

## **ABSTRACT**

The availability of clean and safe groundwater is a crucial aspect of sustaining human health and ecological balance. In recent years, the quality of groundwater in Pune district, Maharashtra, has become a matter of concern due to various anthropogenic activities and natural factors. Understanding the complex relationships between water quality parameters and their impact on vegetation health is essential for effective groundwater management and environmental planning.

This research presents a comprehensive study on groundwater quality assessment in Pune district, Maharashtra, using a Random Forest machine learning model and correlation analysis. The primary goal of this study was to develop a model that can determine the degree of fitness of water samples collected across the region. The model utilized raster data of water quality parameters, including pH, EC, TDS, Alkalinity, Chloride, Fluoride, Iron, and Turbidity, obtained from extensive sampling conducted between the years 2017 and 2022.

The correlation analysis was performed to explore the relationship between different parameters and to examine their influence on vegetation health. In addition, the Normalized Difference Vegetation Index (NDVI) was incorporated to assess the impact of water quality on the overall health and vigor of vegetation in the study area.

The findings of this research provide valuable insights into the groundwater quality status in Pune district. The developed Random Forest model demonstrates its efficacy in assessing the fitness of water samples based on multiple water quality parameters. The correlation analysis revealed significant associations between different water quality parameters, shedding light on the interrelationships and potential sources of contamination. Moreover, the integration of NDVI allowed for a comprehensive understanding of the influence of water quality on vegetation health.

This research contributes to the field of groundwater management by offering a data-driven approach for assessing groundwater quality and its impact on the environment. The results of this study can inform policymakers, water resource managers, and environmental agencies in developing targeted interventions and strategies to mitigate groundwater pollution and preserve the overall ecological balance in Pune district.