

Study Of Land by Using QGIS and Analysis of Soil and Crop Properties-a Review

Sanika Pole¹, Affan Bagwan², Ritesh Ragde³, Dr. Pravin Gorde⁴, Dr. Atul Kolhe⁵
^{1,2,3}B.E.Civil Engg , Dr.D. Y. Patil Institute of Engg Management and Research ,Akurdi
^{1,2}Associate Prof. DY Patil International University, Akurdi

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ABSTRACT

This study was carried out to determine the soil characteristics and crop water requirements of selected areas in Khadakwasla village, Pune district, Maharashtra. The main objective of the study was to develop land capability and land suitability maps using GIS techniques. Soil and crop water requirement analyses were performed using QGIS 3.40.11 software. Information related to soil properties and crop requirements was collected from field observations and relevant literature reviews. The crops considered in the study include maize, sugarcane, wheat, and sorghum. Various spatial datasets such as topographic, morphological, geological, land cover maps, and climatic data were collected and analyzed. Soil samples from the study area were examined for major physical properties and available water capacity. All collected data were integrated and processed in QGIS to generate land capability and suitability maps. The results indicate that a large portion of the study area is suitable for agricultural cultivation with minimal risk of land degradation. The generated maps serve as valuable tools for soil resource conservation and sustainable land-use planning. Overall, the study demonstrates the effectiveness of GIS in agricultural planning by supporting crop selection, productivity improvement, and sustainable development for farmers and policymakers. Keywords: GIS, QGIS, Land Capability, Land Suitability, Soil Characteristics, Crop Water Requirement, Soil Mapping, Khadakwasla Village, Agricultural Planning, Sustainable Land Use.

1. INTRODUCTION

This project aims to develop a QGIS-based land acquisition and land management system that provides detailed information about land use, land cover, and soil types. India has a total geographical area of 3.287 million km², of which Maharashtra covers 307,713 km², while Pune district spans 1C,C42 km². For this study, Khadakwasla village, located in Haveli Taluka of Pune district, has been selected as the study area, with a total geographical area of 7.8C km². Khadakwasla lies on the eastern bank of the Mutha River and falls between 18.75° N latitude and 73.44° E longitude. Land cover refers to the physical features present on the Earth's surface, while land use describes how the land is utilized for specific purposes. GIS plays a crucial role in analyzing land use and land cover changes over time and understanding spatial patterns. In this study, soil data along with auxiliary data such as Digital Elevation Model (DEM), climatic variables, and land-use information are integrated using QGIS. Soil mapping helps in identifying soil types, delineating soil boundaries, and assessing land suitability for various uses. Soil is a natural body formed by the interaction of climate, topography, organisms, parent material, and time, and it plays a vital role in supporting ecosystems and agriculture. Proper classification of land based on capability and suitability is essential for sustainable food production and natural resource conservation. Due to high spatial variability of soils, GIS-based analysis is necessary to achieve accurate land capability assessment. This project demonstrates how QGIS can support informed land-use planning, agricultural development, and sustainable land management.

KHADAKWASLA VILLAGE



FIG 1- Selected Area: Khadakwasla (Pune)

2. LITERATURE REVIEW

Several studies have demonstrated the importance of integrating remote sensing and GIS for agricultural planning and soil analysis. Abdelrahman, Natarajan, and Hegde evaluated land suitability in Karnataka by combining soil, slope, erosion, and terrain data within a GIS environment. Their approach enabled classification of land into different suitability categories, supporting sustainable crop planning. Similarly, Lagacherie and McBratney emphasized Digital Soil Mapping (DSM) as an advanced method for generating high-resolution soil data, introducing spatial soil information and inference systems for accurate prediction of soil properties using environmental variables and statistical techniques.

The role of GIS in agriculture has been further highlighted by Adrian, Dillard, and Mask, who explained its application in precision farming through integration with GPS, allowing efficient management of inputs such as water, fertilizers, and pesticides. Mani and Varghese also discussed the combined use of remote sensing, GIS, and GPS for large-scale monitoring of agricultural and forest resources, improving data-driven decision-making and environmental conservation.

Precision nutrient management has been explored by Di Curzio et al., who developed spatial strategies for nitrogen application in maize using soil and crop data, improving productivity while reducing environmental impacts. Kahlown and Ashraf studied the influence of shallow groundwater on crop water requirements, identifying optimal groundwater depths for maximizing crop yield and water-use efficiency.

GIS-based soil mapping has been widely applied in various studies. Arote demonstrated digital mapping of soil properties using QGIS, reducing field effort and supporting engineering and land-use decisions. Research published in the *Soil Science Society of America Journal* highlighted the effectiveness of QGIS in soil survey and mapping, enabling integration of field and remote sensing data for improved soil analysis. Charishma used Sentinel-2 imagery to estimate topsoil properties, showing strong correlations between spectral data and soil characteristics, thereby reducing reliance on field sampling. Similarly, Bhunia applied geostatistical techniques and GIS tools to analyze spatial variability of soil parameters, supporting precision agriculture and sustainable land management.

Overall, these studies confirm that the integration of GIS, remote sensing, and geospatial analysis plays a crucial role in modern agriculture, enabling efficient resource management, improved productivity, and sustainable environmental practices.

3. CONCLUSION

This study was done to understand the land and soil conditions of Khadakwasla village using QGIS and remote sensing. Different types of data were collected from field surveys and satellite images. With the help of QGIS software, georeferencing maps and toposheets were made to study the area properly and understand its land features.

A site visit to Khadakwasla village was also conducted to observe the area and collect necessary data for the study. This visit helped in understanding the local conditions and comparing them with the maps generated in QGIS. A podcast with local farmers was also included to learn about their farming practices, crop patterns, and experiences.

This combination of field visit, mapping, and farmer interaction made the study more practical and helped to understand the region in a better way.

4. REFERENCES

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