SUSTAINABLE WATERSHED EVALUATION OF HESARAGHATTA LAKE USING REMOTE SENSING AND GIS TECHNIQUES.

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Keywords:
Hesaraghatta watershed; Morphometric analysis; Remote sensing and GIS; Drainage density; Groundwater recharge; Surface runoff; Water quality assessment; Watershed management; Land use/land cover; Ecological degradation; Arkavathy River; Semi-arid region.

Introduction:

1. Hesaraghatta Lake, situated approximately 35 km northwest of Bengaluru, historically served as a significant surface water source for the Bangalore Water Supply and Sewerage Board.
2. In recent years, the lake has experienced significant hydrological degradation, characterized by reduced inflow, seasonal drying, and declining storage capacity.
3. These changes are primarily attributed to land-use alterations, disruption of feeder channels, and increasing anthropogenic activities within the watershed. The resulting environmental stress has led to habitat degradation and loss of biodiversity. Therefore, a systematic watershed-based assessment is essential for sustainable water resource management and ecological restoration.

Role of Remote Sensing and GIS

Remote Sensing (RS) provides synoptic, repetitive, and multispectral data useful for monitoring natural resources. Geographic Information Systems (GIS) facilitate spatial analysis, mapping, and integration of multiple datasets. Combined RS–GIS technology is ideal for watershed characterization, land-use mapping, drainage studies, and morphometric analysis.

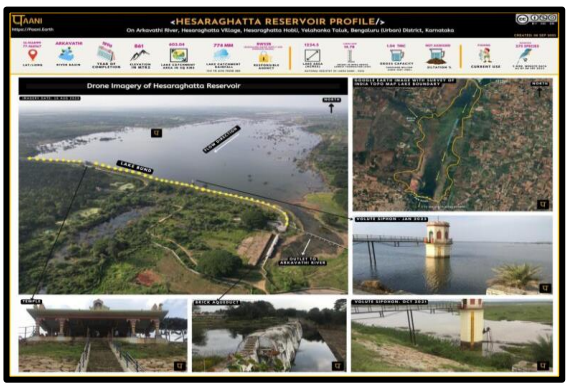

Figure 1: Hesaraghatta Lake in Bangalore

Objectives:

1. To find out the quality of surface water of the Hesaraghatta watershed.
2. To find out Land use and land cover condition of the Hesaraghatta watershed using RS and GIS techniques.
3. To find out the scope for rejuvenation Hesaraghatta Watershed.

Methodology:

To find out the quality of the surface water samples from the lake have been collected at specific locations depends upon the conditions and accessibility for collecting the water samples. 7 samples have been collected from the lake and analyzed.

Experiments conducted are: - pH, Electrical Conductivity, Turbidity (Using Nephlo Turbidity Meter), Acidity (Using Phenolphthalein Indicator) and Alkalinity (Using Methyl Orange Indicator)

The project (Water Quality Analysis)

1. pH 7.89

Result: According to guidelines set by WHO and BIS, acceptable pH ranges from 6.5 to 8.5.

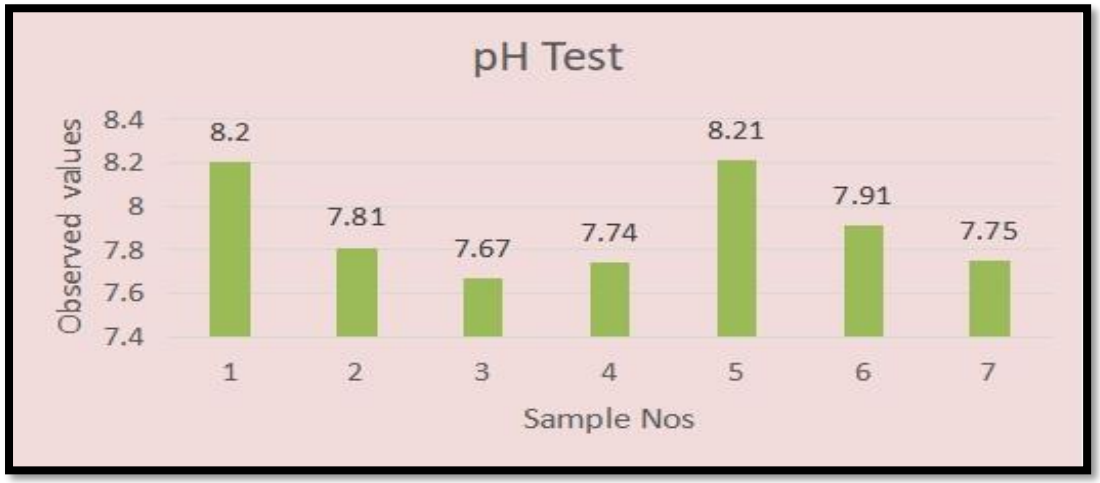

Figure 2: pH test graph (7.89)

2. Electrical Conductivity

Result: The tests showed levels of electrical conductivity higher than allowed under WHO (below 600 mg/L) and BIS (acceptable 500 mg/L) guidelines.

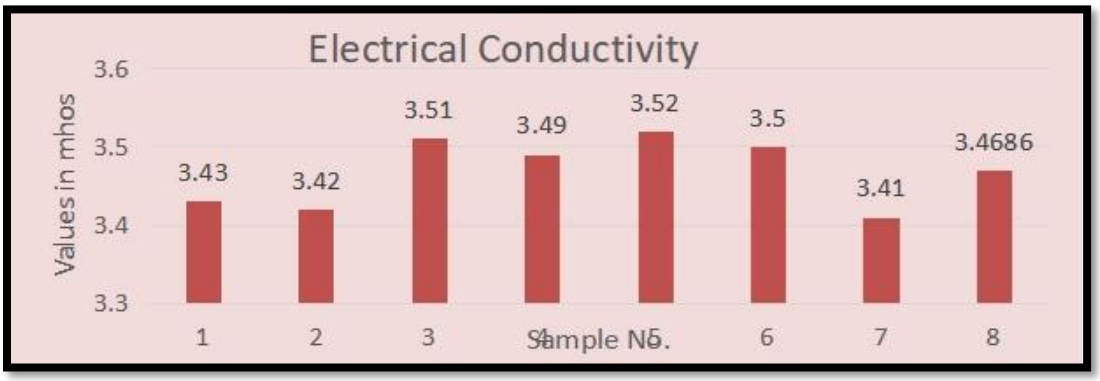

Figure 3: Electrical Conductivity test graph

3. Turbidity

Result: Measurements show turbidity levels are above acceptable limits. Guidelines from WHO and BIS set the range at 1 to 5 NTU, sampled water exceeds these thresholds.

High readings suggest suspended particles are present in notable amounts. This condition may affect usability depending on intended purpose.

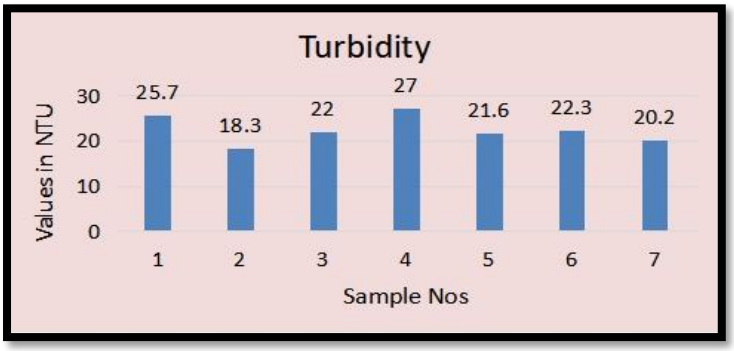

Figure 4: Turbidity test graph

4. Acidity

Result: Water samples show higher acidity levels in the lake.

According to BIS Standard, permissible range is 6.5 to 8.5 and WHO does **not specify a direct standard for acidity.**

ACIDITY (mg/litre)	
Sample 1	12
Sample 2	16
Sample 3	12
Sample 4	8
Sample 5	8
Sample 6	8
Sample 7	12

Table 1: Acidity test table

5. Alkalinity

Result: Low alkalinity marks the water samples taken from Hesaraghatta lake. Though BIS sets 200-600mg/litre as acceptable, these levels fall short and WHO does not specify a direct standard for alkalinity.

ALKALINITY (mg/litre)	
Sample 1	20
Sample 2	36
Sample 3	40
Sample 4	40
Sample 5	40
Sample 6	48
Sample 7	40

Table 2: Alkalinity test table

Maps were generated from KSNDMC (Karnataka Natural Disaster Monitoring Centre) located in Yelahanka, Bangalore.

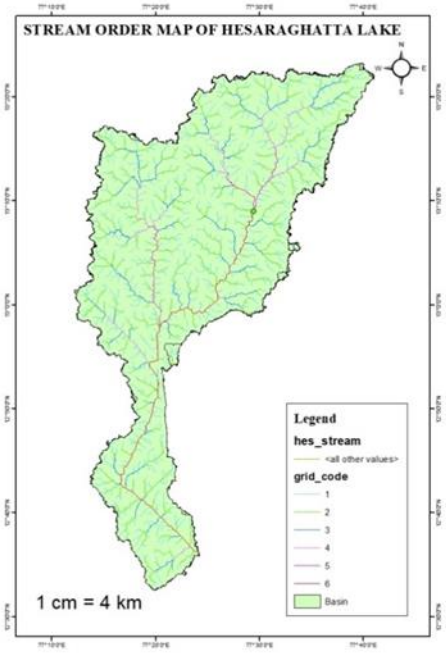

Figure 5: Stream Order Map of Hesaraghatta Lake

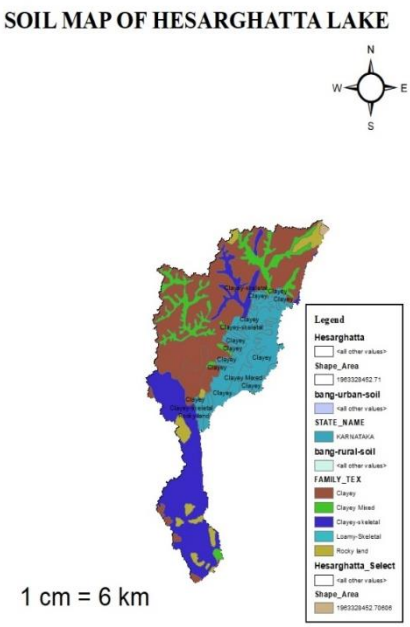

Figure 6: Soil Map of Hesaraghatta Lake

Result and Conclusion:

The study concludes that the Hesaraghatta watershed is experiencing environmental degradation and declining water quality due to both natural and human-induced factors. The lake water is currently unsuitable for domestic use without treatment and is fit only for agricultural purposes. These findings emphasize the need for effective pollution control, proper management practices, and sustainable restoration measures to protect the watershed.

SUSTAINABLE DEVELOPMENT GOALS

1. SDG 6: Clean Water and Sanitation
2. SDG 15: Life on Land
3. SDG 11: Sustainable Cities and Communities

TRL 3 (Experimental Proof of Concept)

Analytical Study: The project focuses on data collection, laboratory analysis of water samples (pH, Turbidity, Alkalinity), and the use of software (ArcGIS 10.8.2) to map the watershed.

Proof of Concept: It demonstrates that Remote Sensing and GIS are viable tools for monitoring the ecological health and morphological characteristics of the Hesaraghatta Lake.

Lack of Deployment: The research concludes with observations and recommendations (e.g., "The lake is only suitable for agriculture," "needs proper treatment") but does not yet present a deployed management system or a pilot-scale intervention.

In conclusion,
The lake water is currently unsuitable for domestic use without treatment and is fit only for agricultural purposes.

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Future Scope: REJUVENATION (OR RESTORATION) OF THE LAKE

The future scope of this project includes:

1. Desilting and Removal of Encroachments
2. Restoration of Inflow Channels

3. Prevention of Pollution in water
4. Soil and Water Conservation Practices
5. Land Use Regulation
6. Groundwater Recharge Measures
7. Biodiversity Restoration
8. Community Participation and Awareness