Original Research Paper

Volume - 14 | Issue - 06 | June - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Geography

DETECTION OF LAND USE AND LAND COVER CHANGE IN THE DROUGHT-PRONE AREA OF DHARMAVARAM MANDAL IN SRI SATHYA SAI DISTRICT, ANDHRA PRADESH.

Dr. M. Karunakara Rao Department of Geography, Sri Krishnadevaraya University, Anantapur, Andhra Pradesh

ABSTRACT The study of Land Use/Land Cover (LULC) is crucial for managing natural resources in response to increasing human demands in today's ecosystem. This research primarily employs Geographic Information System (GIS) and land use data to path changes in Dharmavaram mandal, situated in the Ananthapur district of Andhra Pradesh, India. The focus of this paper is on analyzing and recognizing alterations in LULC between 2017 and 2023 using Esri Land cove Sentinel-2 10 metre Land use and Land cover data. The integration of remote sensing technology and GIS tools has facilitated the monitoring of land use and land cover changes over time. This technology has unveiled changes at both regional and global levels, providing substantial benefits to the scientific community.

KEYWORDS : Land Use, Land Cover & Change Detection

Introduction & Review of Literature:

Land-cover change detection is a crucial aspect of environmental monitoring and management. Various techniques have been developed and compared to effectively track changes in land cover over time. Mas (1999) conducted a study comparing different change detection techniques in the field of remote sensing.

The research, published in the International Journal of Remote Sensing, delved into the nuances of monitoring land-cover changes and highlighted the importance of accurate and reliable methods for detecting such changes. The findings of Mas (1999) shed light on the significance of employing appropriate techniques to ensure the precision and efficiency of land-cover change detection processes.

Remote sensing technology plays a pivotal role in land-use and land-cover mapping, providing valuable insights into the dynamic nature of landscapes. Studies such as the one conducted by Rao et al. (1991) showcase the application of remote sensing, specifically the IRS-1A satellite, for mapping land use and land cover in India.

The utilization of satellite remote sensing data, as demonstrated by the National Remote Sensing Agency (1985), has enabled comprehensive assessments of forest cover changes over specific periods. The India State of Forest Report (2013) further emphasizes the importance of remote sensing data in monitoring and evaluating forest cover trends, highlighting the critical role of technology in environmental conservation efforts.

In essence, the integration of remote sensing techniques and satellite data has revolutionized the field of land-cover change detection and environmental monitoring. These advancements not only enhance our understanding of landscape dynamics but also provide valuable information for sustainable land management practices.

As we continue to harness the power of remote sensing technology, further research and innovation in this domain will undoubtedly contribute to more effective land-use planning and conservation strategies.

Study Area:

Dharmavaram Mandal is situated between 13°40' and 15°15' north latitude and 76°50' and 78°30' east longitude in the heart of the peninsular region within the southwestern part of Andhra Pradesh, India. It shares borders with Bathalapalli, Anantapur, Raptadu, Kanaganapalli, Chennekothapalle, Bukkapatnam, and Mudigubba mandals of Sri Sathya Sai district. Covering an area of 368.33 Sq Km, the municipality is divided into 40 wards. As per the 2011 census, the total population stands at 1,72,654, with the urban population at 1,21,824, accounting for 70.6% of the total area. The literacy rate is reported at 68.46%, and the sex ratio of the entire population is 958.

OBJECTIVES:

- To map the land use and land cover classes of Dharmavaram mandal in Anantapuramu District for 2017 and 2023.
- To determine the changes in land use and land cover for 2017 and 2023.

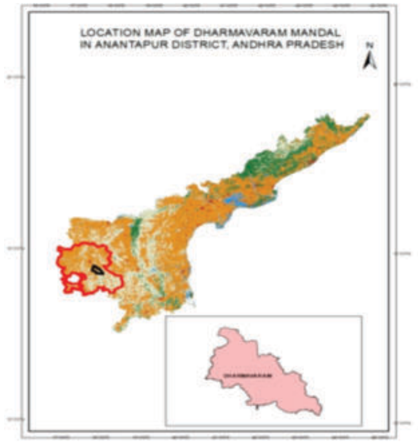
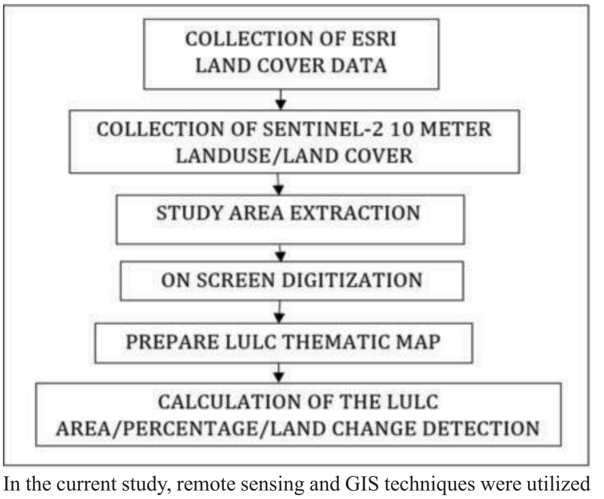


Fig: 1

Collection of the Data:

The data models were then applied to the Sentinel-2 scene collection, which comprises over 2 million Earth observations from 6 spectral bands, in order to generate detailed maps. GIS users can access the data directly through web services in ArcGIS Living Atlas. Additionally, Esri and Microsoft are providing the data for download through this application or Microsoft's Planetary Computer.

METHODOLOGY:



In the current study, remote sensing and GIS techniques were utilized to analyze land use and land cover changes in the Dharmavaram mandal. ArcGIS 10.3.3 software was employed for mapping and analyzing the data.

RESULT AND DISCUSSION:

Volume - 14 | Issue - 06 | June - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

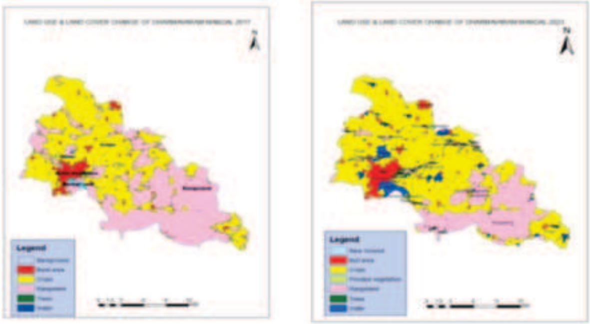


Fig: 2

Table: 1 Lulc Of Dharmavamam Mandal-2017

s.no	Name of the Classes	Area Sq km	Area Percent
1	Water	0.11961	0.031807
2	Trees	0.602889	0.16032
3	Crops	185.7433	49.39293
4	Build area	16.2443	4.319689
5	Bare Ground	1.101202	0.292832
6	Rangeland	172.2411	45.80242

The table 1 presents the Land Use and Land Cover (LULC) data for Dharmavaram mandal in 2017. The area of different land cover types is provided in square kilometers and as a percentage of the total area. The LULC categories include Water, Trees, Crops, Build area, Bareground, and Rangeland. Water covers a small area of 0.11961 sq km, accounting for 0.031807% of the total area. Trees occupy a larger area of 0.602889 sq km, representing 0.16032% of the total area. The most dominant land cover type is Crops, covering 185.7433 sq km, which is 49.39293% of the total area. Build area covers 16.2443 sq km (4.319689%), Bareground covers 1.101202 sq km (0.292832%), and Rangeland covers 172.2411 sq km (45.80242%). This data provides valuable insights into the distribution of different land cover types within Dharmavaram mandal in 2017, which can be crucial for understanding the landscape dynamics, planning sustainable land use practices, and monitoring changes in land cover over time.

Table: 2 Lulc Of Dharmavaram Mandal-2023

s.no	Name of the Classes	Area Sq km	Area Percent
1	Water	14.72387	3.915358
2	Trees	5.073155	1.349049
3	Flooded vegetation	1.420588	0.377761
4	Crops	237.6306	63.19052
5	Buit Area	20.55828	5.466841
6	Bare Ground	0.031668	0.008421
7	Rangeland	96.61601	25.69205

The table 2 presents the land use and land cover (LULC) data for the Dharmavaram Mandal in 2023. The area of the Mandal is divided into seven classes: Water, Trees, Flooded vegetation, Crops, Built Area, Bare Ground, and Rangeland. Water covers an area of 14.72387 sq km, accounting for 3.915358% of the total area. Trees occupy 5.073155 sq km, representing 1.349049% of the area. Flooded vegetation covers 1.420588 sq km, which is 0.377761% of the total area. The largest land use class is Crops, with an area of 237.6306 sq km, making up 63.19052% of the total area. Built Area covers 20.55828 sq km (5.466841%), while Bare Ground and Rangeland cover very small areas of 0.031668 sq km (0.008421%) and 96.61601 sq km (25.69205%), respectively. This data provides a comprehensive overview of the distribution of different land cover types within the Dharmavaram Mandal in 2023, which can be valuable for various scientific research purposes such as land use planning, environmental monitoring, and resource management.

Table: 3 Land Use & Land Cover Change Detection: 2017-2023

LULC change Detection 2017-2023	Area change(sq)
Bare Ground - Bare Ground	0.000072
Bare Ground - Built area	0.026277
Bare Ground - Crops	0.000749
Bare Ground - Rangeland	0.000908
Bare Ground - Water	1.07316
Built Area - Built area	15.723972
Built Area - Crops	0.397461
Built Area - Rangeland	0.029782
Built Area - Trees	0.031159
Built Area - Water	0.060724
Crops - Bare Ground	0.005035
Crops - Built area	2.810851
Crops - Crops	176.083728
Crops - Flooded vegetation	0.162301
Crops - Rangeland	1.709796
Crops - Trees	1.241903
Crops - Water	3.714645
Rangeland - Bare Ground	0.02656
Rangeland - Built area	1.965493
Rangeland - Crops	61.02137
Rangeland - Flooded vegetation	1.248339
Rangeland - Rangeland	94.77556
Rangeland - Trees	3.521547
Rangeland - Water	9.662338
Trees - Built area	0.029444
Trees - Crops	0.103215
Trees - Flooded vegetation	0.009278
Trees - Rangeland	0.093424
Trees - Trees	0.277278
Trees - Water	0.090154
Water - Built area	0.000098
Water - Water	0.119344

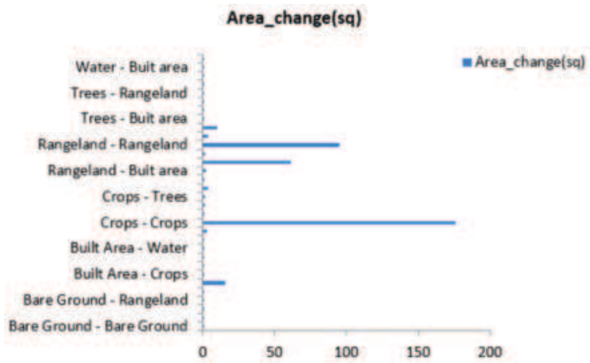


Fig: 3

In the table 3 provided, the focus is on Land Use and Land Cover (LULC) change detection spanning the years 2017 to 2023. The table presents the area changes in square units for different land cover types. The first column indicates the initial land cover type, while the second column specifies the changed land cover type. The values in the third column represent the area change in square units resulting from the transition between the specified land cover types. For instance, the transition from Bare Ground to Built Area resulted in an area change of 0.026277 square units. Notably, the largest area change observed in the table is from Bare Ground to Water, with a substantial value of 1.07316 square units. These numerical values provide insights into the dynamics of land cover changes over the specified time period, highlighting the transformations occurring within the study area. This data is crucial for understanding the impact of human activities, natural processes, and environmental factors on land cover changes, thereby contributing to informed decision-making and sustainable land management practices.

In this table, the distribution of built area in different land cover types is presented. The data shows that the majority of the built area, approximately 15.72%, is occupied by built structures. A small percentage of the built area is allocated to crops (0.40%), rangeland (0.03%), trees (0.03%), and water bodies (0.06%). This information is crucial for understanding the spatial distribution of human settlements and their impact on various land cover types. The data suggests that built structures dominate the landscape, with only a small fraction of land being used for agricultural purposes, natural vegetation, and water bodies. This analysis can provide valuable insights for urban planning, environmental conservation, and sustainable land management practices.

In this table, the land cover types are categorized based on the presence of different vegetation types within the study area. The table displays the percentage of land cover for each category. The land cover types include Crops with Bare Ground covering 0.005035% of the area, Built Area covering 2.810851%, Crops themselves covering 176.083728%, Flooded Vegetation covering 0.162301%, Rangeland covering 1.709796%, Trees covering 1.241903%, and Water covering 3.714645%. These percentages represent the spatial distribution of different land cover types within the study area. The high percentage of Crops indicates that a significant portion of the area is used for agricultural purposes. The presence of Built Area, Trees, and Water suggests some level of urbanization, natural vegetation, and water bodies within the study area. This information is crucial for understanding the landscape composition and can provide insights into the environmental characteristics and land use patterns of the area under investigation.

In this table, the percentages represent the land cover types within a rangeland ecosystem. The data shows that the dominant land cover type in the rangeland area is rangeland itself, accounting for 94.78% of the total area. This indicates that the majority of the rangeland is covered by natural grasslands and shrubs. Crops cover a significant portion of the rangeland area, representing 61.02% of the total land cover. This suggests that agricultural activities are prevalent within the rangeland, potentially impacting the natural ecosystem. Trees cover 3.52% of the rangeland, indicating the presence of woody vegetation within the ecosystem. Bare ground, built areas, flooded vegetation, and water cover smaller percentages of the rangeland area, highlighting the diversity of land cover types within the ecosystem. Overall, the data provides valuable insights into the composition of land cover types within the rangeland, which can be crucial for understanding the ecological dynamics and management of the ecosystem.

In this table, the relationships between trees and various land cover types are quantitatively represented through the values provided. The values indicate the proportion of each land cover type that is occupied by trees. For instance, the value of 0.029444 suggests that trees cover approximately 2.94% of the built area, while the value of 0.103215 indicates that trees occupy around 10.32% of the crops area. Similarly, the values for flooded vegetation, rangeland, and water show the percentage of these land cover types that are covered by trees. Notably, the highest proportion is observed in the "Trees - Trees" category, where trees cover approximately 27.73% of the total tree area. These values provide insights into the spatial distribution and extent of tree coverage across different land cover types, which can be valuable for understanding ecosystem dynamics, biodiversity, and land use planning. The data presented in this table can serve as a basis for further analysis and research on the interactions between trees and different land cover types in the study area.

In the provided table, the values represent the interaction energies between water molecules in different environments. The first entry, "Water - Built area," shows interaction energy of 0.000098. This value indicates the energy associated with the interaction between water molecules and a built surface or area, suggesting a relatively weak interaction. On the other hand, the second entry, "Water - Water," displays significantly higher interaction energy of 0.119344. This value signifies the energy required to overcome the attractive forces between water molecules in a bulk water environment, indicating a stronger interaction compared to water molecules interacting with a built surface. The data presented in the table can be valuable for understanding the behavior of water molecules in different contexts, such as in biological systems, materials science, or environmental studies. Further analysis and interpretation of these interaction energies could provide insights into the properties and dynamics of water molecules in various settings, contributing to the advancement of scientific knowledge in this field.

CONCLUSION:

The table provided analyzes changes in Land Use and Land Cover (LULC) from 2017 to 2023, showcasing transitions between different land cover types and their respective area changes. It highlights significant shifts, such as Bare Ground to Water, offering insights into land cover dynamics over time. The distribution of built area across various land cover types underscores the impact of human settlements on the landscape. Additionally, the categorization of land cover types based on vegetation presence reveals the spatial distribution of agriculture, urbanization, and natural vegetation. The data within a rangeland ecosystem emphasizes the dominance of rangeland and the influence of agricultural activities. Quantitative representations of tree coverage across different land cover types provide valuable insights into ecosystem dynamics. Lastly, the table presents interaction energies between water molecules in different environments, contributing to scientific knowledge in various fields.

REFERENCES:

1. J. F. Mas, "Monitoring land-cover changes: a comparison of change detection techniques," *International Journal of Remote Sensing*, vol. 20, no. 1, pp. 139–152, 1999.
2. T. M. Lillesand and R. W. Kiefer, *Remote Sensing and Image Interpretation*, John Wiley & Sons, New York, NY, USA, 4th edition, 2000.
3. Rao, D.P.; Gautam, N.C.; Karale, R.L.; Sahai, B. IRS-1A application for land use/land cover mapping in India. *Current Sci.* 1991, *61*, 153–161.
4. National Remote Sensing Agency. *Forest Cover Assessment of India Using Satellite Remote Sensing Data during 1972–1975 and 1980–1982 Periods*, Tech. Rep. 1985.
5. *India State of Forest Report*; Forest Survey of India, Ministry of Environment and Forest, Govt. of India: Dehradun, India, 2013; p. 252.
6. Chakraborthy, D.; Dutta, D.; Chandrasekharan, H. Land use indicators of a watershed in arid region, western Rajasthan using remote sensing and GIS. *JISRS* 2001, *29*, 115–128.
7. Gupta, P.K.; Punalekar, S.; Singh, R.P.; Panigrahy, S.; Parihar, J.S. Modeling the impact of land use/cover change on the runoff water availability: Case study for the Narmada River Basin. *ISRO-NNRMS Bull.* 2013, *38*, 124–129.
8. Joshi, P.K.; Bairwa, B.M.; Sharma, R.; Sinha, V.S.P. Assessing urbanization patterns over India using temporal DMSP-OLS night-time satellite data. *Current Sci.* 2011, *100*, 1479–1482.
9. Acharya, P.; Punia, M. Comparison of MODIS derived land use and land cover with Ministry of Agriculture reported statistics for India. *J. Appl. Remote Sens.* 2013, *7*.
10. Manandhar, R.; Odeh, I.O.A.; Ancev, T. Improving the accuracy of land use land cover classification of LANDSAT data using post classification enhancement. *Remote Sens.* 2009, *1*, 330–344.