A GIS Project Report

On

"Land Use Land Cover Pattern in Charkhi Dadri "

Submitted for the partial fulfilment of requirement of Master of Science in Geography

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2021-2023

Certificate from Student

This is to certify that the GIS Project Report entitled *" Land Use Land Cover (LULC)Pattern in Charkhi Dadri "* submitted to the Department of Geography, GCW, Badhra in partial fulfillment of the course **GIS Project Report (19-GEO-411)**for the award of the degree of **M.Sc. Geography**, is a record of bonafide work carried out by me. No part of this report has been submitted elsewhere for award of any other degree.

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Certificate from Supervisor

This is to certify that the GIS Project Report entitled "**Land Use Land Cover (LULC) Pattern in Charkhi Dadri**" submitted to the Department of Geography, GCW, Badhra, in partial fulfillment of the course **GIS Project Report (19-GEO-411)**for the award of the degree of **M.Sc. Geography**, is a record of bonafide work carried out under my supervision and guidance.

All help received by him/her from various sources have been duly acknowledged.
No part of this report has been submitted elsewhere for award of any other degree.

Rinku

Signature

Dated: 27.05.2023

Acknowledgement

There is always a sense of gratitude which one expressed to other for the helpful and needy service, they render during all phases of life. We would like to do it as we really wish to express my gratitude towards all those who have been helpful to me in getting this mighty task of project completed to successful end.

We also expressed my sincere thanks to Ms. Rinku, GCW, Badhra, for suggesting me to purpose and finally completed my project.

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Land Use Land Cover(LULC) Pattern in Charkhi Dadri

ABSTRACT:-

Land is one of the major natural resources. Land use land cover are related to the man made and natural features. Land cover refers to the natural component for example; mountain, rocks, forest, vegetation, rivers. Land use refers to the man-made activities for example: school, college, park, building etc.The main objective of the report to identify various LULC patterns of Charkhi Dadri district. Remote sensing and GIS technique have been used in this study. Classification technique was used for the classification of LULC pattern.

Key Words: LULC, Remote Sensing, LULC Classification.

CHAPTER 1

1 Introduction:

Land use -Land use is the term used to describe the human use of land. It represents the economic and cultural activities (e.g. agricultural, residential, industrial , mining and recreational uses) that are practiced at a given place . It is the function or functions that human apply to the land available to them. It involves the management and modification of natural environment such as settlements and semi - natural habitats such as arable fields, pastures and managed woods. The study of land use is the study of how the land is managed, including how the natural world is adapted to human needs. Land use shows how people used the landscape whether for development , conservation or mixed land uses.

Land cover - Land cover is the physical material at the surface of the earth . It includes trees, bare ground , water etc. Land cover can be determined by analysing satellite and aerial imagery but land use can not be determined from satellite imagery. Land cover represent spatial information on different types (classes) of physical coverage of the Earth's surface, e.g. forests, grasslands, croplands, lakes, wetlands. Dynamic land cover include transitions of land cover classes over time and hence captures land cover changes.

Types of land use – The types of land use are as follows –

- Agricultural land – Agricultural land, which is used for growing crops and rearing animals.
- Commercial – Land that is set aside for commercial activities. This include any land use that is used for buying, selling, trading goods and services.
- Industrial – Land that is used for industries. Some examples factories, warehouses, power plants.
- Residential – Residential land is used for housing.
- Transportation – Transport land is used for roads, railways, subways or airports.
- Institutional – Land that is occupied by school, hospitals, govt. Offices.

Types of land cover – The types of land cover are as follow –

- Forest
- Grassland

- Wetlands
- Barren land
- Perennial snow or ice.

Why land cover changes into land use – land cover changes into land use due to –

- Urbanization
- Industrialization
- Coastal zone degradation
- Deforestation
- Dam building
- Road construction

Why do we need LULC –LULC is very important for us to understand the topology of the surface. It helps us in planning, management and monitoring programmes at local, regional and national level. This provides a better understanding of land utilization aspects. It plays an important role in the formation of polices and programme required for development planning.

1.1 Land use land cover change:

Land use types and is result of complex interaction between human and the physical environment. LULCC is a major driver of global change and has a significant impact of ecosystem processes, biological cycles and biodiversity.

1.2 Land use and land cover pattern:

The land use pattern shows how the land is used for various purpose the development of housing / commercial / industrial areas. There are widely 10 use pattern – radiocentric (a large circle with development starting from centre), rectilinear (2 areas crossing centre), star (open spaces in star shape), ring (areas in circle with open space in centre), linear (along topography contours), branches (with connection areas), sheet (spread out), articulated sheet (central and sub clusters), constellation (equal size areas nearby) and satellite (constellation around main area).

CHAPTER 2

Literature Review:

Falcucci , Maiorano , Boitani - Alessandra Falcucci , Luigi Maiorano and Luigi Boitani (2006) studied about the changes in land use land cover pattern in Italy and their implications for biodiversity conservation. They use three land use land cover maps covering the Italy and spinning the time frame 1960 - 2000. The Italian institute of statistical provided data on the human population for the period 1960 - 2000. Thus , an increasing conservation effort should be made to protect the Mediterranean type forests and scrublands as well as traditional agricultural practices.

Basawarja, Chari, Mise and chetti - R. Basawarja , K B Chari , S R Mise , S B, Chetti (2011) studied about the impact of urban sprawl in altering the land use, land cover pattern of Raichur city. Urban sprawl has been criticized for eliminating agricultural lands, spoiling water quality and causing air pollution. For studying the temporal changes in land use and land cover pattern of Raichur city, a survey of India toposheets and satellite imagery was acquired from different periods of time. Land use and land cover pattern during the year 2009 indicates agriculture as the major land use type.Thus, the raichur city is under imminent threat from the rapid urbanization. The increasing urbanization would increase the deamnd of ground water which in turn would further impact the agriculture. Thus , it is imperative to formulate appropriate measures to check the haphazard growth of urbanization.

Adefioye, Sunday and Adewumi (2013) studied about the analysis of land use / Land cover pattern along the River Benue Channel in Adamawa State, Nigeria. Uncontrolled human activities has led to the significant modifications of the natural biodiversity of the world . Consequently , land use and land cover are changed abruptly without adequate consideration for future developments. The data used for this study is the Enhanced Thematic Mapper , landsat image of Adamawa State , Shuttle Radar Topographic Mission Image of Upper Benue Catchment Areas, Catchment map of Nigeria and political map of Adamawa State. Food shortage , desertfication , Shortage of water , increase in temperature are the implications of the land use / land cover change in Adamawa State. Thus, there is a need to balance between human development , land use planning and water resource management to ensure a sustainable development. If the current trends of the unplanned development continues , the adverse effects would be greater than the intending benefits of the development.

Landuse patterns (LULC) have a significant impact on the quality of water resources. Urbanization and waste coal mines have a significant impact on the grade of mineralisation represented by high concentrations of major ions and total dissolved solids, compared to agricultural, forests, and wetlands. However, the water resources affected by urbanization are of good quality considering the presence of nitrates and unwanted metals, and the water resources affected.

Abdullah, Masrur, Adnan , Baky, Hussan and Dewan(2016) studies a detailed analysis of Land Use land cover changes (LULC) is essential for a better understanding of the interaction in the coastal areas of Bangladesh, but remain important for the accurate classification of coastal LULC. It shows that the XGBoost features selection approach effectively addresses the problem of landscape in homogeneity. The multi- period LULC map of the spectrum shows a net increases in agricultural land (5.44%) and the urban areas (4.9%) in the coastal areas of Bangladesh. This work also provide methodological insight useful for spatial and spectral complexity of remote sensing data used to classify LULC in non - uniform landscape increase. This study used landset data and advanced features selection and classification technique (XGBoost and Random forest) to provide a detailed Assessment of multi- temporal LULC change in the coastal areas of Bangladesh.

Parsa, Yaveri and Nejadi (2016) studied about the spatial temporal analysis of land use /land cover pattern changes in Arasbaran Biosphere Reserve of Iran. The land use and cover spatial temporal changes in the Arasbaran Biosphere Reserve were classified (as agriculture, forest and barren /Range Lands) and compared with future spatial pattern (using the CA - Markov model) to evaluate quantitative and qualitative changes of this BR LULC over time. Remotely sensed data have been widely used to obtain geo referred data and maps for evaluation and monitoring of LULC. In data pre processing , Geometric corrections , Image enhancement was done. The results demonstrate the priority need for more severe regulations regarding protection of the Biosphere Reserve against LUCCs and for its valuable core forest LULC in particular.

Parsa , Salehi - Vahid Amini Parsa and Esmail Salehi (2016) studied about the analysis and simulation pattern of land use/ land cover change in Naghadeh , Iran . The monitoring of LUCCs within a certain time period and predicting future trends of temporal and spatial pattern are absolutely necessary. RS images of Landsat satellites are used to investigate the long term land use changes . In order to predict the LULC pattern of the study area,

integration of the Markov chain and cellular automata model was used. Land use changes modelling provides accurate prediction regarding the amount, composition , state of the changes which can be used as a early warning system for proper planning and decision making. This research highlights the significance of LULC monitoring using RS data , technology and C A Markov model. The ability of prediction and simulation of Markov model shows that such king of prediction can help to manage urban growth and land use system in study area.

Bathis and Ahmed's research work (2019) demonstrate the effectiveness of the normalised difference vegitation index, normalised difference built up index and normalised difference water index image to map the LULC classes in the Doddahala watershed. Multi spectral images from the lands are satellite series for the year 1994 -1995, 2000 -2001 and 2014-15 for all the major seasons are processed to evaluating the LULC changes in the drought prone and waterscare watershed. Survey of India toposheet and high resolution satellite images from Google Earth are used for the preparation and update the land cover changes. The major changes are seen in the cropland,fallow land, water bodies. The LULC changes water set are mainly due to the variation in annual rainfall and the climatic parameters. Decreased soil fertility tends the croplands to convert as fallow land. The sustainable land and water management practices in the upstream region inhens the LULC classes in the downstream regions.

Kumar, Patley, Tiwari and Gosavi (2019) study about Khangri glacier of Arunachal Pradesh. The study gives the insight of application of snap tool for the estimation of glacier velocity using temporal Senital Synthetic Aperture Radar (SAR) data. This paper discuss the techniques to interpret field based observation over the GIS platforms in easy way. This Study shows that Himalayan glaciers are retreating with few exception where they are advancing of static. i.e- Dudhi koshi retreating at the rate from 10 to 60 m per annum. The study area is Khangri glacier and the latitude between 27° 46' 57" N to 27°48'45" N and longitude -92°21'16" E to 92°23'17"E . Area of i interest is watershed of glacier located in the eastern Himalayan cryosphere near Gori chain mountain,Twang district A.P. Methodology used for this study is through DGPS. Khangri glacier is located at a high height of access around 6300 m, making acces difficult.The field trips on the glacier, On the other hand, offered important inputs for studying the glacier's snout location and water output. It also aids in the validation for of Rs based observations or discoveries. As evidenced by snout

monitoring through field survey for years. 2017.2018 and 2019, as wellas archival high resolution google earth data at 0.5 m for years 2013, 2015,and 2016, the glacier is in an equilibrium condition and has not receded significantly. Though the effect of climate change on the Himalayas cannot be ignored,the current results of the Khangri must be investigated further before any conclusions on the Khangri glacier can be drawn.

Qingjian, Sheng, Zuomin, Minxin and Shelin (2019) studied on Guinzhou province located in Southwestern China, has a unique type of karst terrain that is ecologically vulnerable. The environmental conditions of soil erosion and rock desertification are very serious, and changes in landscape patterns have a significant negative impact. Study area in Guizhou which is located at latitude 24°370-29°130 and longitude 103°360-109°350. It is a transportation hub in Southwestern China and an important part of the Yangtze river economic belt. The total area of Guizhou is 176,167 square kilometer which is 1.8% of the total area of the country. In last areas the mechanism of correlation and interaction between escaped patrons changes and social economic languages and landscape patterns changes should be investigated from 2000 to 2017. (1)The area of cultivatable land and grasslands has always decreased. (2) urban and rudal areas have been replaced by two grand types-forest and water. (3) Overall The degree of landscape aggregation and proximity has decreased and landscape in homogeneity has increased.

Wang, Hou, Murayama , Derdouri (2020) studied about the Spatiotemporal analysis of land use and land cover patterns. Their relationship with land surface temperature in Nanjing, China. In this study we take Nanjing in China as the study area we monitored the Spatiotemporal dynamics of land us and land cover. Lst of Nanjing from 2000 to 2018 . Nanjing had experienced rapid urbanization with the cost of a tremendous decrease in the agriculture lands. Existing studies have pointed out that the increase of LST is related to urban growth, especially in developing conutries. The monitoring result shows that during the urbanization and industrialization process, the built up area had been expanding from the central area of the city to the suburban area from 2000 to 2018.

Shen studied on Spatial pattern of landuse and landcover in water supplying area of middle Route, China. Land use and land cover changes (LULC) have serious impact on water resources and especially important for inter basing middle routes in China's north- south water conversion(MRSNWD) project. There are significant differences in LULC patterns between the southern slope of the quinling mountains, the Planes and hills of the hangang

river basin, and the northern slopes of daba mountains. Intensive land use and devasted land occurs mainly in the hangan Oe river basin. On regional scale,therr was no significant effect of slope aspects on the LULC pattern but they are significant differences in LULC structure between the southern slopes of the qunling mountains and the northern slope of the daba mountain.

Nadeu, Oost, Fayes, Vente(2014) -Elisabet Nedeu, Kristofvan Oost, Caroline Boix Fayes & Jorisde Vente studied about the important of land use patterns for erosion induced carbon fluxes in a Mediterranean catchment. We study the effect of LULC patterns on erosion induced lateral carbon fluxes and the net ecosystem carbon balance at the catchment level. In this study annual carbon input from above and below ground vegetation was estimated as a function of the LULC distribution. Four catchments were selection that had more than 20% of the area occupied by agriculture in 1956 of which at least 25% was converted to another LULC in 2008.the study sites are located within the rogativa catchment in Spain has a dry subhumid Mediterranean climate with a mean annual temperature of 13.3°C and 581MM of mean annual rainfall. Currently the landscape represent mixture of evergreen forests and shrublands, pastures, rainfed cereals, walnut plantation and vineyards. The application of the SPFROS carbon model allowed relative importance of different LULC classes on the export of soil organic carbon from hillslopes at the catchment scale and assessing their impact on ecosystem carbon stores.

Pan, Walsh , Bilsbarrow , Frizzelle, Erlien , Baquero (2014) - William Pan , Stephen Walsh , Richard E. Bilsbarrow , Brian G. Frizzelle , Christine M.Erlien & Francis Baquero studied about the farm level models of spatial patterns of land use and land cover dynamics in the Ecuadorian Amazon. In this research variables were integrated that represents socio economic / demographic , biophysical and geographical variables collected and analysed through GPS, household survey , satellite imagery processed for mapping , LULC , statistical models. LULC types at the farm level mapped through remote sensing techniques. This research affirmed the power of longitudinal surveys, the efficacy of a satellite time series and GIS tools, the relevance of pattern metric measures and the value of fixed and random effects models for relating multi - thematic and spatially explicit discriptions of people , place and the environment within a population environment and LULC context. Digital finca boundary files were used in Arcinfo Grid to clip ghr fincas out of the 1986 and 1999 classified TM images.

Alhamed's (2015) main purpose of this study is to identify the impact of land use diversity on the quality of water resources in Southern Bochum, a typical catchment aera of the Ruher region. The study area part of the north western German climate (LANUV 2010). The LULC pattern in this area form lands, forests, wetlands, outcrops and waste coal mines. The urban area is represented by the south and residential areas in the central and western regions.

CHAPTER 3

Research Methodology

3. 1 Objectives of the study:-

The study has following objectives:

- To understand the spatial pattern of LULC pattern in Charkhi Dadri.
- To analyze the spatial variations in LULC pattern in the study area.

3.2 Data Source and Methodology:-

This study is based on secondary data available in the form of satellite images. The required satellite image was downloaded from USGS Earth explorer website. For the present study Landsat 8 data has been used. The QGIS software has been used for the data processing. The unsupervised classification of the image has been done to understand the LULC in the study area. Atmospheric correction was done to remove the errors in the downloaded data.

Table- 1.

Data Source Table

Sr. No.	Satellite	Sensor	Date	Scan/ Image Id	Spatial Resolution
1.	Landsat 8	OLI_ TIRS	07/10 /2020	LC08_L1TP_147040_ 20200928_20201007_ 01_T1	30

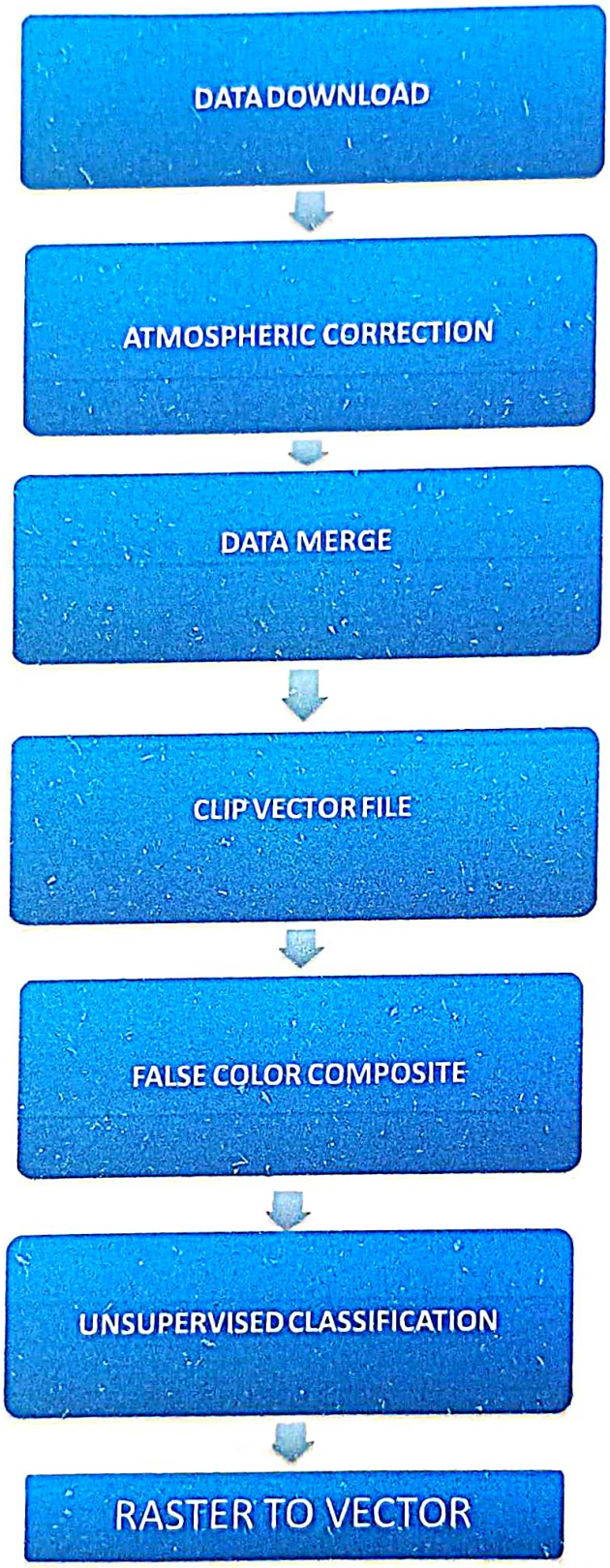
3.3 Unsupervised Classification:

Image classification in the field of remote sensing refers to the assignment of land cover categories (or classes) to image pixels. For instance, land cover data collections and imagery can be classified into urban, agriculture, forest, and other classes for the sake of further analysis and processing. There are two types of image classification – Supervised and unsupervised classification.

Unsupervised Classification is where the outcomes (groupings of pixels with common characterstics) are based on the software analysis an image without the user providing sample classes. The computer uses techniques to determine which pixels are related and groups them into classes. The user can specify which algorism the software will use and the desired number of output classes. However, the user must have knowledge of the area being classified when the groupings of pixels with common characteristics produced by the computer have to be related to actual features on the ground (such as wetlands, developed areas, coniferous forests, etc.). Unsupervised classification normally requires only a minimal amount of initial input from the analyst.

Fig. 1

Methodology adopted:



CHAPTER 4

Study area:

The study has included Charkhi Dadri as study area. Charkhi Dadri District is one of the 22 districts of Haryana state in north west India. The Government of Haryana state officially notified Charkhi Dadri as 22nd district of Haryana on 16th November, 2016. It was created on December 1, 2016. It is about 90 km from the national capital Delhi. District Charkhi Dadri comprises of two sub – divisions (Charkhi Dadri and Badhra) and two tehsils (Charkhi Dadri and Badhra) and one sub- tehsil (Bondkalan). It is located between 28.5921 degree North latitude and 76.2653 degree East longitude respectively. It is located 112.6 km of India capital New Delhi And 295 km of Haryana capital Chandigarh. According to 2011 census, it has a population of 56,337 out of which 29,953 are males and 26,384 are females. Average Sex Ratio of Charkhi Dadri is 881.Literacy rate is 83.7 %. The male literacy rate is 90.33 % and female literacy rate is 76. 2% . It's area is of 1346 square km and density is 370 per square km. The Charkhi Dadri District is divided into 19 wards for which elections are held every 5 years. Total no. of Household in Charkhi Dadri is 11074.

Fig. 2

Location of Study Area

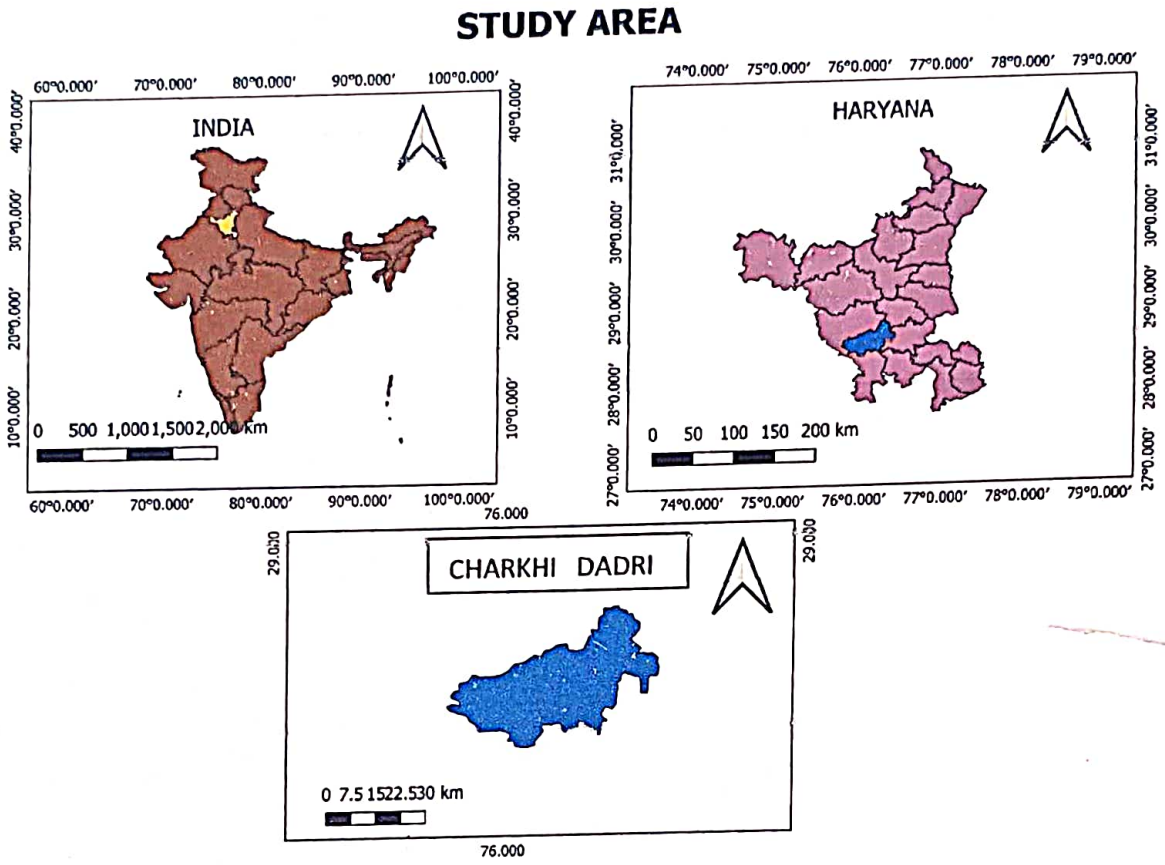
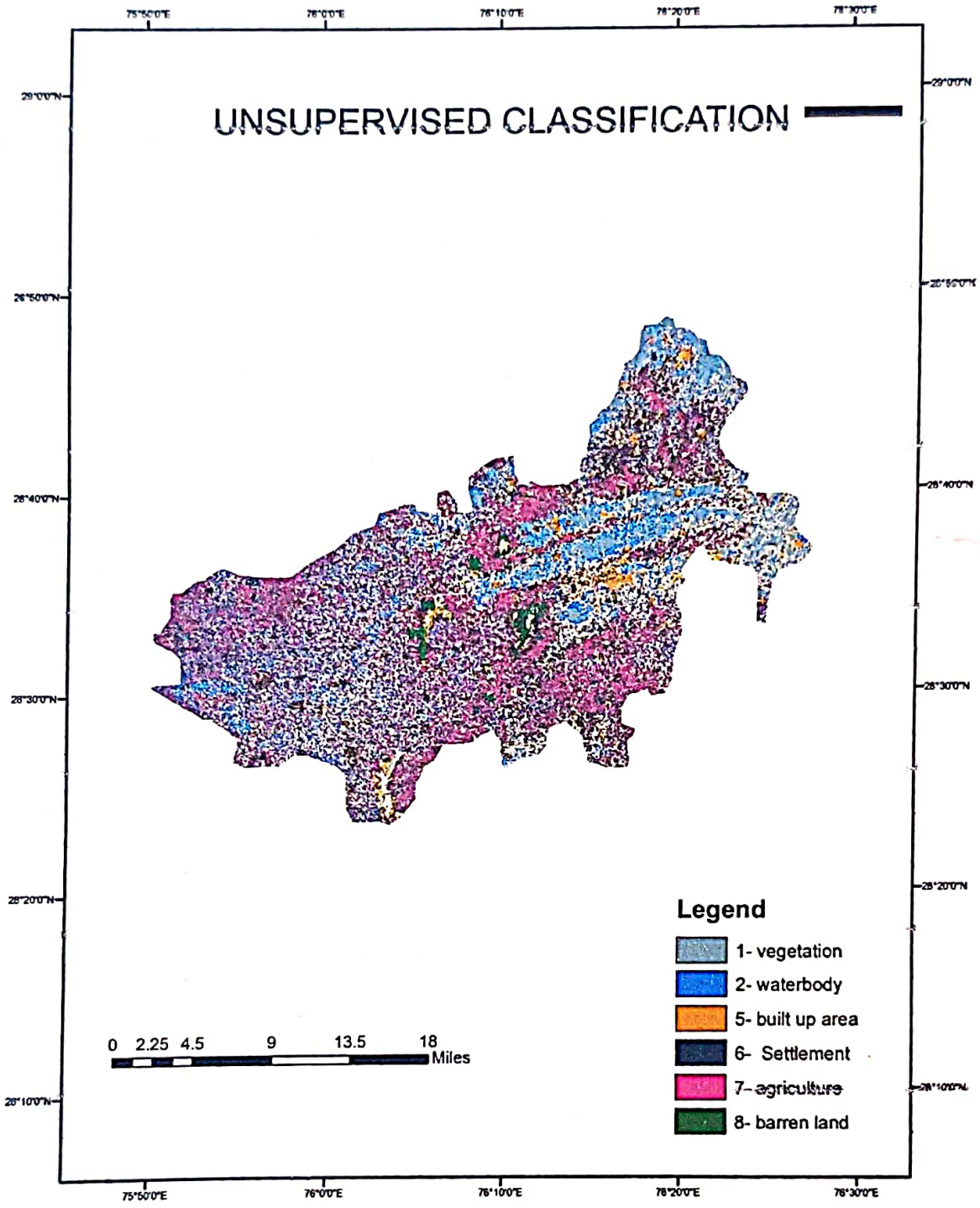


Fig. 3

Land Use Land Cover in Charkhi Dadri



Raster to Vector Conversion

In some studies, it may be necessary to perform vector based analysis on a raster dataset. There are two most common factor of spatial analysis of data. The way of representation of data raster and vector format varies in structure and significance.

Raster data is comprised of evenly sized and spaced cells that represents a continuous surface while vector data is represented in point, line, and polygons that represents discrete entities and location on the earth surface there are tools and software available for the conversion between raster and vector data types .

Table 2

Percentage of LULC

Class	LULC Class	Percentage
1	Vegetation	14
2	Settlement	20
3	Water body	12
4	Agricultural land	20
5	Fallow land	12
6	Barren land	5
7	Built up area	17

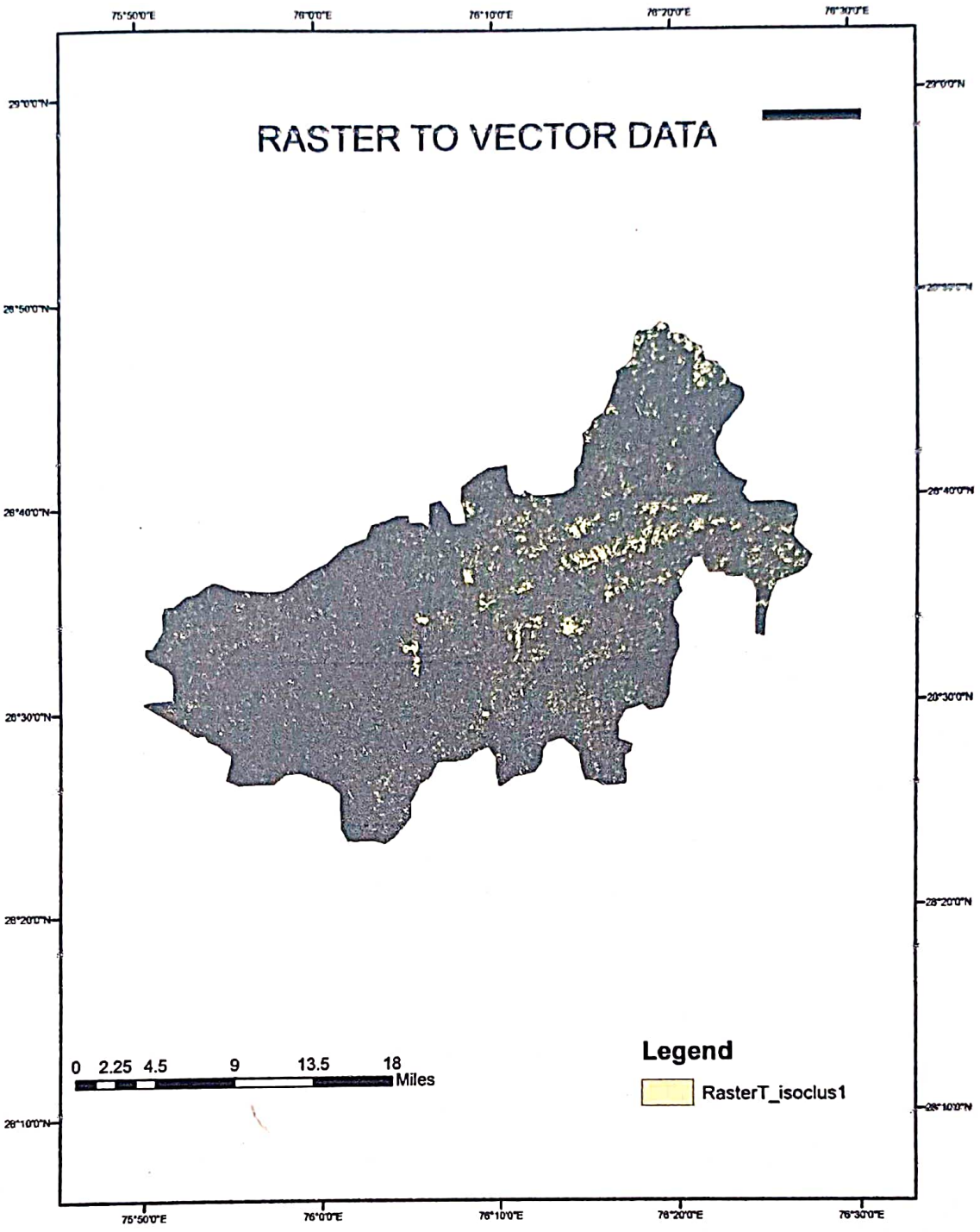

RASTER TO VECTOR DATA
75°50'0"E
76°0'0"E
76°10'0"E
76°20'0"E
76°30'0"E
29°0'0"N
28°50'0"N
28°40'0"N
28°30'0"N
28°20'0"N
28°10'0"N
0 2.25 4.5 9 13.5 18
Miles
Legend
RasterT_isoclus1

Diagram 1

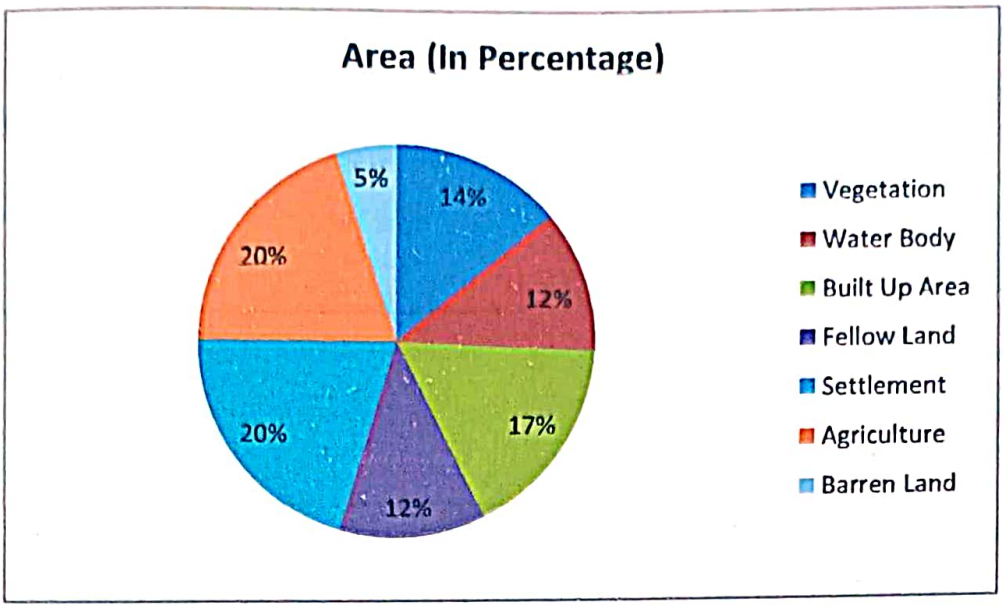
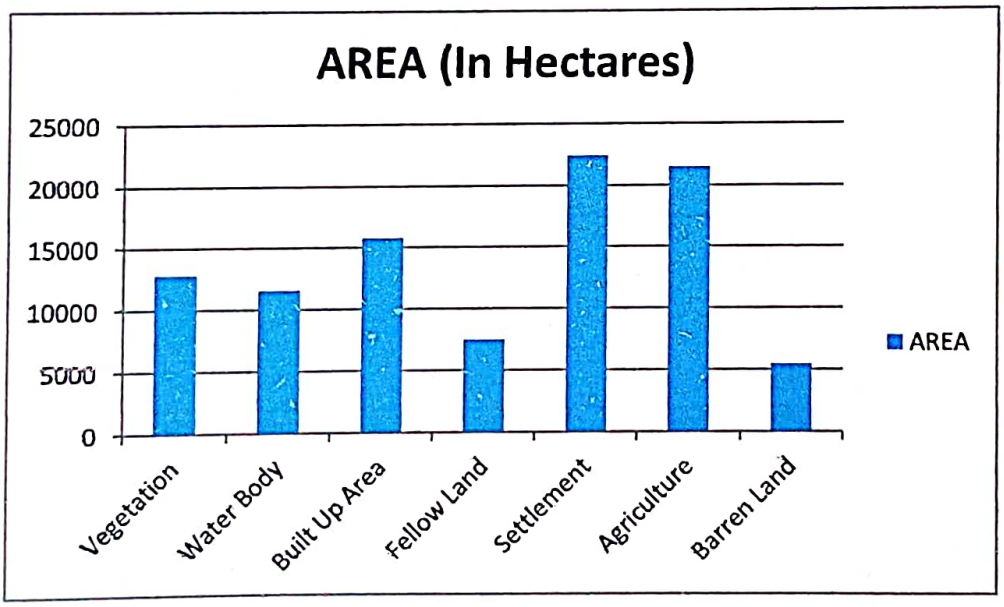


Diagram 2



CHAPTER 5

Discussions and Findings :

In this report, we studied about various LULC patterns of Charkhi Dadri such as vegetation , settlement, water body , agricultural land, fallow land and finds that -

1. **Vegetation**– Vegetation refers to plants in general. It is 14 % of total area.
2. **Settlement** – Settlement refers to a collection of human made structures, put up with the intension of habitation. It is 20 % of total area of Charkhi Dadri.
3. **Build up area** –A built up area is a human settlement with high population density and infrastructure of built environment. It is about 17 % of the total area of Charkhi Dadri.
4. **Agricultural land** – Agricultural land includes crops, plantation, aquaculture etc. It is 20 % of the total area.
5. **Fallow land** – Fallow land is a piece of land that is normally used for farming but that is left with no crops on it for a season in order to let it recover its fertility. It is 12 % of the total area.
6. **Water body** – Water body includes ponds, lakes etc. It is 12 % of the total area.
7. **Barren land** – Barren land includes deserts, dry salt flats, beaches, sand dunes etc. It is about 5 % of the total area.

CHAPTER 6

Conclusion:

Remote sensing and GIS are widely used techniques for the analysis of land use land cover pattern. LULC is important for classifying human activities and natural elements. Land is limited but with rapid urbanisation, industrialisation, rapid population growth, land cover is quickly changing into land use. LULC of an area provides information to help users to understand the current landscape. In this report, we studied about LULC classification of Charkhi Dadri district. We studied about LULC patterns such as vegetation, water body, settlement, agricultural land and fallow land. Vegetation is 14 % and barren land is 5% of total area of Charkhi Dadri. Settlement is 20 %, water body is 12% and build up area is 17 % of total area of Charkhi Dadri. Agricultural land is 20 % and fallow land is 12% of total area of Charkhi Dadri.

Reference:

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27.05.2023