IJRAR.ORG E-ISSN: 2348-1269, P-ISSN: 2349-5138

INTERNATIONAL JOURNAL OF RESEARCH AND ANALYTICAL REVIEWS (IJRAR) | IJRAR.ORG

An International Open Access, Peer-reviewed, Refereed Journal

LAND USE AND LAND COVER CHANGE DETECTION IN CHITTOOR DISTRICT, RAYALASEEMA REGION OF ANDHRA PRADESH

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Abstract:

The environmental monitoring of land use and cover change detection in a specific study area is essential. This study analyzes the drought prone area of Ralaseema southern region of Andhra Pradesh semi-arid climate and mixed land use pattern for the period from 2017 to 2024. The data utilized includes Sentinel-2, 10 meter annual map of earth's land surface imagery, GIS, and statistical tools. The Sentinel data is used to forecast future land use and land cover changes in the area. The process involves several steps: analyzing land use and land cover changes from 2017 to 2024, detecting changes, and creating GIS maps and calculations. The study separately examines the trends in water, vegetation, settlements, agriculture, and rangeland for the years 2017 and 2024. Ultimately, the changes in land use and land cover have a significant impact on the environmental conditions of the study area. The utilization of natural resources refers to water, settlement, and agricultural activities by the people during this period, which involves managing the natural resources of the study area. The findings indicate significant shifts in land use, particularly the conversion of rangeland to crops (794.87 sq km) and built-up areas (205.54 sq km), reflecting agricultural intensification and urban expansion. The valuable indication for policymakers and environmental observers to encourage sustainable increase practices in the drought prone region of Chittoor district.

Key words: LULC, GIS, RS, Environment & Region

Introduction:

Land Use and Land Cover studies play a vital role in thoughtful the interaction between natural resources and human behavior. Land Cover refers to the physical and biological cover of the Earth's surface, including water bodies, forests, grasslands, and barren lands, while Land Use refers to the way in which human beings utilize land and its resources for different purposes such as agriculture, settlements, industry and forestry. The study of LULC changes is essential for identifying patterns of resource utilization, environmental poverty, and urban growth.

Among the development of Remote Sensing and Geographic Information System techniques, monitor and analyze temporal changes in land use and land cover have become more efficient and precise. Satellite based LULC change detection helps in identify alteration caused by both natural process and human behavior, thereby provide important information for environmental organization and sustainable planning.

The Chittoor District, located in the Rayalaseema region of Andhra Pradesh, is characterized by semi arid climatic conditions, heaving topography and a prevalence of agriculture and horticulture based land use. In recent decades, the district has undergone substantial changes due to population growth, industrialization and rapid urbanization. These transformations have considerably influenced vegetation, water resources and land productivity. Consequently, assess LULC changes in Chittoor district using Sentinel-2 satellite data for the years 2017 and 2024 help in understanding spatial temporal dynamics and provides a scientific basis for sustainable land and resource administration in the area.

Study Area

The Chittoor District, located in the Rayalaseema region of southern Andhra Pradesh, India. The district lies between about 12°37′N to 13°58′N latitude and 78°33′E to 79°55′E longitude, covering an area of about 15,152 sq. km. Chittoor is characterized by undulating topography, a semi-arid climate, and seasonal rainfall partial by both the southwest and northeast monsoons. Agriculture is the primary occupation, with major crops including groundnut, paddy, sugarcane, and mango. The district also experiences rapid urban development and land transformation due to developmental behavior.

Objectives:

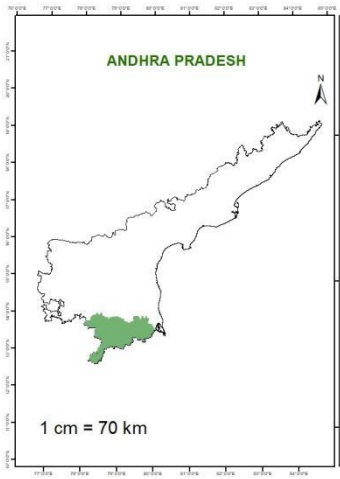
1. To the study of spatial and temporal changes in land use and land cover from 2017 to 2024
2. To the analysis of environmental monitoring of the study area from 2017 to 2024

Methodology:

In the study an effort have been made to clarification the from 2017 to 2024 period of Land use and Land cover in Chittoor district. Significant data have been analysis to get important explanation the Sentinel-2, 10 meter relevant data. Simple statistical calculations like mean, median, etc are used. The tables and graphs are used to carry out spatial variation of deferent period. The present study is primarily based on secondary data collected on website.

Data Collection: The study utilized Sentinel-2 MSI (Multi-spectral) imagery obtains from the Copernicus Open Access Hub for the years 2017 and 2024.

Data Preprocessing: Preprocessing be carry absent using ArcGIS 10.3 and M.S. Office



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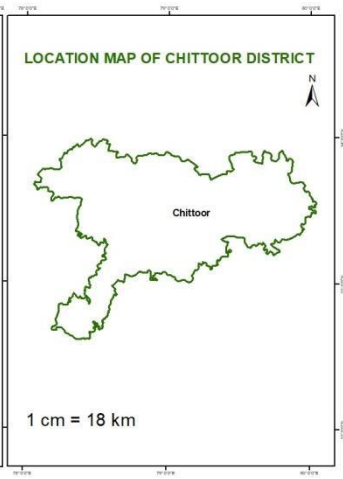


Fig:3

Table: 1
LULC change of Chittoor District-2017

S.no	Name of the Class	Area sq km
1	Water bodies	78.42945
2	Trees	1847.206
3	Flooded vegetation	1.683626
4	Crops	6652.286
5	Built up area	602.6487
6	Bare ground	15.1743
7	Clouds	0.0002
8	Rangeland	5977.698

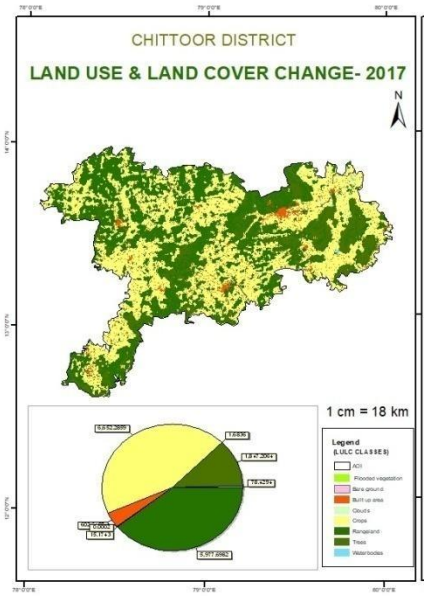
The Land Use and Land Cover changes in Chittoor district for the year 2017, importance the distribution of different lands cover classes across the region. The most significant land cover type identified in the district is agricultural crops, which occupy a wide area of roughly 6,652.29 square kilometers. For a substantial figure underscore the importance of agriculture in the region's economy and land use practices. Following crops, the second largest category is trees, covering about 1,847.21 square kilometers. This indicates a significant presence of forested areas or tree plantations, which may contribute to biodiversity and ecological balance (table.1 & fig.2).

Water bodies, surrounding lakes, rivers, and other aquatic environments account for about 78.43 square kilometers. For this comparatively small area suggests limited freshwater resources in the district, which could have implication for both local ecosystem and human activities. As well, the presence of flooded vegetation, which covers about 1.68 square kilometers, indicates areas that may occurrence seasonal stream, causal to the generally ecological diversity.

The built-up area, which includes urban and develop land, is recorded at 602.65 square kilometers. For the reflect extent of urbanization in Chittoor district, prominence the growth of infrastructure and human settlements. Equally, bare ground, covering only 15.17 square kilometer, suggest limited areas devoid of vegetation, which may be due to various factors such as erosion or land deprivation.

Rangeland, an important land cover type for grazing and livestock, occupies about 5,977.70 square kilometers, representing a noteworthy area keen to pastoral activities. Finally, clouds are noted in the table with a negligible area of 0.0002 square kilometers, which is likely included for wholeness but does not represent a land cover type appropriate to land use analysis.

The data presented as have provide valuable insight into the land use dynamics of Chittoor district in 2017, illustrating the majority of agricultural behavior as also prominence the presence of natural and developed land cover types. For this information is crucial for appreciative the ecological and socio-economic landscape of the region, as well as for informing future land management and protection strategy.



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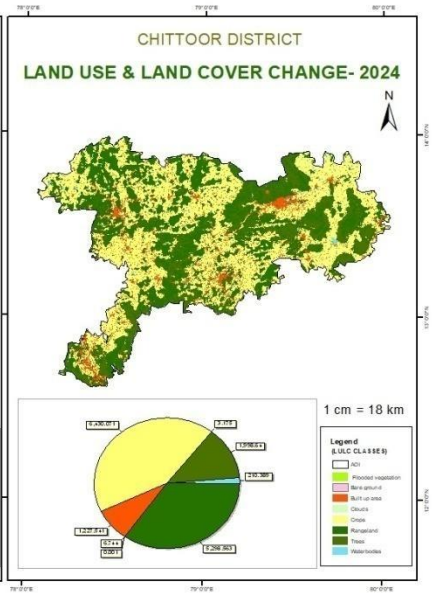


Fig:5

The land use and land cover changes in Chittoor district for the year 2024, detail the distribution of different lands cover classes across the region. The data is quantified in square kilometers, if a clear indication of the spatial allocation of different land types. The most significant land cover class identified is agricultural land, specifically crops, which occupies an area of approximately 6,430.071 square kilometers. For this considerable area underscore the importance of agriculture in the district's economy and land use pattern. Subsequent crops, rangeland is the next largest category, covering about 5,298.563 square kilometers. This indicates a substantial presence of grazing lands, which may support livestock agricultural and contribute to the local livelihood (table.2 & fig.3).

Table: 2
LULC change of Chittoor District: 2024

S.no	Name of the Class	Area sq km
	Water bodies	210.3893
1	Trees	1998.64
2	Flooded vegetation	3.175447
3	Crops	6430.071
4	Built up area	1227.541
5	Bare ground	6.743581
6	Clouds	0.0006
7	Rangeland	5298.563

In terms of forested areas, the class label as "Trees" include about 1,998.64 square kilometers. For this highlights the level of forest cover in the district, which is essential for biodiversity, carbon appropriation, and ecological balance. As well, the presence of water bodies, measured at 210.3893 square kilometer, reflects the availability of aquatic resource, which is essential for both ecological health and human utilize.

The built-up area, which includes urban and developed land, is recorded at 1,227.541 square kilometers. For indicates the extent of urbanization and transportation development within the district. Equally, the area classified as bare ground is moderately least, at 6.743581 square kilometer, signifying limited land that is devoid of vegetation or expansion.

Further categories contain flooded vegetation, which occupies a small area of 3.175447 square kilometers, and clouds, which are negligible at 0.0006 square kilometers. The presence of these classes may specify seasonal variation in land cover and the influence of climatic conditions on the region's landscape.

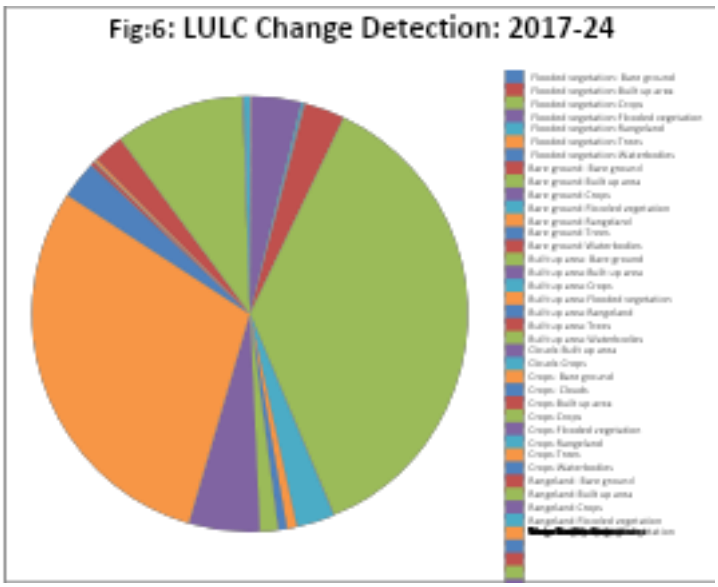
In general, the data accessible to provides a complete photograph of the land use dynamics in Chittoor district for 2024, prominence the predominance of agricultural and rangeland areas as also acknowledge the roles of urban development and natural features such as water bodies and forests. The information is essential for thoughtful the environmental and socio-economic perspective of the district, guiding future land management and policy decisions.

The complete analysis of land use and land cover changes in Chittoor district above a seven year period from 2017 to 2024. The data is prepared to reflect the transition between various land cover types, quantified in square kilometers. The analysis is crucial for understanding the dynamics of land use in the region, which can inform environmental management and urban planning strategies (table.3 & fig.5).

Table: 3
LULC Change Detection of Chittoor District: 2017 – 2024

Change Detection Classes	Area sq km
Flooded vegetation- Bare ground	0.0001
Flooded vegetation-Built up area	0.029713
Flooded vegetation-Crops	0.330135
Flooded vegetation-Flooded vegetation	0.198155
Flooded vegetation-Rangeland	0.589257
Flooded vegetation-Trees	0.056059
Flooded vegetation-Water bodies	0.479925
Bare ground- Bare ground	2.95059
Bare ground-Built up area	1.891559
Bare ground-Crops	4.578308
Bare ground-Flooded vegetation	0.002453
Bare ground-Rangeland	4.041564
Bare ground-Trees	0.086725
Bare ground-Water bodies	1.620433
Built up area- Bare ground	0.346721
Built up area-Built up area	558.140633
Built up area-Crops	26.40809
Built up area-Flooded vegetation	0.002194
Built up area-Rangeland	14.39828
Built up area-Trees	2.331171
Built up area-Water bodies	0.999059
Clouds-Built up area	0.000158
Clouds-Crops	0.000042
Crops- Bare ground	1.665277
Crops- Clouds	0.0002
Crops-Built up area	452.275553
Crops-Crops	5558.238555
Crops-Flooded vegetation	1.0615
Crops-Rangeland	428.83104
Crops-Trees	112.690535
Crops-Water bodies	97.359767
Rangeland- Bare ground	1.441968

Rangeland-Built up area	205.541152
Rangeland-Crops	794.866767
Rangeland-Flooded vegetation	1.324681
Rangeland-Rangeland	4503.650136
Rangeland-Trees	427.427411
Rangeland-Water bodies	43.294226
Trees- Bare ground	0.019405
Trees- Clouds	0.0004
Trees-Built up area	8.877038
Trees-Crops	35.954479
Trees-Flooded vegetation	0.0102
Trees-Rangeland	343.140466
Trees-Trees	1455.847788
Trees-Water bodies	3.305296
Water bodies- Bare ground	0.318448
Water bodies-Built up area	0.739331
Water bodies-Crops	9.556821
Water bodies-Flooded vegetation	0.576157
Water bodies-Rangeland	3.800194
Water bodies-Trees	0.110641
Water bodies-Water bodies	63.323042



The classes categorize change based on different land cover types, including flooded vegetation, bare ground, built-up areas, crops, rangeland, trees and water bodies. For instance, the transition from flooded vegetation to crops shows a significant area of about 0.33 sq km, indicating a notable shift in land use that may reflect agricultural expansion or changes in hydrological conditions. Conversely, the transition from flooded vegetation to water bodies is also substantial, with an area of about 0.48 sq km, suggesting likely alteration in water management or natural water body dynamics.

Bare ground exhibit wide transition, particularly to crops (4.58 sq km) and rangeland (4.04 sq km), which may show land recovery or shifts in agricultural practices. The built-up area category reveals a dominant stability, with a remarkable area of 558.14 sq km remaining as built-up land, underscoring urban growth and development stress in the district. Notably, the transition from crops to built-up areas is important at around 452.28 sq km, prominence the intrusion of urbanization into agricultural zone.

Rangeland also show significant changes, mostly in its transitions to crops (794.87 sq km) and built-up areas (205.54 sq km), which may return both agricultural strengthening and urban expansion. The data for trees indicates a moderately stable land cover, although transitions to rangeland (343.14 sq km) and built-up areas (8.88 sq km) propose a few degree of land conversion, potentially impacting home biodiversity and ecosystem services.

Water bodies, as showing a stable area of 63.32 sq km, also knowledge transitions to crops (9.56 sq km) and rangeland (3.80 sq km), representative potential pressure from agricultural practices on aquatic ecosystems. In general, the data presented in critical insights into the developing landscape of Chittoor district, stress important trends in land cover change that warrant additional study and monitoring to ensure sustainable land organization practice in the face of constant growth and environmental change.

Conclusion:

The complete analysis of Land Use and Land Cover changes in Chittoor district from 2017 to 2024 reveal noteworthy spatial and temporal transformation driven by both natural process and human behavior. The results obviously indicate that agricultural development and urbanization are the leading forces determining the district's landscape. Considerable adaptation of rangeland and crop areas into built-up land reflects fast urban growth, as the change of bare ground and flooded vegetation into agricultural land suggest intensify cultivation and changing land organization practice.

Although some category, such as forest (tree cover) and water bodies have made known relative stability, their part adaptation to other land uses highlights growing pressure on natural ecosystems. The refuse in vegetation and growth of urban areas may lead to unpleasant environmental impact, including loss of biodiversity, soil degradation, and hydrological inequality.

Complete the study underscore the imperative need for sustainable land use planning and valuable environmental administration in Chittoor district. Nonstop LULC monitoring using remote sensing and GIS can carry policymakers in balancing developmental wishes with ecological conservation, ensure long term sustainability in this drought prone area of the Rayalaseema region.

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