform, soil, rainfall, groundwater table and landuse units. The study could be further extended to a smaller area using similar approach for an effective resources management and development activities.