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Agriculture Land Use and Land Cover Analysis

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A B S T R A C T

Land use and land cover are vitally important in the field of change detection investigations. Land use includes agriculture and industrial land as subcategories. Land cover is the term that describes both natural and man-made features. There are water and plant features. The land use/land cover ratio serves as a representation of the ecosystem. The ecosystem is out of balance when there is more industrial than agricultural land because of the effects of industry. These kinds of issues can be handled when remote sensing is combined with change detection methods. The temporal coverage of several remote sensing satellites provides details about the land use and land cover of a certain area. The change detection method is used to find changes over a range of time intervals. The number of changes thus found can help in estimating the impact on the environment, allowing for the eventual need for preventative action.

Keywords: Land use, Land cover change detection.

1. Introduction

1.1 Introduction to analysis

To maintain a sustainable ecosystem, it is crucial to monitor and identify changes in land use and land cover (LU/LC), which is a crucial part of understanding how human activities interact with the environment.

Agriculture, climate, rainfall, population, soil, slope, and other topics are covered in the LU/LC classes. Programs for managing, planning, and monitoring natural resources depend on precise data on the land cover. The management of natural resources and the monitoring of environmental change now heavily rely on LU/LC change.

The phrase "land use change" describes the modification of the land's use and purpose, which may involve alterations to the intensity, management, or even the cover of the land. As a result of how people have employed natural and socioeconomic factors over time and space, a region's land use and land cover pattern. Information on land use change is needed to update land cover maps and efficiently manage and plan the resources for sustainable development. It is essential to have a solid understanding of the landscape's physical characteristics, the imaging technologies being used, and the information extraction methodology when using satellite remote sensing to identify changes in land use and land cover.

1.2 Motivation

Basically, agricultural intensification is required to help ensure food security and to slow the expansion of cropland and pasture in India. Intensification efforts for agricultural production should be joined with specific measures to minimize biodiversity losses. It helps us to known about the food provision, climate change mitigation, and preservation of biodiversity in India.

1.3 Aims and Objective of work

This work aims to meta-analyze the existing work carried out on changes identified in land use and land cover after using data analysis as a tool to improvise the usage of agricultural land. The prime objective of this effort is to assess how land usage and land cover have changed across the nation's numerous districts and states.

2. Methodology

Digital interpretation is used to extract raster data from the 2005–06 and 2011–12 years which are then converted into vector data using the toposheet as a guide. To create the anticipated map, the SaarS model uses drivers (such as elevation, slope, rainfall, temperature, soil depth, drainage network,

population density, health facility, literacy rate, sex ratio, and road network) and performs a change analysis using vector data from 2005–06 and 2011–12.

Powerful tools for extracting land use and land cover layers from SOI toposheets and satellite pictures include ARC GIS 10.1 and ERDAS IMAGINE 10.1 for the study of land use and land cover. The land use/land cover classes include agricultural land, settlements, rivers, drains, mangroves, and mud flats, among others. The feature classes are identified based on the visual interpretation of the satellite imagery in conjunction with filed checks, using agent-based/multi-agent system models.

The model presented here is an agent-based hybrid model with statistical functionalities that address the simulation's temporal and spatial aspects. SaarS model is the name given to the design which is developed by ISRO.

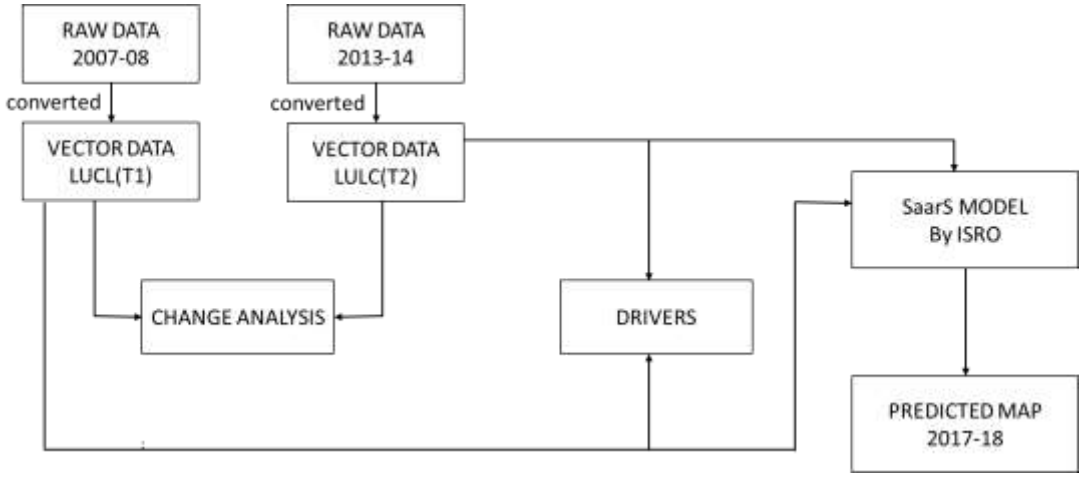

Fig 2.1 Flowchart of SaarS model

2.1 Data Used

LISS-III digital data from 2005 and LISS-III digital data from 2012 have been used to track changes in land use and land cover. Along with additional supporting information, the Survey of India (SOI) series 66B3 and 66B4 topographical maps of the scale 1:50000 were used.

2.2 SAARS MODEL

The model described here is an Agent-based hybrid model involving statistical functionalities which take care of the temporal and spatial properties of the simulation. The model has been named SaarS model. This model was developed by ISRO (Elliott, J., Best, N., Munson, T., and Foster 2010)

2.3 SOCIO-ECONOMICAL DRIVERS:

Population Density: The Directorate of Census provided the statistics for the 2001 and 2011 censuses. The population growth rate by the district for the years 2001 and 2011 was also acquired in addition to the census. Where the growth rate could not be determined, it was inferred by observing the pattern in nearby locations. The following equation was used to estimate the population for the years 2005 and 2012.

Population of year Y= Population of year Y 1 (log e X) Where: Log e = 2.17828 X = Population growth rate

Health facility: District-wise health facilities collected included the number of hospitals, dispensaries, community health centers, and primary health centers. This data was collected for 2005, 2006, and 2011, 2012**.**

Literacy rate: District-wise number of literates in percentage was recorded for 2005, 2006, and 2011, 2012.

Sex ratio: District-wise ratio of several female populations per thousand male populations was recorded for the 3-time frames.

Road Network: Road connectivity is an important aspect of development as it connects the villages to districts headquarters to different mandals and districts, enabling local populations to move from one place to another for their needs. District total road length was recorded for the period of the present study.

Agricultural Work Force: The people who work in the agricultural fields make up this labor group. The farm workforce was determined using a census that listed the number of individuals working in the fields in each taluka.

3. Results and Discussions

The Agricultural Land of 2005-06 is converted into built up (Rural) land in 2011-12 by 154.88 hectares.

The Agricultural Land-Plantation of 2005-06 is converted into Built Up-Industrial land in 2011-12 by 171.38 hectares.

The Agricultural Land-Aquaculture of 2005-06 is converted into Built Up-Industrial land in 2011-12 by 50.76 hectares.

The Agricultural Land-Aquaculture of 2005-06 is converted into Agricultural Land-Crop Land-Kharif Crop land in 2011- 12 by 1.89 hectares.

The Agricultural Land-Aquaculture of 2005-06 is converted into Agricultural Land-Crop Land-Rabi Crop land in 2011-12 by 701.22 hectares.

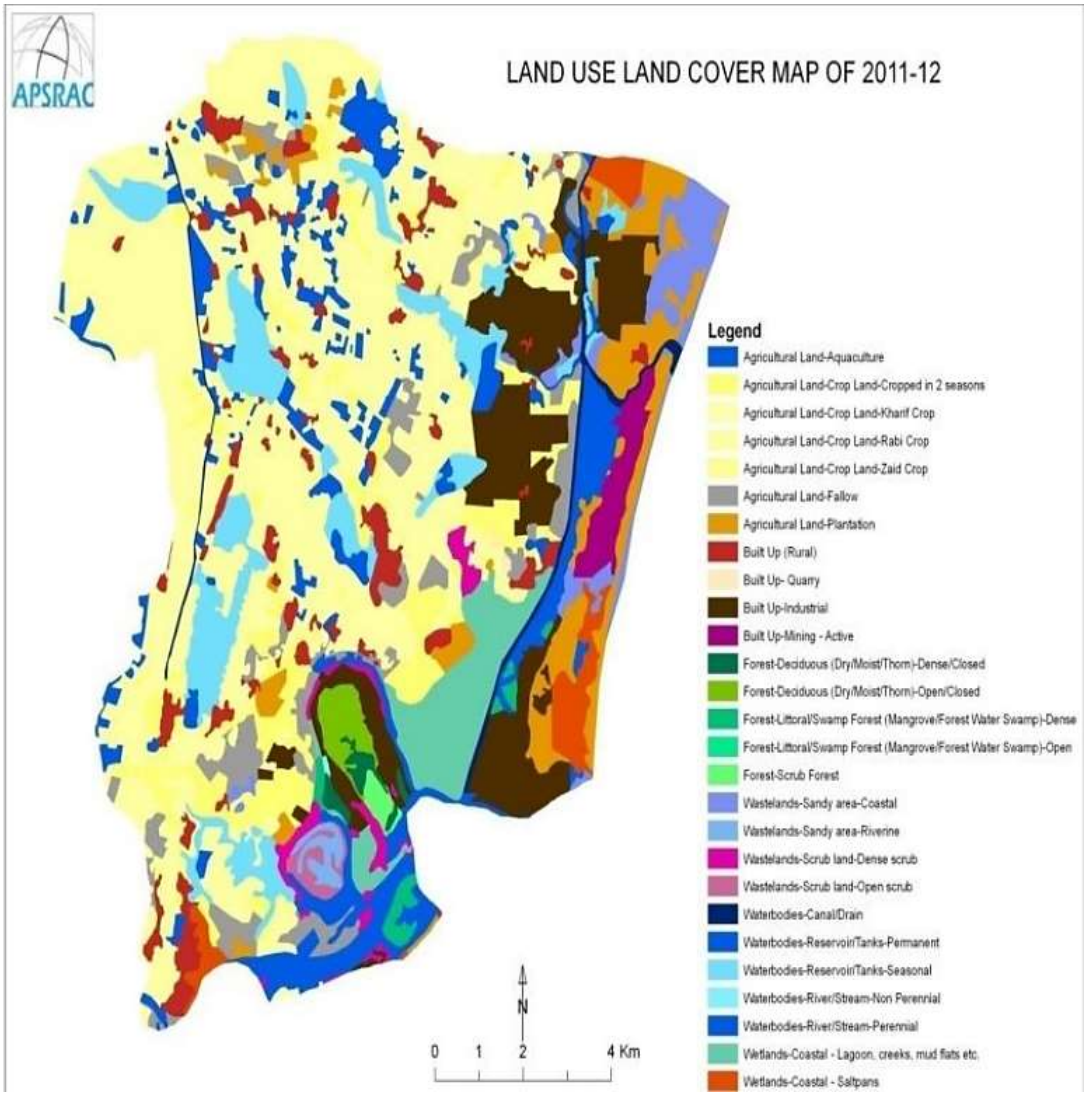

Fig 3.1 Land Use and Land Cover Map of 2013-2014

CONCLUSION

The study presents the map for the anticipated 2017–18 season, which was discovered using the analysis's maps for the 2007–08 and 2013–14 seasons. The driver data collection, which was used to determine the suitability of land use and land cover classes, included the development and prediction of maps. This finding is important for understanding how the land use and cover patterns changed over time in the selected year. This study can serve as a crucial resource for other research projects and the creation of future land management planning strategies.

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