LAND USE AND LAND COVER DYNAMIC STUDY OF DHENKANAL DISTRICT, ODISHA, INDIA

A PROJECT REPORT

Submitted by

SASMITA SAHOO

Reg No. 210301120081

in partial fulfilment for the award of the

degree Of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGNIEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

BHUBANESWAR CAMPUS

CENTURION UNIVERSITY OF TECHNOLOGY AND MANAGEMENT

ODISHA

November, 2023

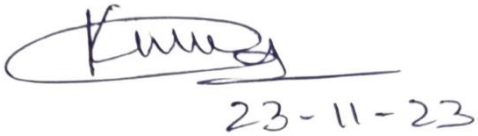
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

BHUBANESWAR CAMPUS

BONAFDE CERTIFICATE

Certified that this project report **"LAND USE AND LAND COVER DYNAMIC STUDY OF DHENKANAL DISTRICT, ODISHA, INDIA"** is the Bonafide work of "SASMITA SAHOO" who carried out the project work under my supervision. This is to further certify to the best of my knowledge that this project has not been carried out earlier in this institute and the university.

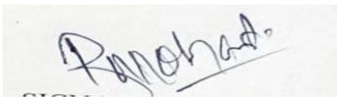


SIGNATURE

Dr. Kamal Kumar Barik

Head Of the Department of Civil Engineering

Certified that the above-mentioned project has been duly carried out as per the norms of the college and statutes of the university



SIGNATURE

Prof. Raj Kumar Mohanta

Head Of the Department of Computer Science and Engineering

DEPARTMET SEAL

DECLARATION

I hereby declare that the project entitled **"LAND USE AND LAND COVER DYNAMIC STUDY OF DHENKANAL DISTRICT, ODISHA, INDIA"** submitted for the "Minor Project" of 5th semester B. Tech in Computer Science and Engineering is my original work and the project has not formed the basis for the award of any Degree / Diploma or any other similar titles in any other University / Institute.

Name of the Student: SASMITA SAHOO

Signature of the Student: Sasmita Sahoo

Registration No: 210301120081

Place: Jatni, Odisha

Date: 23/11/23

ACKNOWLEDGEMENTS

I wish to express my profound and sincere gratitude to **Dr. Kamal Kumar Barik**, Department of Civil Engineering, SoET, Bhubaneswar Campus, who guided me into the intricacies of this project nonchalantly with matchless magnanimity.

I thank **Prof. Raj Kumar Mohanta**, Head of the Dept. of Department of Computer Science and Engineering, SoET, Bhubaneswar Campus and **Dr. Sujata Chakravarty**, Dean, School of Engineering and Technology, Bhubaneswar Campus for extending their support during Course of this investigation.

I would be failing in my duty if I don't acknowledge the cooperation rendered during various stages of interpretation by my friends.

I am highly grateful to the teachers who evinced keen interest and invaluable support in the progress and successful completion of my project work.

I am indebted to my collegues for their constant encouragement, co-operation and help. Words of gratitude are not enough to describe the accommodation and fortitude which they have shown throughout my endeavor.

Name of the Student: SASMITA SAHOO

Signature of the Student: Sasmita Sahoo

Registration No: 210301120081

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CHAPTER - 1

INTRODUCTION

1.1 Introduction

Satellite image classification and land cover analysis play pivotal roles in understanding and managing the dynamic landscapes of diverse regions. In the context of Dhenkanal District, this project seeks to harness the capabilities of advanced remote sensing technology, with a specific focus on utilizing satellite imagery for comprehensive land cover analysis. Nestled in the heart of India, Dhenkanal District exhibits a rich tapestry of natural features, agricultural expanses, and human settlements. The strategic application of these technologies, particularly through ERDAS IMAGINE software, promises to unravel intricate details about the district's land use and land cover.

In recent years, the advent of high-resolution satellite imagery and sophisticated analysis tools has opened new avenues for environmental monitoring and resource management. Dhenkanal District, characterized by its diverse topography and land cover types, presents a compelling case for employing advanced classification techniques to discern and quantify various land cover categories. The significance of this project lies in its potential to offer valuable insights for urban planning, agricultural management, and environmental conservation in the region.The allure of satellite imagery lies in its ability to capture a holistic view of Earth's surface, allowing for detailed analysis of land cover patterns and changes over time. Dhenkanal District, with its amalgamation of urban, rural, and natural environments, becomes an ideal canvas for unraveling the intricate tapestry of land use.

The insights derived from this analysis not only serve academic curiosity but also hold immense practical value for local authorities, policymakers, and environmentalists striving to make informed decisions about land planning, conservation, and sustainable development.This project, rooted in the convergence of technology and environmental science, seeks to bridge the gap between data-driven insights and actionable intelligence, offering a lens through which the nuanced dynamics of Dhenkanal District's land cover can be comprehensively understood.By embarking on this exploration, we not only contribute to the scientific discourse on remote sensing and image analysis but also strive to empower local stakeholders with the knowledge necessary for fostering sustainable growth and preserving the ecological integrity of Dhenkanal District.

1.2 Objective

- Supervised Classification: Implement supervised classification using ERDAS IMAGINE to accurately categorize land cover types in Dhenkanal District. Train the classification model with ground truth data to enhance precision.

- Unsupervised Classification: Employ unsupervised classification techniques within ERDAS IMAGINE to identify inherent patterns and groupings in satellite imagery. Explore clustering algorithms to reveal hidden structures in the landscape.
- Area Calculation: Utilize ERDAS IMAGINE's capabilities for precise area calculation of different land cover classes. Generate statistical information on the spatial distribution and extent of each category within the district.
- Accuracy Assessment: Conduct a thorough accuracy assessment of the classification results to evaluate the reliability and robustness of the applied methodologies. Employ appropriate metrics to validate the precision of the derived land cover maps.
- Land Cover Analysis: Analyze the classified imagery to derive meaningful insights into the spatial distribution and dynamics of land cover in Dhenkanal District. Interpret the results in the context of environmental and socio-economic considerations.

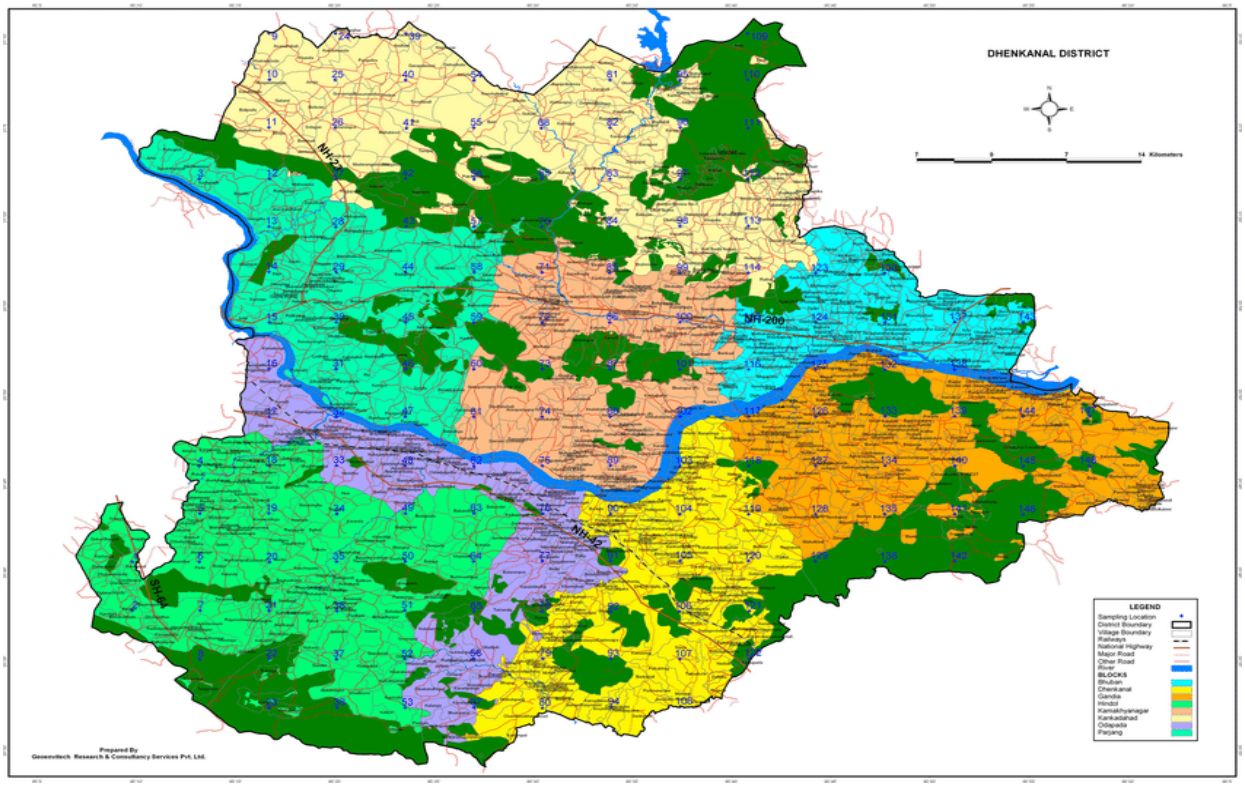
CHAPTER - 2

DESCRIPTION ABOUT THE STUDY AREA

2.1 Geographical feature of Dhenkanala

Dhenkanal district is one of the centrally located districts in Odisha. It lies between Longitude: **85° 58' to 86° 2'** East and Latitude: **20° 29' to 21° 11'** North. The nearest airport is Biju Patnaik Airport located at a distance of 52.12 Km. It is bordered by Kendujhar and Angul districts to the north, Jajpur district to the east, Cuttack district to the south and Angul district to the west.

The district comprises mainly plains, however there are several discontinuous hill ranges in the district and along its southern border. The Brahmani River is the main river of the district.

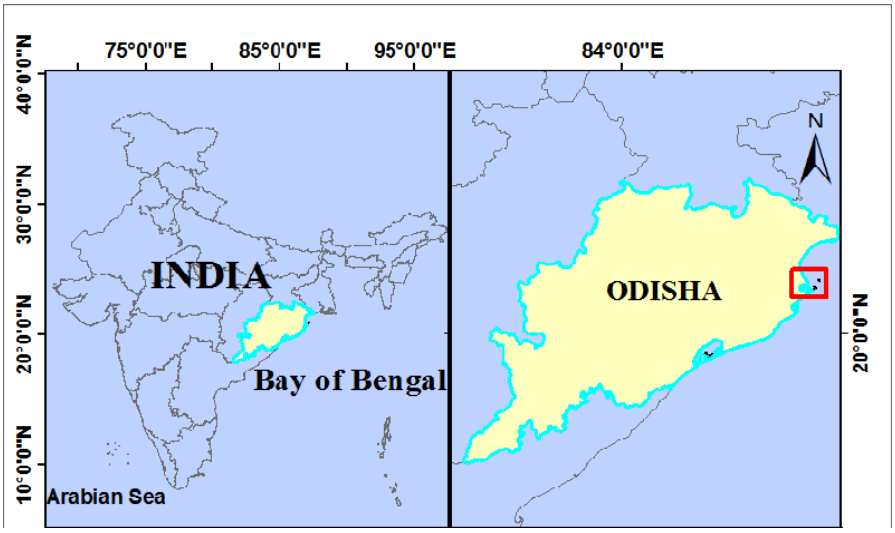


It is commonly believed that the Dhenkanal District owes its name to a Savara chief named 'DHENKA' who formerly ruled over in this tract. Dhenkanal District covers an area of 4452 Sq Km. It has a vast area covered with dense forests and a long range of hills.This is the reason of calling the District as 'Home of Elephants and tigers of the country'.

Adminstrative Division	Dhenkanal
Adminstrative Headquarters town	**Dhenkanala Town**
Sub Divisons	**3**
Tahsils	**8**
Gram Panchayat	**198**
Urban Bodies	**4**
Police Station	**15**
Village	**1237**
Population	**1192948**
Male population	**612597**
Female Population	**580351**
Literacy rate	**79.41%**
Male literates	**471681**
Female Literates	**370307**

2.2 Land Cover types of region

Land is one of the most important natural resources. All agriculture, animal and forestry productions depend on the productivity of the land. The entire eco- system of the land, which comprises of soil, water and plant, meets the community demand for food, energy and other need of livelihood. Human factor is very significant in bringing about changes in the land-use pattern in the study area. These are noticed in some other places also (Jaiswal et al., 1999; Jijun et al., 2003). The requisite for better land use planning is information on existing land use and their spatial distribution as they are important to determined land use policy planning of transportation and communication services etc.



Land-use Classification

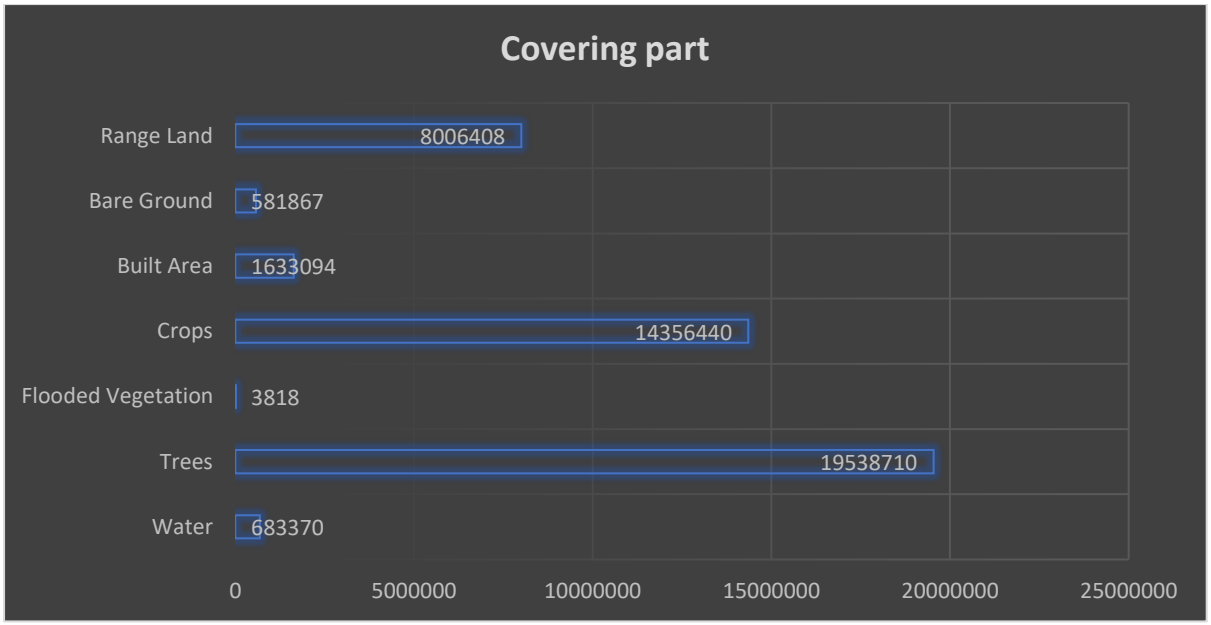
A generalized land-use classification was adopted based on the land-use classification system developed by NRSA, 1989. Similar land-use types were grouped into one generalized land-use type to form the following six main land-use types in the study area.

Mining area consisting of both quarries and overburden dumps.

- Settlements which consists of **built-up land, industries, roads and railway lines**.
- Water bodies consisting of **rivers, streams, nalas, wet lands, reservoirs and ponds**.
- Forest land consisting of **dense forest, open forest, scrub forest, forest plantation and shifting cultivation.**
- Plantation consisting of **orchards, and mine reclamation** areas.
- Agriculture land that consists of **kharif, rabi, double crop and all types of land capable of doing agriculture,** either presently cultivated or fallow land.
- Barren land/ waste land consisting of gullied, **barren rock, land with scrub, and land** without scrub but excluding mining area (mining area has been considered as a separate land-use unit in the study area).

	Classification of Forest	Area in Sq.
1	Reserve Forests	1141.02

2	Demarcated Protected Forests	13.78
3	Un-demarcated Forests	0.00
4	Un Classified Forests	0.04
5	Other Forests	582.78
6	Total Forest Area	1737.62
7	Total Geograpical Area	4452

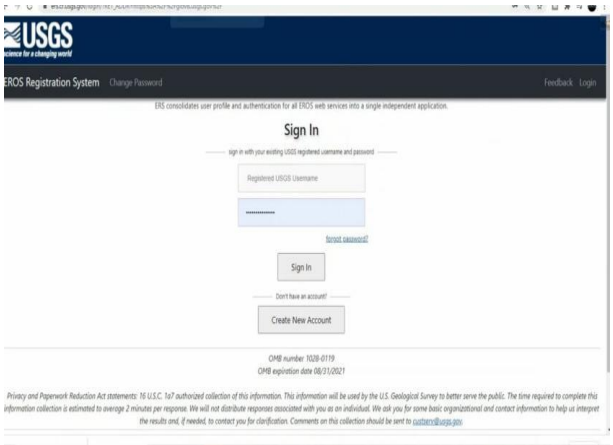


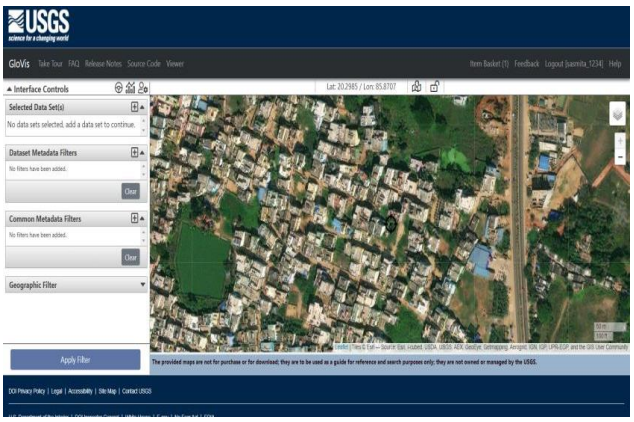
CHAPTER – 3

SOFTWARE USED

3.1 Uses of Glovis Earth Explorer

GloVis stands for the Global Visualization Viewer. Since 2001, GloVis has been a tool for accessing remote sensing data. GloVis hosts only publicly available data. The data sets are all federally created and therefore in the public domain, which means there are no copyright or licensing restrictions. GloVis [http://glovis.usgs.gov/] is designed as a search tool to support users of the USGS Landsat archive. It provides a variety of capabilities to facilitate searches of archives, which are described here to familiarize readers with its capabilities. Most readers who wish to use GloVis in support of their classroom activities will apply only a few of its capabilities for searching for and displaying their imagesAlthough GloVis provides access to several forms of imagery, it opens by default to display the Landsat archive, displaying Thematic Mapper (TM) imagery. Landsat TM, and other sensors, collect information in several regions of the electromagnetic spectrum— images displayed as "color composites," formed using three of the numerous bands, usually with the brightnesses in the green, red, and near infrared regions displayed in the blue, green, and red channels, respectively.





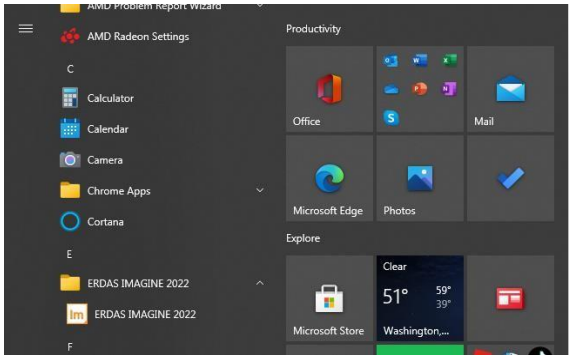
Log in to your Glovis account: Go to **website** and log in to your account using your email address and password.Search for the image: Once you have logged in, search for the image you want to download by using the search bar or navigating to the appropriate page.Otherwise We can also use another site called Earth Explorer to download image with clear quality.

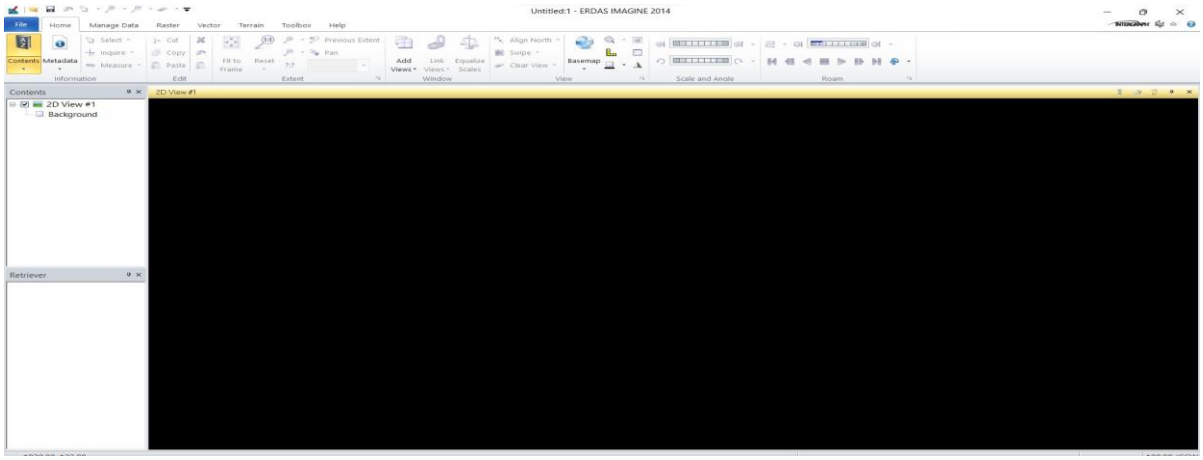
3.2 Uses of ERDAS IMAGINE

ERDAS Imagine is a raster-based software package designed specifically to extract information from imagery. ERDAS IMAGINE includes a comprehensive set of tools to create accurate base imagery for inclusion into a GIS and ESRI Geodatabase. ERDAS IMAGINE® provides a variety of tools such as image orthorectification, mosaicking, reprojection, classification and interpretation that allow the user to analyze image data and present it in formats ranging from printed maps to 3D models.

Image data visualization, classification, modeling, analysis and interpretation. Including:

- Geometric Correction
- Image Orthorectification
- Multispectral Classification
- Image Interpretation
- Image Analysis
- Image Mosaicking
- Digital Terrain Modeling
- Map Production

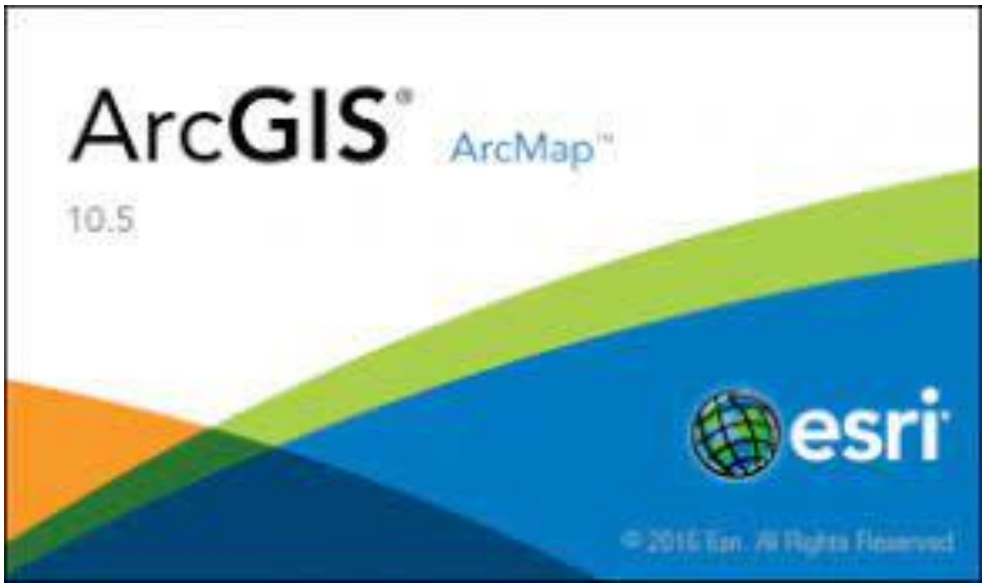




3.3 Uses of Arc Gis

ArcGIS, developed by Esri (Environmental Systems Research Institute), is a comprehensive and widely-used geographic information system (GIS) software suite that empowers users to create, manage, analyze, and visualize spatial data. Esri, founded in 1969, has played a pivotal role in advancing GIS technology, making it accessible and user-friendly for a diverse range of industries and applications.

ArcGIS provides a robust platform for spatial analysis and mapping, offering a suite of interconnected tools and applications that cater to the needs of GIS professionals, researchers, and decision-makers. The software is renowned for its versatility, supporting tasks ranging from basic mapping to complex spatial analytics and 3D visualization. With a user-friendly interface, ArcGIS enables users to seamlessly integrate and analyze various types of geospatial data, fostering informed decision-making.

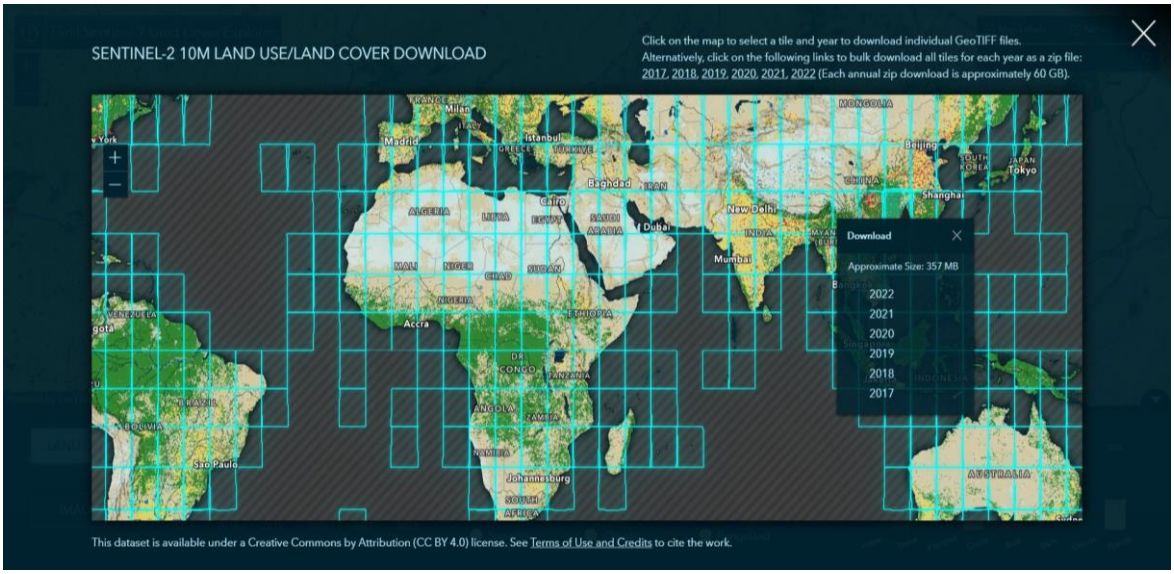


3.4 Uses of Esri

Esri's ArcGIS ecosystem extends beyond the desktop application, encompassing web-based platforms such as ArcGIS Online, where users can create and share maps and applications. ArcGIS Online facilitates collaboration and serves as a central hub for accessing a wealth of authoritative geospatial content through the ArcGIS Living Atlas of the World.

Furthermore, Esri is actively engaged in fostering a community of GIS professionals and enthusiasts through events, conferences, and a wealth of educational resources. Their commitment to innovation is evident in the continual enhancement of the ArcGIS platform, incorporating cutting-edge technologies such as artificial intelligence and machine learning for more advanced spatial analysis.

In recent years, the integration of cloud computing technologies has further expanded the capabilities of ArcGIS, allowing for scalable and accessible GIS solutions. Esri's dedication to providing tools for sustainable development, environmental stewardship, and societal well-being underscores the transformative impact of GIS technology on our understanding of the world and its interconnected systems. As GIS continues to evolve, Esri remains at the forefront, driving innovation and empowering users to harness the power of spatial data for addressing real-world challenges.

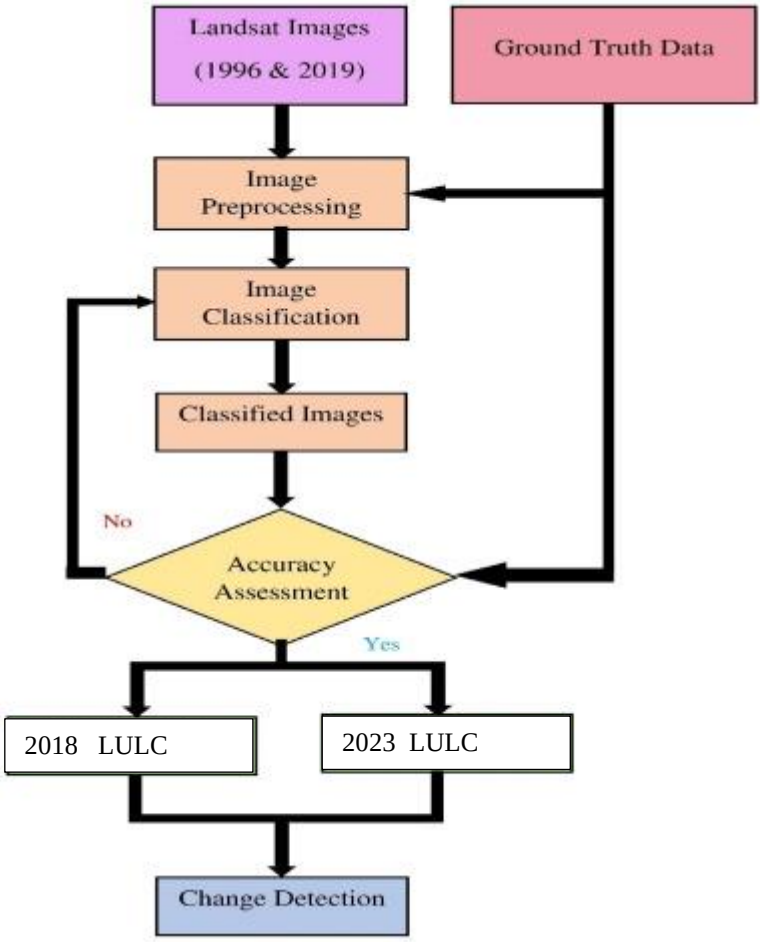


CHAPTER – 4

METHODOLOGY

4.1 Flow Chart

In conducting a thorough land cover analysis of the Dhenkanal district, a structured and multi-step approach is employed. Initially, satellite imagery is acquired through platforms such as Glovis or Earth Explorer, ensuring comprehensive coverage of the region.



This imagery then undergoes a series of preprocessing steps, including radiometric calibration, atmospheric correction, and image registration, aimed at enhancing data quality. Following preprocessing, image enhancement techniques such as contrast stretching and histogram

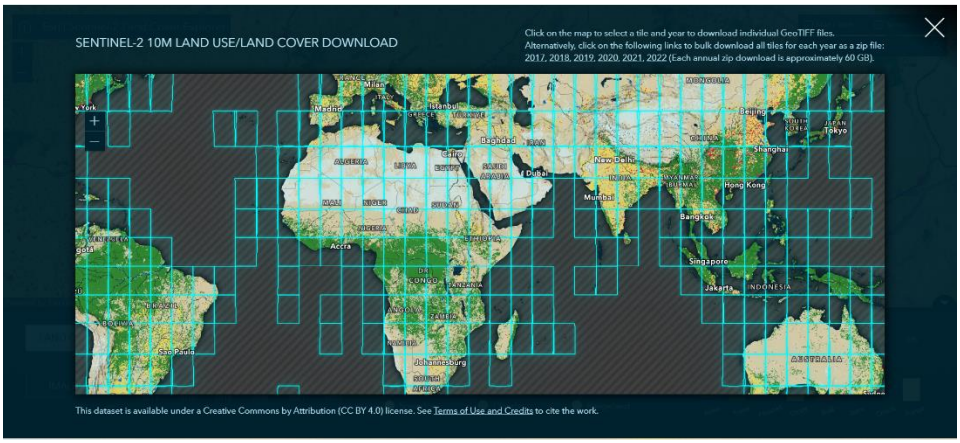
equalization are applied to improve visual interpretation. Image fusion may be implemented if multiple bands or images are available, leading to the creation of a False Color Composite (FCC). The extraction of relevant layers involves careful selection of specific bands and the generation of spectral indices. Subsequently, a classification phase unfolds, encompassing both supervised (utilizing training samples) and unsupervised methods, often employing machine learning algorithms like decision trees or support vector machines. Post-classification activities involve accuracy assessments and refinement of class boundaries. Area calculations are performed to quantify the extent of different land cover classes, and the results are visualized using Geographic Information System (GIS) software like ERDAS or QGIS, ultimately providing a comprehensive understanding of the land cover composition in Dhenkanal district.

4.2 Data Collection and Description

The steps for accessing and downloading Sentinel-2 imagery using Esri tools may involve using Esri's ArcGIS Living Atlas of the World or other ArcGIS Online services. Keep in mind that the availability of data and the specific steps may have changed, so it's advisable to check the latest resources and documentation. Here are general steps you can follow:

Visit ArcGIS Living Atlas of the World:

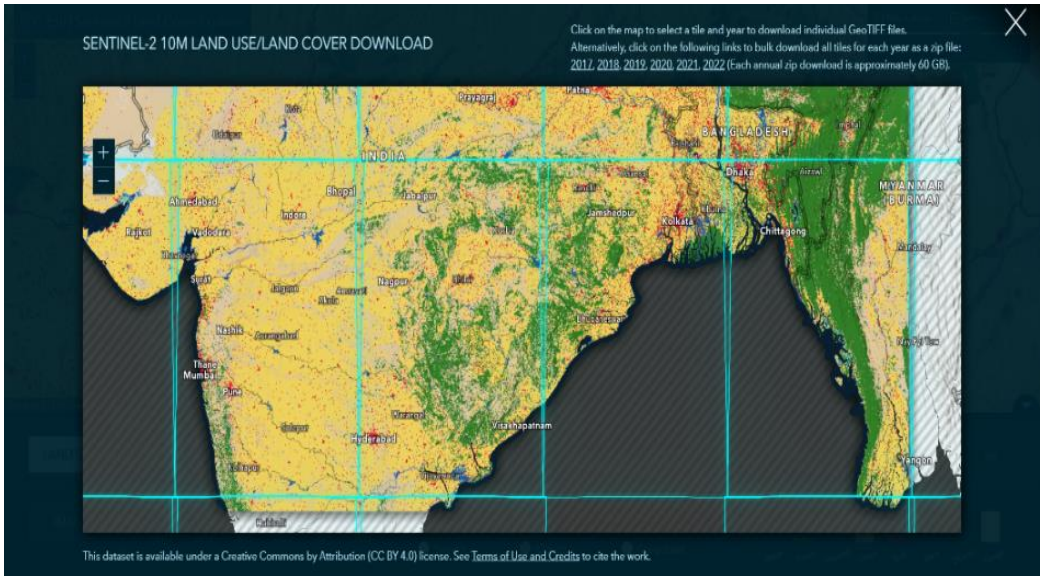
Go to the ArcGIS Living Atlas of the World website.



Search for Sentinel-2 Imagery:

Use the search bar to look for Sentinel-2 imagery or browse the available imagery layers.

Click on the layer to access more details. You may find options for different bands, time periods, and resolutions.



Add the Imagery Layer to ArcGIS Online:

Some layers may allow you to add them directly to your ArcGIS Online account. If prompted, sign in to your ArcGIS Online account and add the layer.

Use the Imagery Layer in ArcGIS Software:

If you are using ArcGIS Desktop or another ArcGIS software, you can add the Sentinel-2 imagery layer by connecting to the ArcGIS Online account.

Download Data :

Depending on the terms of use and access provided by the data provider, there may be options to download the data. Look for download options or explore related services.

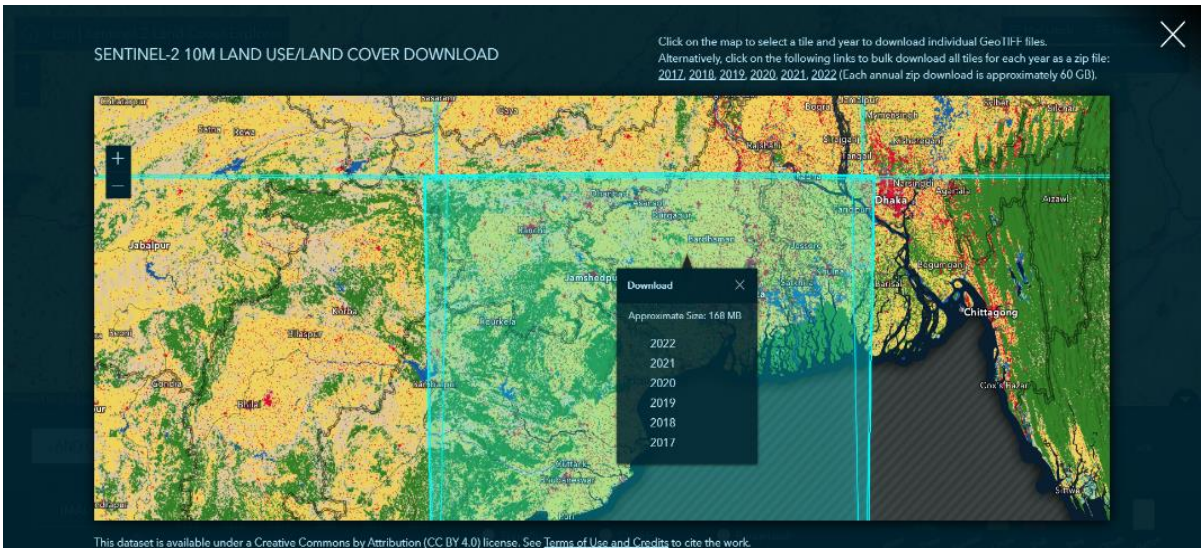
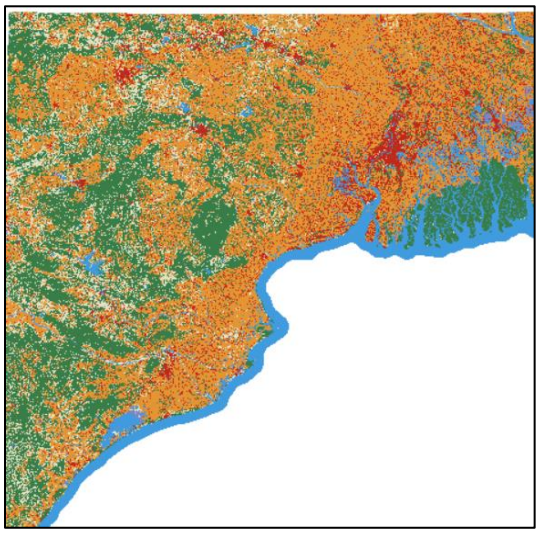


Table:1 Satellite data used for the study

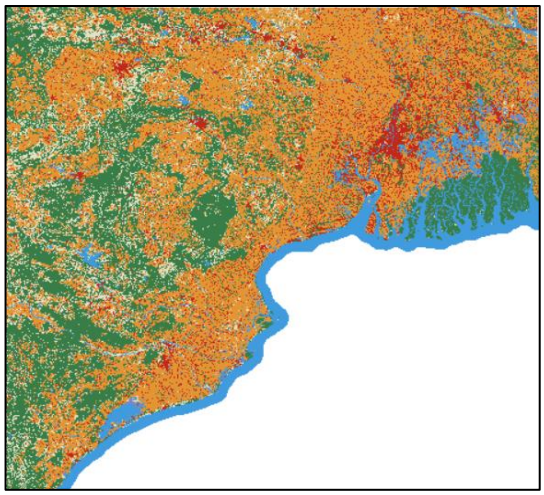
Satellite/ Sensor	Band	Year of Acquisition	Spatial Resolution
Sentinel 2	7 Band	2018	10 m
Sentinel 2	7 Band	2021	10 m
Sentinel 2	7 Band	2023	10 m

Land Cover of 2018 January



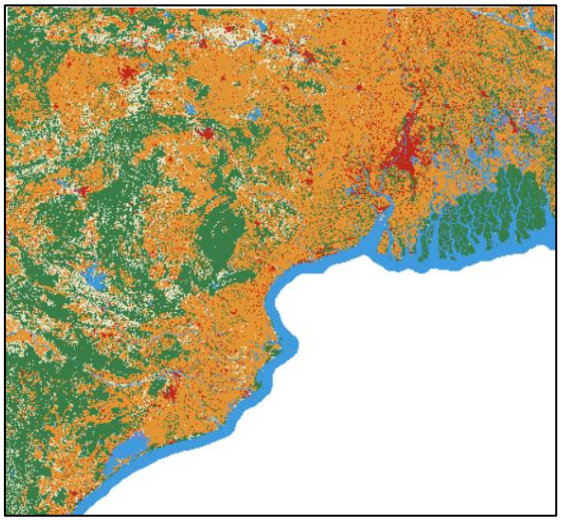
Variable mapped: Land use/land cover in 2000 January
Data Projection: Universal Transverse Mercator (UTM)
Extent: Global
Source imagery: Sentinel-2
Cell Size: 10m (0.00008983152098239751 degrees)
Type: Thematic
Source: Esri Inc.

Land Cover of 2021 January



Variable mapped: Land use/land cover in 2010 January **Data Projection:** Universal Transverse Mercator (UTM)
Mosaic Projection: WGS84
Extent: Global
Source imagery: Sentinel-2
Cell Size: 10m (0.00008983152098239751 degrees)
Type: Thematic
Source: Esri Inc.

Land Cover of 2023 January



Variable mapped: Land use/land cover 2020 January
Data Projection: Universal Transverse Mercator (UTM)
Extent: Global
Source imagery: Sentinel-2
Cell Size: 10m (0.00008983152098239751 degrees)
Type: Thematic
Source: Esri Inc.

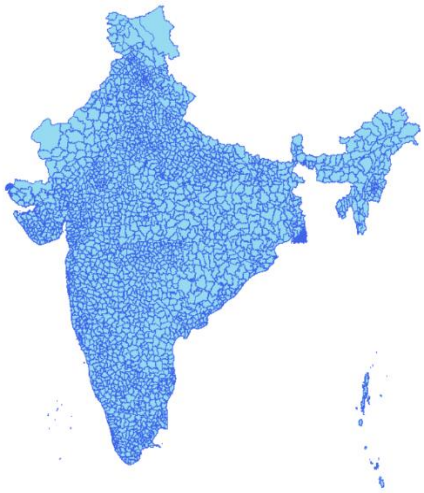
4.4 Subset and feature extraction in image:

State Boundary Of India Shape File

Odisha is surrounded by the states of West Bengal to the northeast, Jharkhand to the north, Chhattisgarh to the west, and Andhra Pradesh to the south. The state's boundaries are not just geographical demarcations; they represent historical, cultural, and administrative divisions that have shaped the socio-economic dynamics of the region. The boundaries also encapsulate a

multitude of ethnicities, languages, and traditions, reflecting the rich tapestry of Odisha's cultural mosaic.

Within Odisha, the districts further delineate administrative divisions. Each district possesses its own distinct identity, shaped by local cultures, historical significance, and unique geographical features. From the coastal districts of Puri and Ganjam to the mineral-rich Keonjhar and Sundargarh in the interior, the districts contribute to the state's overall socio-economic tapestry. The district boundaries encapsulate not just administrative units but also serve as a reflection of the state's socio-cultural and economic diversity.



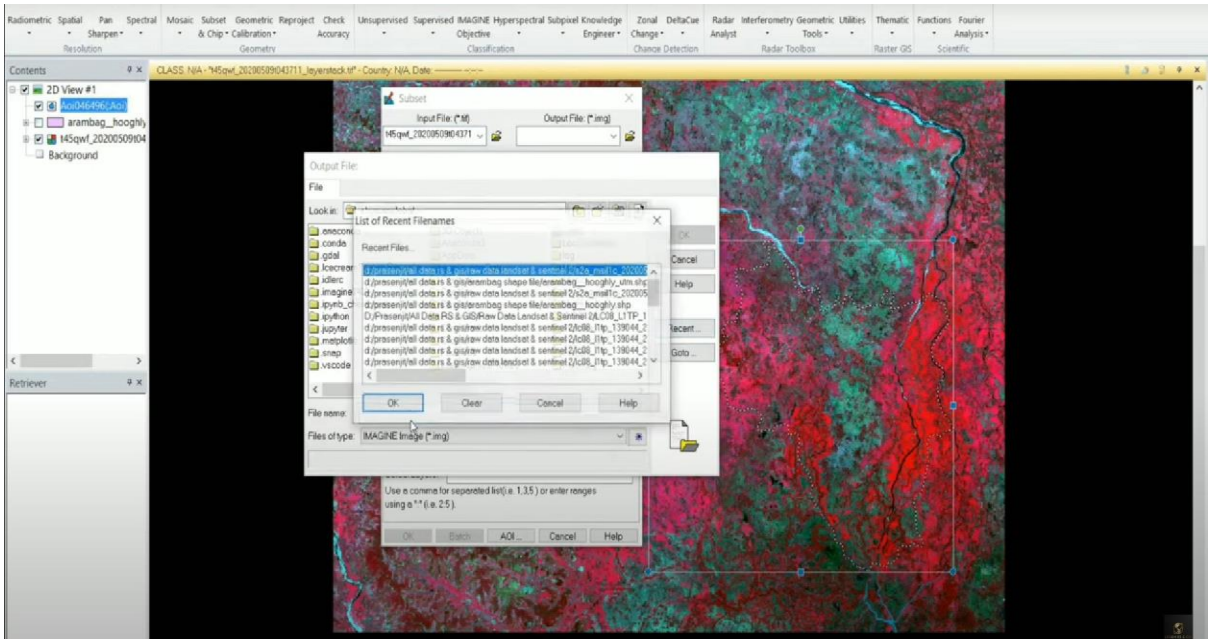
State Boundary Of India District Shape File

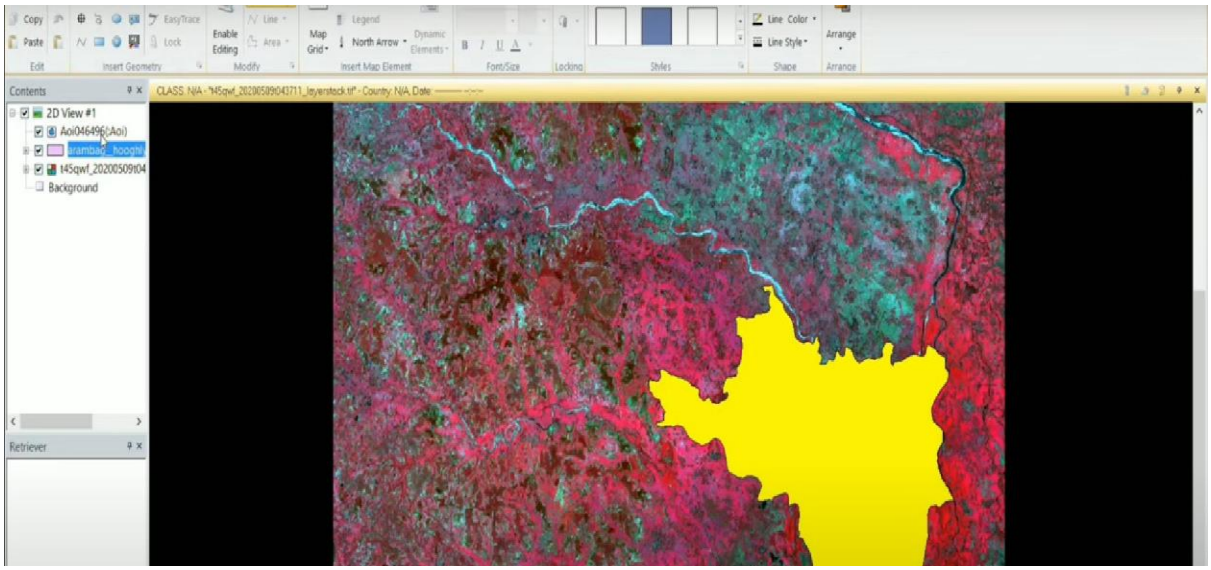
State Boundary Of Dhenkanala District Shape File

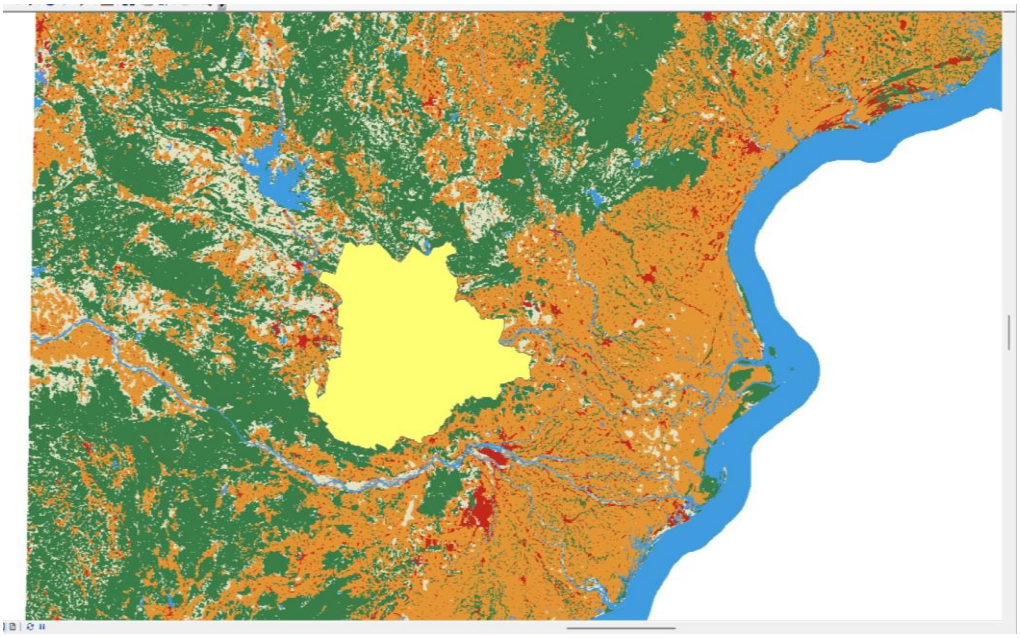
Dhenkanal, a district located in the state of Odisha, India, is a region steeped in history, cultural heritage, and natural beauty. Nestled amidst the Eastern Ghats and characterized by lush greenery, Dhenkanal is known for its serene landscapes, historical sites, and vibrant traditions.

The district is named after the town of Dhenkanal, which serves as its headquarters. Dhenkanal town is recognized for its historical significance and is home to notable landmarks such as the Dhenkanal Palace. The palace, showcasing a blend of Odishan and Rajput architectural styles, stands as a testimony to the region's royal legacy. The town is also known for its rich handicrafts, including the intricate art of brass and bell metal work.

The geographical features of Dhenkanal encompass plains, hills, and forests, contributing to the district's diverse ecosystem. The district is traversed by rivers like Brahmani, Mahanadi, and their tributaries, adding to the fertility of the land. Agriculture is a vital aspect of the local economy, with the cultivation of rice, pulses, and oilseeds being predominant.







Subsetting the image

4.5 Classification

We have classified the images into different labels and here is the Class definitions

1. Water

Areas where water was predominantly present throughout the year; may not cover areas with sporadic or ephemeral water; contains little to no sparse vegetation, no rock outcrop nor built up features like docks; examples: rivers, ponds, lakes, oceans, flooded salt plains.

2. Trees

Any significant clustering of tall (~15 feet or higher) dense vegetation, typically with a closed or dense canopy; examples: wooded vegetation, clusters of dense tall vegetation within savannas, plantations, swamp or mangroves (dense/tall vegetation with ephemeral water or canopy too thick to detect water underneath).

4. Flooded vegetation

Areas of any type of vegetation with obvious intermixing of water throughout a majority of the year; seasonally flooded area that is a mix of grass/shrub/trees/bare ground; examples: flooded mangroves, emergent vegetation, rice paddies and other heavily irrigated and inundated agriculture**.**

5. Crops

Human planted/plotted cereals, grasses, and crops not at tree height; examples: corn, wheat, soy, fallow plots of structured land.

6. Built Area

Human made structures; major road and rail networks; large homogenous impervious surfaces including parking structures, office buildings and residential housing; examples: houses, dense villages / towns / cities, paved roads, asphalt.

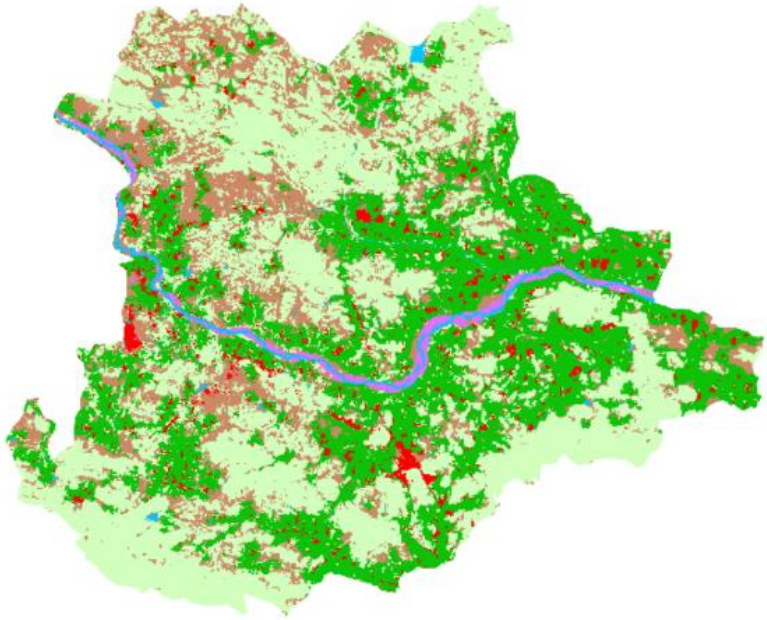
7. Bare ground

Areas of rock or soil with very sparse to no vegetation for the entire year; large areas of sand and deserts with no to little vegetation; examples: exposed rock or soil, desert and sand dunes, dry salt flats/pans, dried lake beds, mines.

8. Rangeland

Open areas covered in homogenous grasses with little to no taller vegetation; wild cereals and grasses with no obvious human plotting (i.e., not a plotted field); examples: natural meadows and fields with sparse to no tree cover, open savanna with few to no trees, parks/golf courses/lawns, pastures. Mix of small clusters of plants or single plants dispersed on a landscape that shows exposed soil or rock; scrub-filled clearings within dense forests that are clearly not taller than trees; examples: moderate to sparse cover of bushes, shrubs and tufts of grass, savannas with very sparse grasses, trees or other plants.

Classified Land Cover of 2018 January



Raster Information:

Columns and Rows: 64218, 88853

Number of Bands: 1

Cell Size (X, Y): 10, 10

Uncompressed Size: 5.31 GB

Format: FGDBR

NoData Value: (Not specified)

Colormap: Absent

Pyramids: Absent

Source Type: Generic

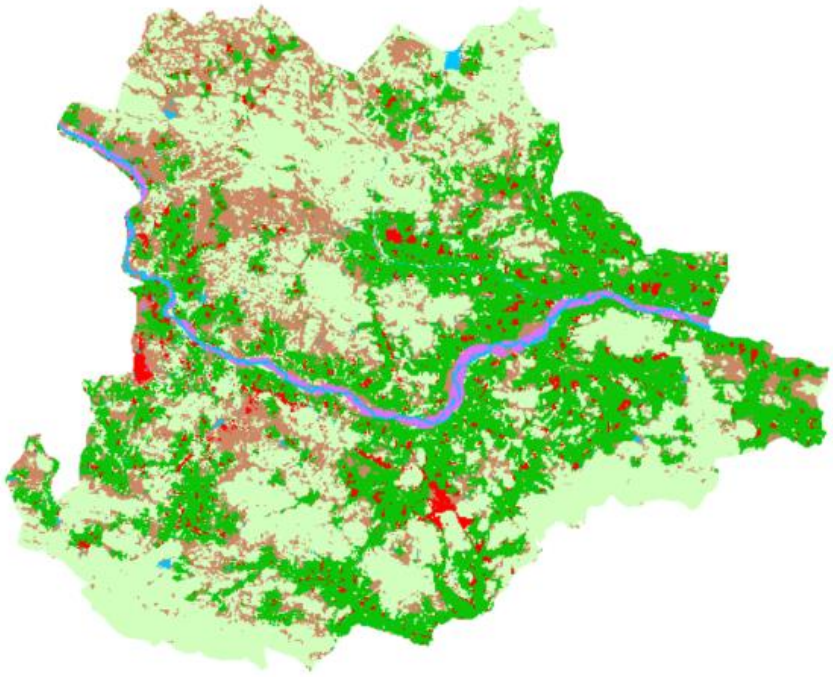
Pixel Type: Unsigned Integer

Pixel Depth: 8 Bit

Compression: LZ77

Mensuration Capabilities: Basic

Classified Land Cover of 2021 January



Raster Information:

Columns and Rows: 64218, 88853

Number of Bands: 1

Cell Size (X, Y): 10, 10

Uncompressed Size: 5.31 GB

NoData Value: (Not specified)

Colormap: Abs

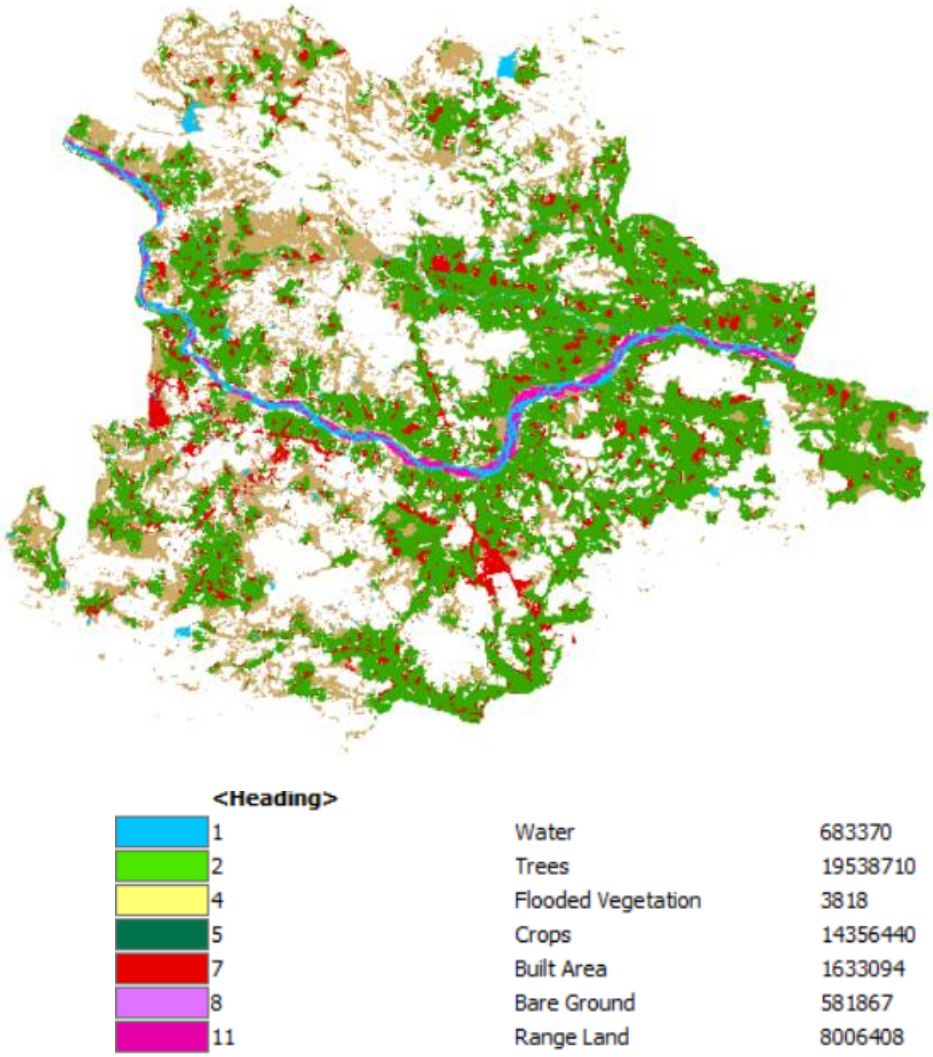
Format: FGDBR

Source Type: Generic

Pixel Type: Unsigned Integer

Pixel Depth: 8 Bit

Classified Land Cover of 2023 January



Raster Information:

Columns and Rows: 64218, 88853

Number of Bands: 1

Cell Size (X, Y): 10, 10

Pixel Depth: 8 Bit

NoData Value: (Not specified)

Colormap: Absen

Uncompressed Size: 5.31 GB

Format: FGDBR

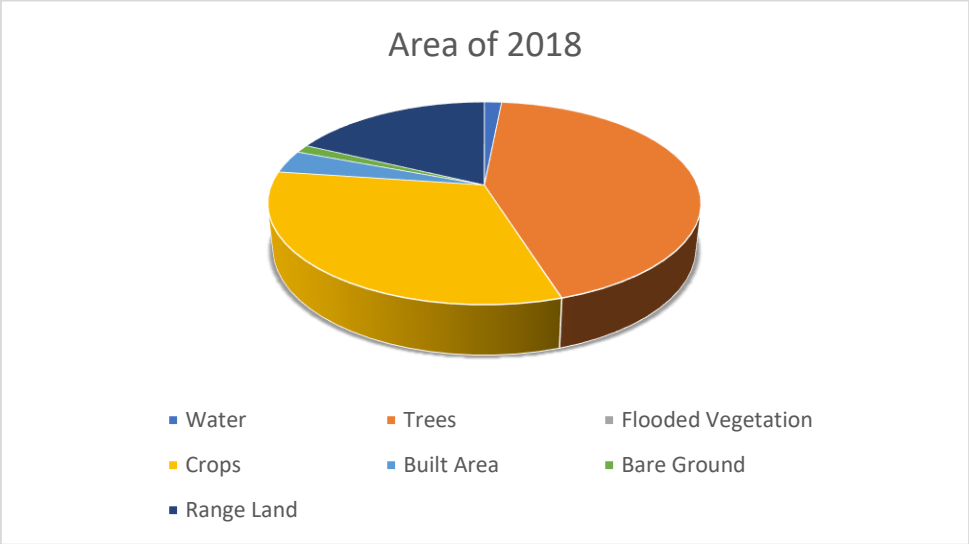
Source Type: Generic

Pixel Type: Unsigned Integer

CHAPTER - 5

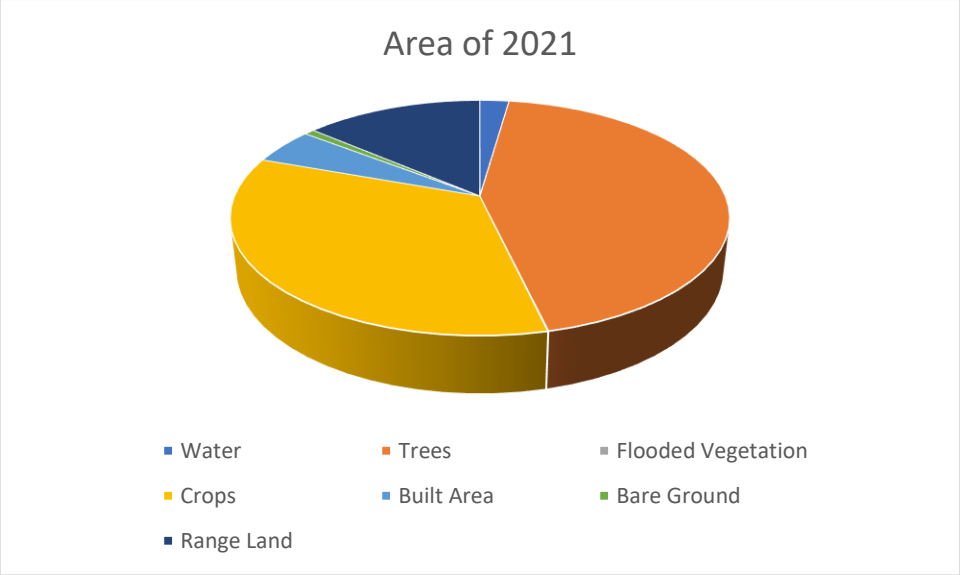
RESULT AND DISCUSSION

5.1 Classification Outcomes:

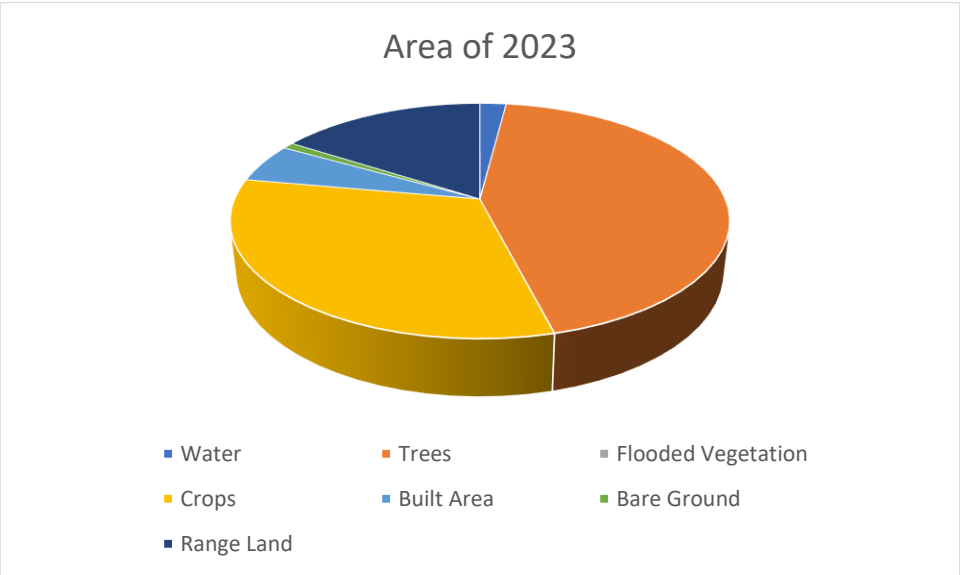


In 2018, the landscape exhibited a diverse mix of land use and cover. The region was characterized by extensive tree coverage, substantial agricultural activity with crops covering a significant portion, and vast range lands. Water bodies, built-up areas, and bare ground were also present, reflecting a harmonious blend of natural and anthropogenic features. This snapshot of 2018 indicated a balanced distribution across various land use categories.

Water: 683,370	Water: 1,007,627	Water: 908,437
Trees: 19,538,710	Trees: 19,747,260	Trees: 19,694,334
Flooded Vegetation: 3,818	Flooded Vegetation: 11,660	Flooded Vegetation: 3,457
Crops: 14,356,440	Crops: 15,298,894	Crops: 14,255,694
Built Area: 1,633,094	Built Area: 2,223,373	Built Area: 2,410,283
Bare Ground: 581,867	Bare Ground: 351,510	Bare Ground: 388,186



Fast forward to 2021, and notable changes in land use and cover patterns become apparent. Water bodies showed a marked increase, suggesting potential alterations in hydrological patterns. The area dedicated to crops expanded, reflecting advancements in agriculture, while the built-up environment also grew, indicating urbanization. Additionally, flooded vegetation exhibited a considerable rise, possibly influenced by changes in precipitation and ecological dynamics. These shifts underscore the dynamic nature of the landscape over the three-year period.

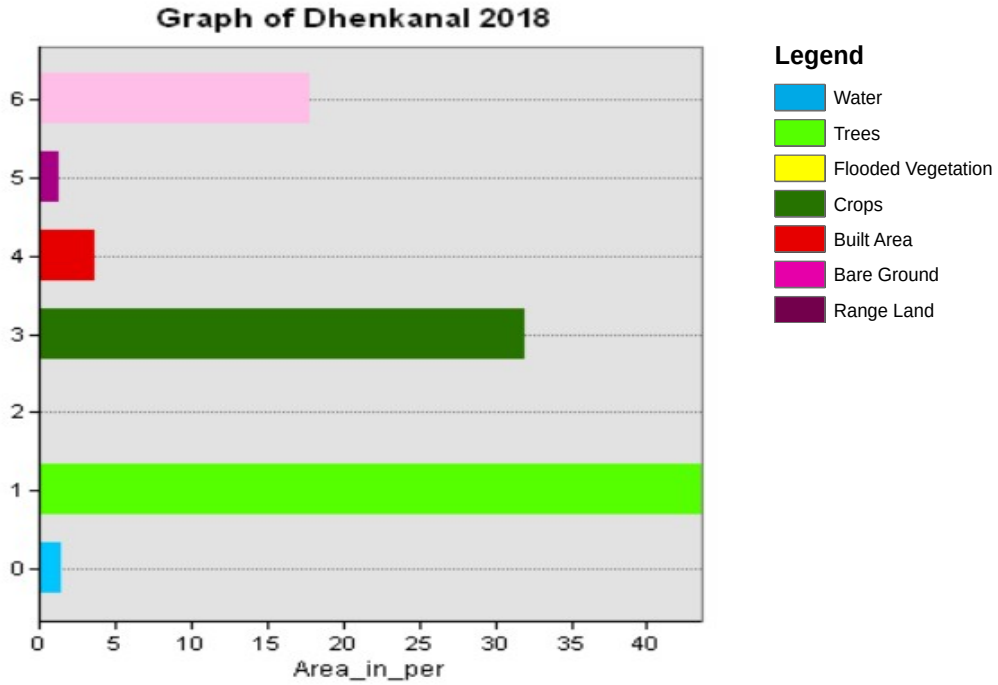


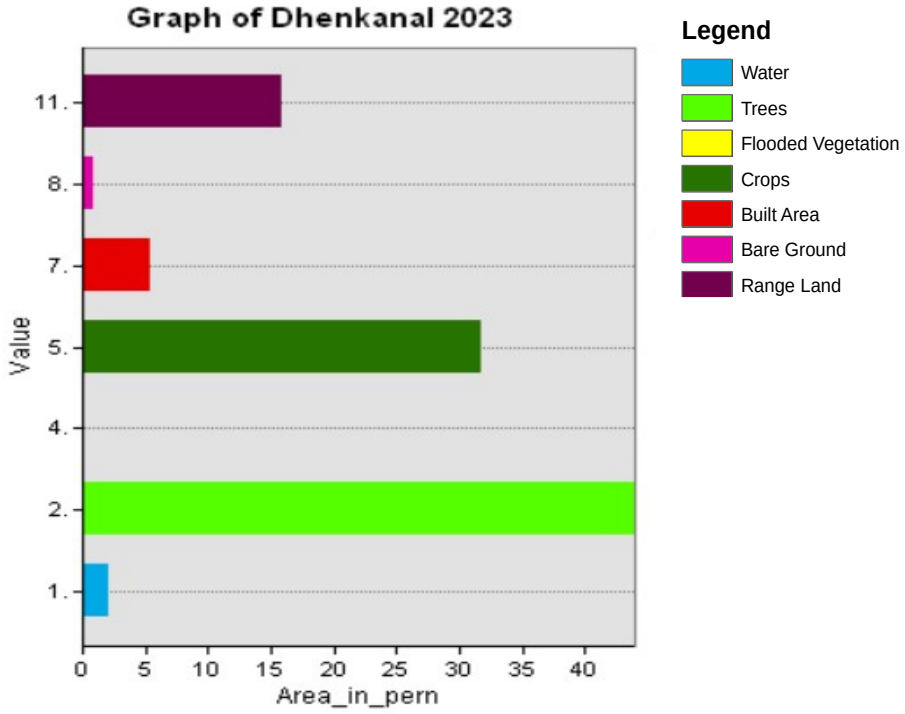
By 2023, further changes were observed in the land use and cover characteristics. Water bodies experienced a decrease, indicating potential fluctuations in the region's hydrology. The area

covered by crops reduced slightly, suggesting shifts in agricultural practices. Built areas continued to expand, indicating ongoing urban development. The range land exhibited a decline, possibly influenced by land management strategies or environmental changes. These variations in land cover from 2018 to 2023 showcase the evolving nature of the landscape.

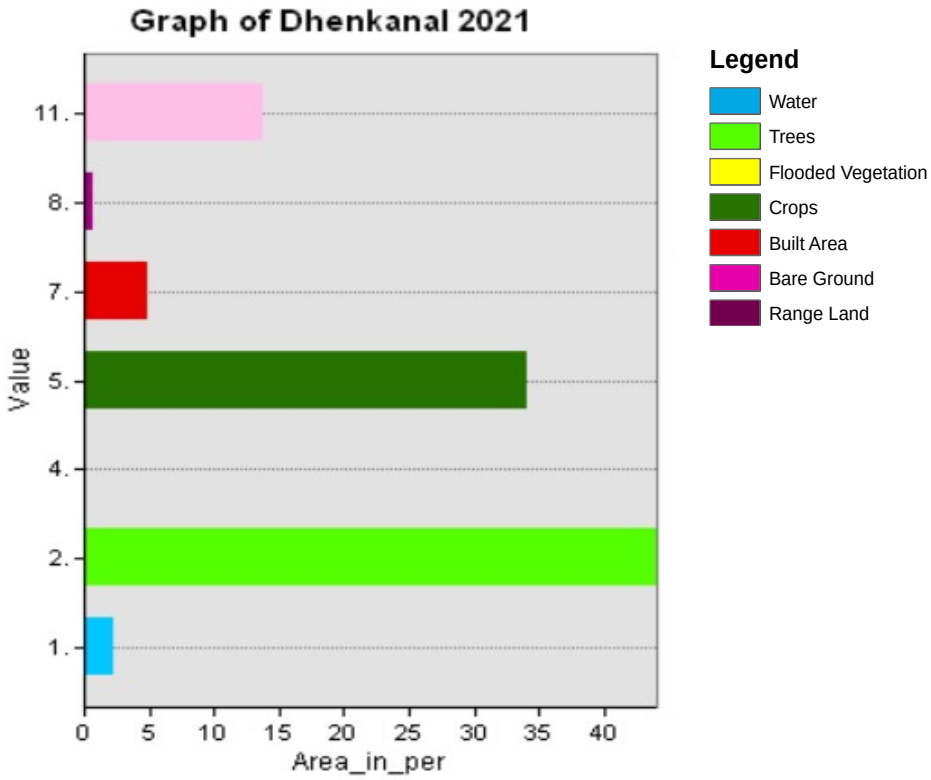
5.3 Area calculation and comparison

Comparing the three years reveals a dynamic landscape with varying patterns in land use and cover. The increase in water bodies in 2021 may be attributed to climatic factors, while the subsequent decrease in 2023 might result from natural fluctuations. Agricultural practices seem to play a significant role, with changes in the extent of crops over the years. Urbanization appears to be a consistent trend, evident from the growth in built-up areas. The shifts in flooded vegetation and range land highlight the sensitivity of these ecosystems to environmental dynamics. Overall, this comparison underscores the intricate interplay between human activities and natural processes, shaping the land use dynamics of the region.





In this year, the area was predominantly covered by trees, crops, and range land. Water bodies, built areas, and bare ground were also present, indicating a mix of natural and anthropogenic features.



Water Bodies:

2018: 683,370

2021: 1,007,627

2023: 908,437

The water bodies showed an increase from 2018 to 2021, possibly indicating changes in precipitation or hydrological patterns. However, there was a subsequent decrease in 2023, suggesting dynamic fluctuations in water resources.

Trees:

2018: 19,538,710

2021: 19,747,260

2023: 19,694,334

The tree coverage remained relatively stable throughout the three years, indicating the resilience of the natural ecosystem despite other land use changes.

Flooded Vegetation:

2018: 3,818

2021: 11,660

2023: 3,457

Flooded vegetation exhibited variations, with a notable increase in 2021, possibly influenced by changes in precipitation or ecological dynamics. The subsequent decrease in 2023 suggests a return to previous levels.

Crops:

2018: 14,356,440

2021: 15,298,894

2023: 14,255,694

The agricultural landscape witnessed changes, with an increase in crop coverage from 2018 to 2021 and a subsequent decrease in 2023. These shifts may reflect changes in agricultural practices or land management.

Built Areas:

2018: 1,633,094

2021: 2,223,373

2023: 2,410,283

Built areas consistently expanded over the years, indicating ongoing urbanization and infrastructure development.

Bare Ground:

2018: 581,867

2021: 351,510

2023: 388,186

Bare ground exhibited variations, possibly influenced by land management practices, natural processes, or changes in land cover dynamics.

Range Land:

2018: 8,006,408

2021: 6,163,383

2023: 7,143,316

Range land showed fluctuations, possibly influenced by land management practices, grazing activities, or ecological changes.

Overall Comparison:

The years 2018, 2021, and 2023 showcase a dynamic landscape with notable changes in water bodies, crops, built areas, and other land use categories. These variations may result from a complex interplay of climatic, agricultural, and urbanization factors. Understanding these changes requires a comprehensive study integrating ecological, environmental, and human-related factors.

CONCLUSION

The culmination of the "Satellite Image Classification and Land Cover Analysis of Dhenkanal District" project represents a significant stride in harnessing remote sensing and geospatial technologies for comprehensive regional assessment. Through the adept application of advanced image classification techniques on Sentinel satellite imagery, the project successfully delineated and categorized diverse land cover types within the Dhenkanal district. The derived land cover maps not only offer a precise depiction of the district's spatial landscape but also unveil patterns of temporal changes in land use. The project's findings are poised to be pivotal in facilitating informed decision-making for local authorities, policymakers, and stakeholders involved in land management, urban planning, and environmental conservation. Rigorous accuracy assessments, including ground truth validation.

This paper presents the result of Dhenkanal urban region for over 3 years(2000-2020). In this research , The results clearly indicated the decrease in number of vegetation image pixels and water image pixels with the increase in number of urban pixels. The year 2016 had a large number of water regions in comparison with 2020. As urban regions is growing and it has affected the natural resources like water and vegetation. The influence and impact of human settlements on the environment can be seen and justified.

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ASSESSMENT

Internal:

SL NO	RUBRICS	FULL MARK	MARKS OBTAINED	REMARKS
1	Understanding the relevance, scope and dimension of the project	10		
2	Methodology	10		
3	Quality of Analysis and Results	10		
4	Interpretations and Conclusions	10		
5	Report	10		
	Total	**50**		

Date: **Signature of the Faculty**

COURSE OUTCOME (COs) ATTAINMENT

- **Expected Course Outcomes (COs):**

(Refer to COs Statement in the Syllabus)

- **Course Outcome Attained:**

How would we rate our learning of the subject based on the specified COs?

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

1 2 3 4 5 6 7 8 9 10

LOW HIGH

- **Learning Gap (if any):**

- **Books / Manuals Referred:**

Date: **Signature of the Student**

- **Suggestions / Recommendations:**

(By the Course Faculty)

Date: **Signature of the Faculty**