Groundwater potential zone map of Tirupattur, Tamilnadu

1. Introduction

Groundwater serves as a vital source of fresh water for domestic, agricultural, and industrial needs, especially in semi-arid regions like **Tirupattur, Tamil Nadu**. Due to increasing water demand and declining water tables, it is essential to identify zones with high groundwater potential to ensure sustainable management.

This study aims to delineate **Groundwater Potential Zones (GWPZ)** using a **multi-criteria spatial analysis approach** in ArcGIS. The thematic layers considered in this analysis include:

- Drainage Density
- Lineament Density
- Slope
- Soil
- Lithology
- Land Use/Land Cover (LULC)
- Geomorphology

Each factor influences groundwater recharge, storage, and movement differently, making them crucial in accurate groundwater assessment.

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2. Study Area

Location: Tirupattur district is located in the north-western part of Tamil Nadu, India.
Climate: Semi-arid with seasonal rainfall during the northeast and southwest monsoons.
Major Water Sources: Tanks, seasonal rivers, and borewells.

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3. Data and Methodology

3.1 Data Sources

- **Satellite Data:** Landsat-8/9 & ESRI landcover for LULC
- **Slope Data:** SRTM for slope
- **Geological Data:** Bhukosh
- **Soil Data:** FAO/UNESCO soil map
- **Lineament Data:** Bhukosh

3.2 Methodology Steps

1. **Preparation of Thematic Layers:**

   o **Drainage Density:** Derived from DEM using the hydrology tool in ArcGIS; lower drainage density areas favor infiltration.

   o **Lineament Density:** extracted from bhukosh and weighted as potential groundwater conduits.

   o **Slope Map:** Classified from DEM; gentle slopes have higher recharge potential.

   o **Soil Map:** Categorized based on infiltration capacity.

   o **Lithology Map:** Identified rock types influencing porosity and permeability.

- o **LULC Map:** Classified using supervised classification in ArcGIS.
- o **Geomorphology Map:** Extracted from bhukosh datasets to identify recharge-friendly landforms.

2. **Weight Assignment:**
Analytical Hierarchy Process (AHP) was applied to assign relative weights to each thematic layer based on its influence on groundwater occurrence.

3. **Overlay Analysis:**
Weighted overlay of all layers was performed in ArcGIS to generate the **Groundwater Potential Zone Map**.

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4. Results and Discussion

4.1 Groundwater Potential Zones Classification

The final map classified Tirupattur into the following categories:

- **Very High Potential Zone** – Found in low slope, high lineament density, and permeable lithology areas.
- **High Potential Zone** – Mostly agricultural plains with favorable soils and moderate drainage density.
- **Moderate Potential Zone** – Transitional areas with mixed geomorphic and lithologic characteristics.
- **Low Potential Zone** – Steep slopes, rocky terrain, and high drainage density areas.
- **Very Low Potential Zone** – Hill regions with impervious lithology and sparse lineaments.

4.2 Key Influencing Factors

- **Lineament Density** and **Slope** emerged as primary controls on groundwater occurrence.
- **LULC** showed that agricultural and vegetation-rich zones corresponded with higher groundwater potential.
- **Lithology** revealed that weathered granite and gneissic terrains stored more groundwater than hard compact rocks.

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5. Conclusion

The study successfully identified groundwater potential zones in Tirupattur using a GIS-based weighted overlay method. The findings can assist local authorities, farmers, and water management agencies in:

- Planning borewell drilling in high potential areas
- Designing artificial recharge structures in moderate potential areas
- Avoiding groundwater exploitation in low potential zones

Recommendation: Regular monitoring, coupled with sustainable groundwater management practices, is essential to ensure long-term water security in the district.
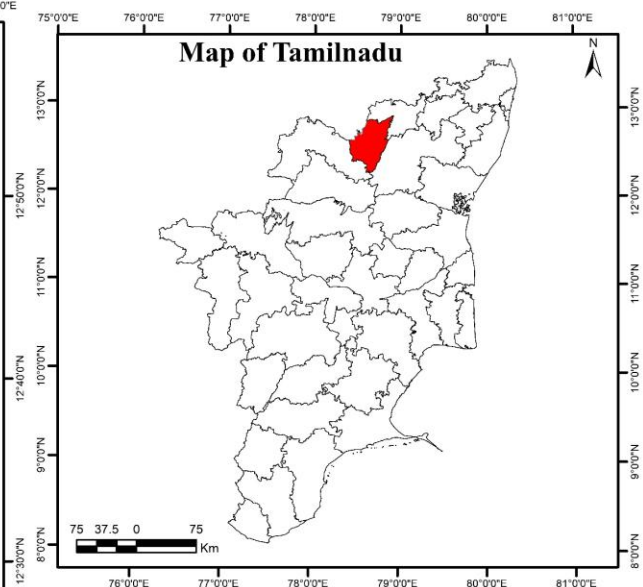
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6. References

1. GSI Geological Maps of Tamil Nadu
2. BHUKOSH for geomorphology & lithology data
3. SRTM datasets from USGS Earth Explorer
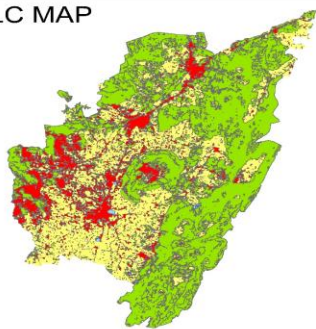4. Landsat data from USGS portals
5. FAO/UNESCO

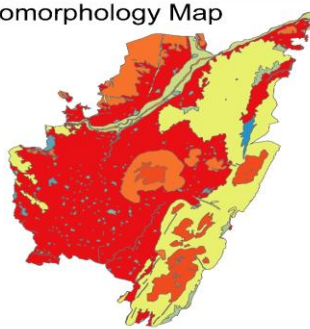**Groundwater Potential Zone Map of Tirupattur**
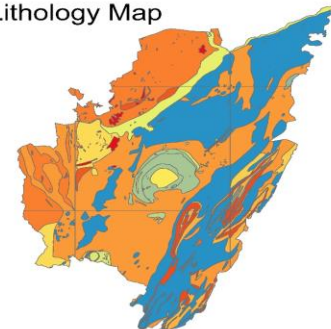
Map of Tamilnadu

Legend

GWPI

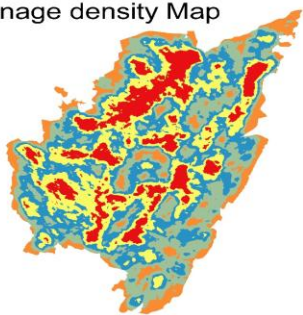VERY POOR

POOR

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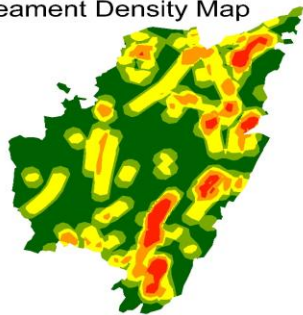
GOOD

EXCELLENT

tiruppattar
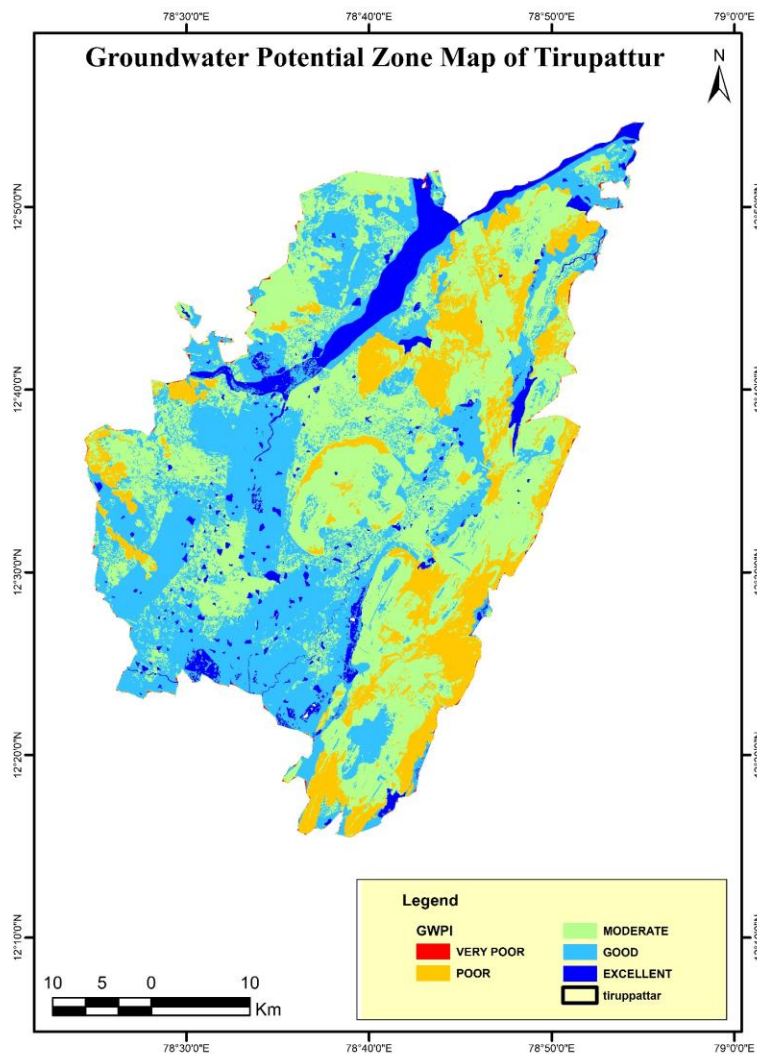
LULC MAP

Geomorphology Map

Lithology Map

Drainage density Map

Lineament Density Map

Slope Map