Determination of Land Use Land Cover Changes and Ground Water Potential Zones in Kilimanoor Block Using GIS Techniques

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Abstract— Changes in land use and land cover (LULC), a dynamic process that occurs on the ocean floor, are now a key part of contemporary methods for managing natural resources and keeping track of environmental changes. The process of detecting LULC changes with reference to geo-corrected remote sensing data is known as LULC change detection. Knowing the historical land use pattern has been made possible thanks to the creation of LULC maps utilising topsheet data from Survey of India (SOI). In the kilimanoor block of Kerala's trivandrum district, between the years of 2003 and 2018, the study will examine changes in land use and land cover. Additionally, a study of the region's groundwater potential zones has been developed as an application. Information about the possibility for groundwater will be helpful in determining the best places to harvest water. The ability of Geographic Information Systems (GIS) to link data to specific map elements and establish new linkages that can assess a development's viability. The results indicate that, between 2003 and 2018, built-up and agricultural areas experienced the greatest amounts of LULC changes. Anthropogenic activity, such as settlement, road construction, and built-up areas, has significantly increased between LULC 2003 and 2018, according to the comparison.

Keywords: LULC, Remote Sensing, Ground Water Potential Zone, GIS

I. INTRODUCTION

A region's patterns of land use and land cover are a result of how people have used social and economic forces over time and space. When referring to maps that show details on the different sorts of characteristics found on the earth's surface (referred to as land cover) and the human activity that is linked with them, the phrases "Land Use" and "Land Cover" (LULC) are sometimes used interchangeably (called as land use). A variety of agricultural, hydrological, and ecological models—which are essential tools for the development, planning, and management of natural resources in a territory—input land cover as a key parameter.

In addition to having knowledge of the current land use and cover, it is essential to be able to track how land use is changing in response to shifting demand in order to use the land as efficiently as possible and to offer data for modelling studies. If the site is compact and easily accessible, surveys and ground observation may be used to determine the best land cover. However, if the location is huge or difficult to visit, such solutions have quickly lost their viability. Topo sheets may be helpful as a source of information, but they are typically antiquated and too basic for in-depth examination. Satellite remote sensing is being used for more and more investigations, particularly at the landscape level, as software has improved and imagery costs have decreased. The rapidly evolving field of remote sensing offers an effective and quick method for mapping and gathering fundamental data on land use and cover over huge areas.

LULC change can be observed using remote sensing and geographic information system techniques. Geographic information systems (GIS) offer effective techniques for analyzing LULC concerns as well as tools for land use planning and modelling, making it feasible to examine the changes in land cover quickly, affordably, and accurately. In this study, LULC change and its effects are assessed using LANDSAT images from the Kilimanoor block in the Trivandrum district of Kerala, India, taken in 2003 and 2018. The extraction and provision of water to waste land has been suggested as a way to make the land useful. Waste lands and relevant ground water potential zones have been identified.

Groundwater availability is indicated by zones known as groundwater potential zones. Identification of possible groundwater zones could help with the efficient development and usage of both groundwater and surface water resources for eradicating water shortages and subsequently increasing irrigation practices and agricultural income for the society's standard living standards. To assure the sustainability of well yields and combat the issue of water table depletion, appropriate and effective procedures are required to discover viable sites for drilling wells and for erecting artificial recharge structures.

II. STUDY AREA

A. *Kilimanoor Block Panchayat*

In the Thiruvananthapuram district's Chirayinkeezhu Taluk, Kilimanoor Block Panchayat occupies an area of 18036.6 hectares and is divided into 83 Gramapanchayats and 15 Block Panchayat Divisions. The Kilimanoor Block Panchayat is bordered on the north by the Chadayamangalam and Ithikkara blocks; on the east by the Chadayamangalam and Vamanapuram blocks; on the south by the Attingal Municipality, the Chirayinkeezhu and Vamanapuram blocks; and on the west by the Ithikkara and Varkala blocks. The largest panchayat in this area is Navayikulam, with a total area of 2965.21ha, while the smallest is Pallickal, with a total area of 1670.38ha. The Lower Ridge, Valley Fill, Residual Hill, Water Body, and other major landforms can be seen here. The watersheds of Vamanapuram, Ayirur, and Ithikkara all drained via this area. This block is traversed by the State Highway, MC Road, and other roads. Fig 1 shows the administrative map of Kilimanoor Block and table I shows the names of block panchayats

Fig. 1: Administrative Map of Kilimanoor Block

Serial No	Names of block panchayat
1	Karavaram
2	Kilimanoor
3	Madavoor
4	Nagaroor
5	Navayikulam
6	Pallickal
7	Pazhayakunnummal
8	Pulimathu

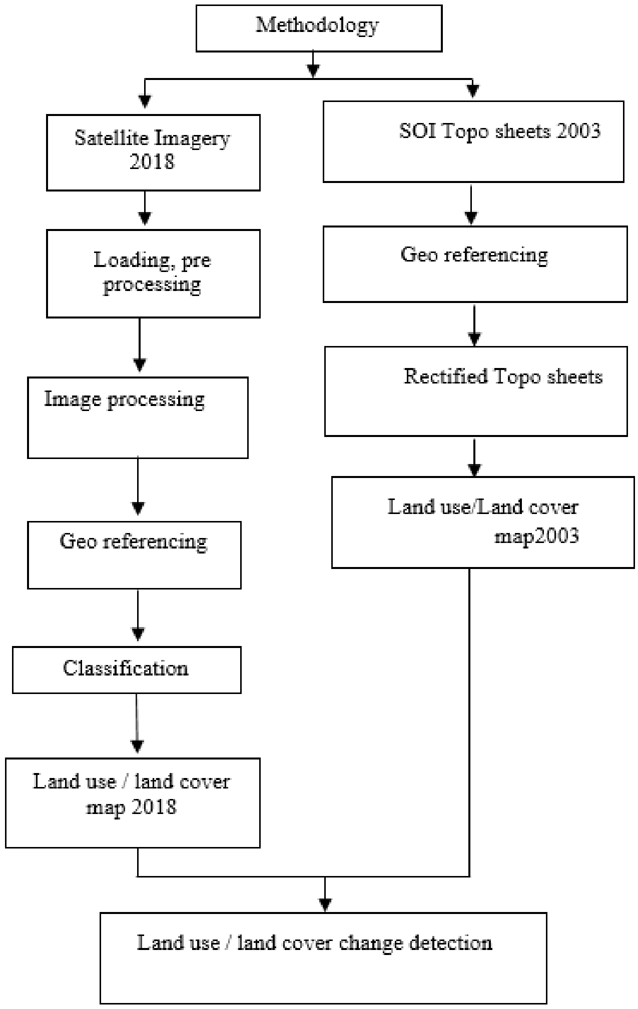
Table I: Name of Block Panchayat

III. OBJECTIVES

1) To assess the extent of Kilimanoor Block's land use and land cover changes between 2003 and 2018.
2) To create the study area's theme maps.
3) To use a GIS technique to integrate a variety of thematic maps and determine the region's potential ground water zones.
4) To create a GIS model to locate possible ground water areas.
5) To show off the capabilities of GIS and remote sensing for mapping ground water potential zones

IV. METHODOLOGY

The study's recommended methodology included a number of tasks, including base map preparation, LULC map production, image processing utilising software, digitization, and interpretation of the results. Ground water potential zones are determined using a similar process. All of the aforementioned themes are further processed and analysed in the fourth step, and SATTY'S analytical hierarchical procedure is used to rank them in order to determine the best groundwater potential zone. Geomorphology, slope, drainage density, land use and land cover, geology, and lineament density were considered in the current study.to be considered for the identification of possibility for groundwater. All thematic layers will be overlaid using GIS to find the final integrated output of groundwater potential zones. Methodology chart is shown below



A. *SATTY'S Analytical Hierarchical Process (AHP)*

The best choice among a group of alternatives is taken into account by the AHP along with a set of evaluation criteria. According on the decision maker's pair-wise comparisons of the evaluation criteria, the AHP creates a weight for each assessment criterion. The importance of the related criterion increases with increasing weight. The AHP then gives each option a score for a fixed criterion based on the decision-pair-wise maker's assessments of the options based on that criterion. The better the alternative performs in relation to the factor being assessed, the higher the score. Table II shows scale of importance

Intensity of Importance	Definition
1	Equal Importance
2	Weak
3	Moderate Importance
4	Moderate Plus
5	Strong Importance
6	Strong Plus
7	Very Strong
8	Very Very Strong

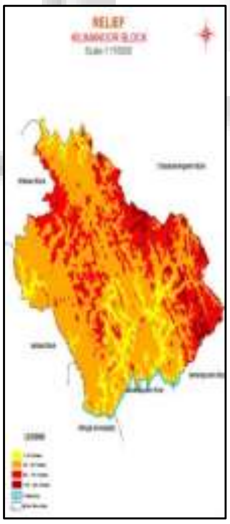
9	Extreme Importance

Table II: Scale of importance

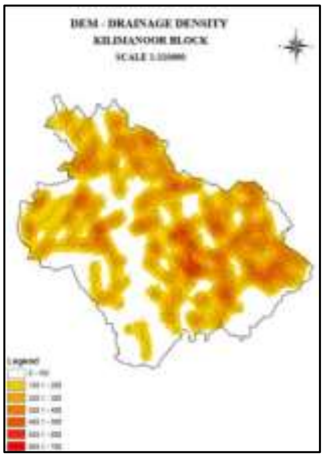
V. ANALYSIS

The crucial function that soil, a non-renewable and dynamic natural resource, plays in preserving life on the earth. Weathering of rocks, which is sparked by chemical, mechanical, and biological processes, results in the formation of soil. Relief is the term used in geography to describe the highest and lowest points of an area's elevation. Often, lowlands and other low-lying places have the lowest elevations, whereas mountains and ridges typically have the highest. A drainage basin is an organic structure that naturally directs runoff water to one location. Water features in this map include ponds, rivers, tributaries, permanent streams, and transient streams. One of the crucial terrain characteristics that is explained by the horizontal spacing of the contours is slope. Lineaments are noticeable, straight, linear structures that are discernible on the surface of the Earth. These generally represent surface irregularities brought forth by geological or geomorphic processes. Lineaments are formed by geological elements such as faults, shear zones, fractures, dykes, veins, bedding planes, and stratigraphic contacts. Geomorphology is the study of how topographic and bathymetric features developed over time as a result of physical, chemical, or biological processes occurring at or close to the earth's surface. Geology is an earth science that examines the physical earth, the rocks that make it up, and the processes that cause those rocks to change over time. Fig 2 shows parameters of LULC

Soil

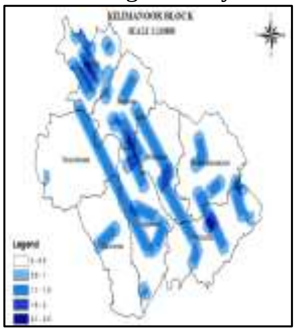


Relief



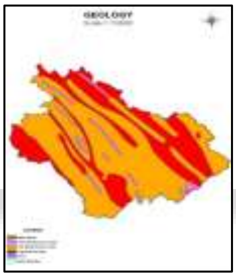
Drainage density

Slope



Lineament

Geomorphology

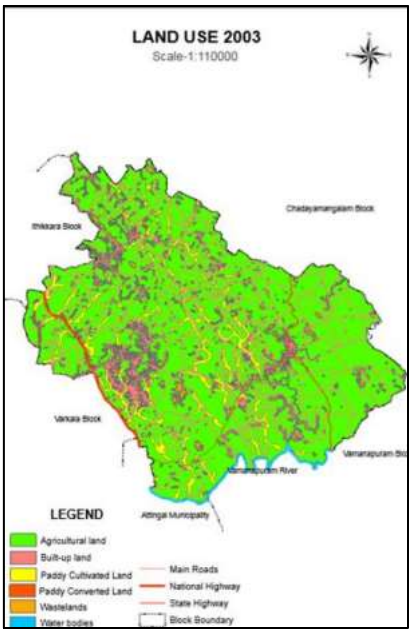


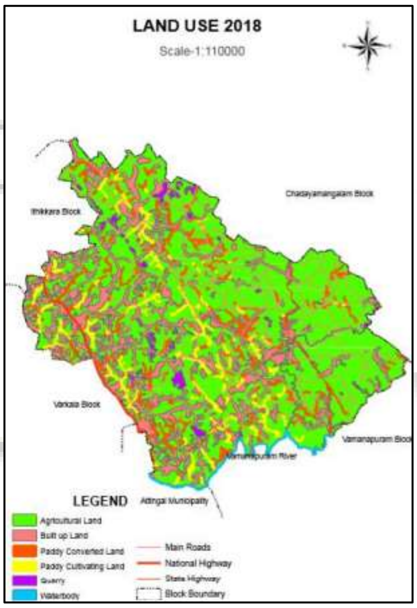
Geology

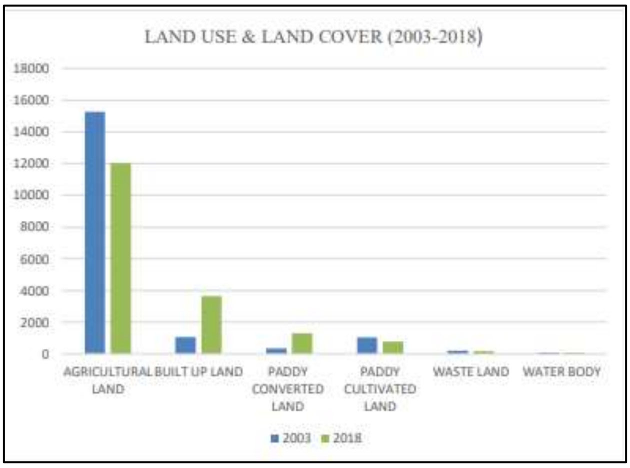
Fig. 2: Parameter of LULC

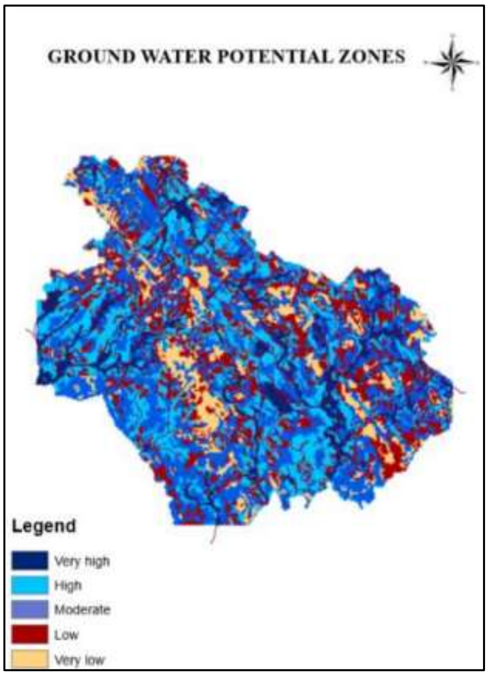
VI. RESULT AND DISCUSSIONS

An area's overall land use provides insight into how its natural and cultural resources are used regionally. Maps of land use and land cover have been created using satellite remote sensing data collected over a 15-year period (2003 to 2018). The Landsat and IRS-LISS IV satellite datasets utilised in the current investigation produced the comparisons below regarding the identification of changes in land use and land cover. It is clear from the current study that between 2003 and 2018, there was a significant drop in the studied area. The built-up land class is exhibiting an upward trend, which leads to the conclusion that population pressure is actively contributing to the loss of forest cover. LULC inventories and trends for the past and present are prepared using multiple-period satellite data, and the effects of the Kilimanoor Block are explored. The following maps display the Kilimanoor Block's Land Use/Land Cover map for the years 2003 and 2018.









VII. CONCLUSION

In this study, satellite photos of the land from 2003 and 2018 were In the Trivandrum district's Kilimanoor block, changes in use were evaluated. Here, we deduced that satellite data provides the rare capacity to quickly and accurately identify changes in land use. For a better understanding of the fundamental causes and ecological effects of such changes, accurate data on land cover change is essential.In some areas of the Kilimanoor Block, groundwater potential has been identified using geographic information systems and remote sensing, which has shown to be a powerful and economical technology. For a thorough understanding of the current environmental issues, it is crucial to analyse the nature, rate, and effects of land use change on groundwater quality. Groundwater is negatively impacted by human manipulation of water resources through overexploitation and release of untreated wastewater. The quantity, quality, and scope of groundwater resources are crucial for conservationists and managers of natural resources. Therefore, controlling water level variations may be a useful tool for improving the quality and quantity of groundwater resources. This research has identified major research and monitoring goals for future conservation strategies as being crucial in impacting integrated management. Regular updates of two fundamental sources of information on LULC data and indirect and direct information about the quality and quantity of groundwater resources are required when using remotely sensed data for monitoring purposes.

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