USING GIS AND REMOTE SENSING TECHNIQUES FOR DELINEATION OF GROUNDWATER POTENTIAL ZONES – A CASE STUDY OF THE TITEL MUNICIPALITY, SERBIA

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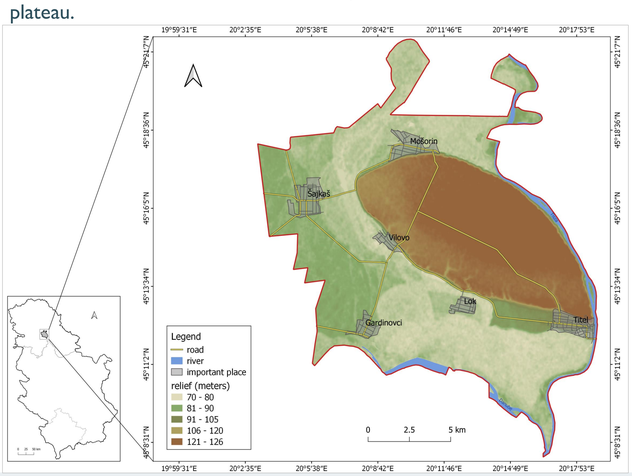
1 Introduction

Groundwater is the largest available freshwater resource on the Earth which serves as an essential source for domestic purpose, industrial and agricultural uses [1,2]. As a result of a drastic increase of population on the planet as well as the global impact of climate change, repetition of drought conditions and scarcity of rainfall, demand for groundwater resources is intensely increasing in the past decades [3]. Serbia is relatively rich in groundwater reserves situated in different types of aquifers, yet that reservoirs have not been significantly investigated [4]. New technologies such as remote sensing and geographic information systems (GIS) have an essential role in evaluating groundwater potential makes it easier, more accurate, cheaper, and faster than using traditional techniques.

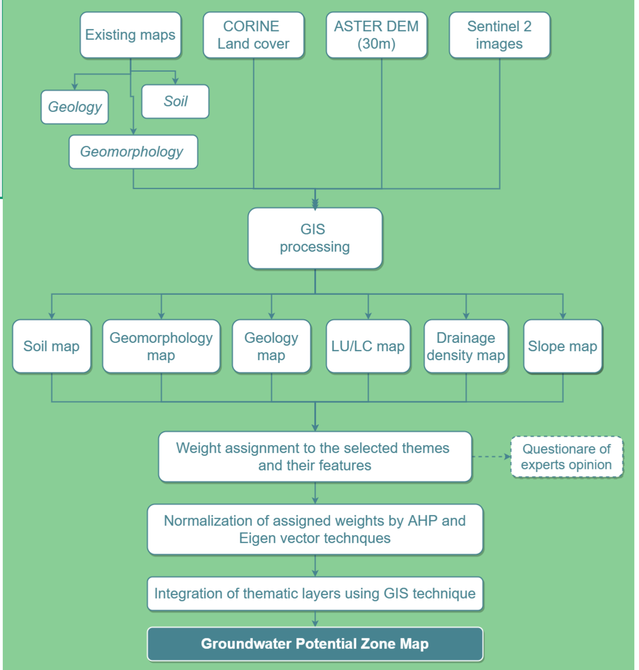
2 Research area

Titel Municipality is located in the northern part of Serbia, in Vojvodina Province. Geographicaly it is located at the confluence of the two rivers - Danube and Tisza river. This area is also characteristic because of three relief units: alluvial plains, river terrace, and loess plateau.



3 Methodology

The methodology proposed in this research to identify and delineate groundwater potential zones using GIS, remote sensing and AHP techniques [5] is illustrated in figure bellow.

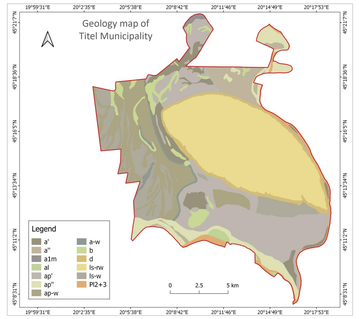


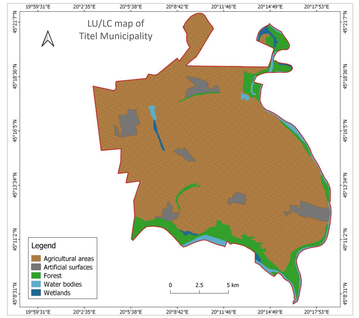
Groundwater potential zones are delineated using groundwater potential index [6].

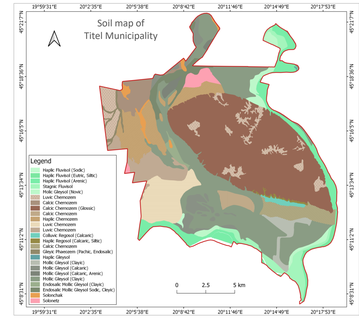
$$GWPI = \sum_{i=1}^{m}\sum_{j=1}^{n}(W_i \times X_j)$$

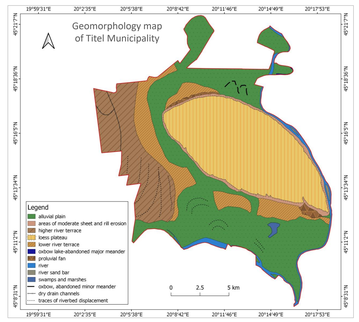
4 Results and Discusion

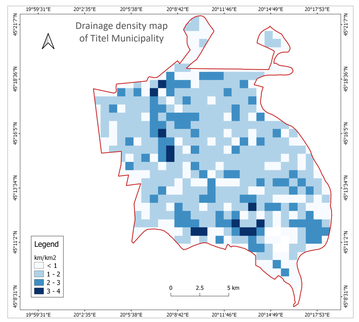
The groundwater potential zone map of Titel Municipality has been generated through the integration of six thematic maps (geology, land use/land cover, soil, geomorphology, drainage density, and slope. Each thematic layer has been given weight according to their strength. Based on GWPI, values of groundwater potential zones were characterized and classified into five classes.

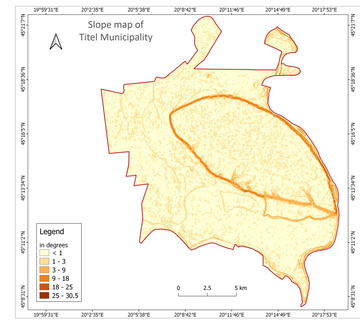






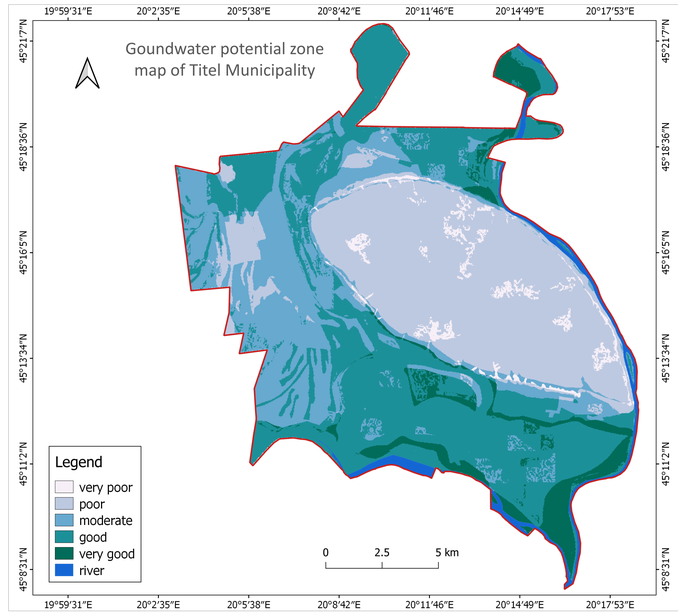






GWPZ	Score	Area (km^2)	Area (%)
Very poor zone	<= 5.238	8.11	3.11
Poor zone	5.238 - 6.176	81.98	31.41
Moderate zone	6.176 - 7.114	55.52	21.27
Good zone	7.114 - 8.052	92.50	35.44
Very good zone	8.052 - 8.99	18.60	7.13

These techniques indicated that *very good* and *good* groundwater potential zones are predominantly located in Danube and Tisza alluvial plain and the lower river terrace, while *poor* and *very poor* zones are identified at the loess plateau and in the artificial areas. The main reason for this is the proximity to the rivers which has a significant influence on groundwater recharging. Also, this is the lowest part of the terrain which indicates that there is a main *collector* for groundwater which flows from higher relief units. The high potential in this part of the study area is also influenced by good water-holding capacity of the Fluvisol and geological sediments.



Conclusion

Digital technology integrates different methods using geographical information systems and remote sensing techniques to increase the accuracy of results in researching. These techniques play a significant role in monitoring and assessing the groundwater potential zones.

In the present study, we utilized GIS and remote sensing techniques for the delineation of groundwater potential zones in the Titel Municipality. With this methodology, we showed that very good and good groundwater zones are predominantly located in the alluvial plain and the lower river terrace, while poor groundwater zones are mostly evident on the landform of the loess plateau and artificial surface. The GWPZ map will serve as a useful guide for sustainable management and utilization of the region as well as to improve the irrigation facility and develop the agriculture productivity of the area.

References

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