JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AN ANALYSIS OF LULC CHANGES OF KASARAGOD BLOCK, KERALA: USING GEOSPATIAL TECHNOLOGY

Anusree M[1], Dasharatha P. Angadi[2], Poojith Kumar D.P[3]

[1]Faculty, [2] Professor,.[3] Faculty,

Department of Geography, Mangalore University. Mangalagangothri

Karnataka, India

Abstract:

Land use and land cover are similar, but there is a difference, land use describes the economic and cultural activities like agricultural, residential, industrial, mining, and recreational uses that are practiced at a given place and land cover refers to the surface cover on the ground i.e. Vegetation, urban infrastructure, water, soils, etc., the land cover data of a region is covered by forest, wetland, impervious surface, agriculture, etc. The sources of water and its types include wetland or open water will be advantages for different uses. Land use and Land cover can be determined by analyzing satellite and aerial imagery. The land cover maps provide information to help managers best understand the current landscape and to see the changes over time, LUCC maps of several years are needed. With this information, we can evaluate past management decisions as well as gain insight into the possible effects of their current decisions before they are implemented. This study reveals to identify the changes of Land Use/Land Cover of the Kasargod blocks in Kerala. The objectives of the study is to prepare temporal Land Use/Land Cover maps of the study area and to analyze major land use land cover classification and identify the changes of LULC in the study area. To analyze the changes in land use land cover Landsat TN, OLI/TIRS images of 1991, 2001, and 2021 are collected from the USGS web portal. The collected temporal data have been classified into major land use land cover classes under the supervised classification technique in ENVI software. The post-classification process was done in Arc GIS software and temporal LULC thematic was generated to identify the changes that occurred in the land use land cover pattern.

Keywords: Land use land cover, supervised classification, Landsat TM, OLI/TIRS, ENVI, Arc GIS, etc

Introduction

Land-use/Land-cover, being the new concept developing with the remote sensing technology, has become a crucial item of basic tasks to carry through a series of important works, such as the prediction of land-use change, prevention of natural disaster, management and plan land use, protection of the environment, etc. With the more thorough development of remote sensing technology and the Geo-Analysis model, using remotely sensed data to monitor the status and dynamical change of land-cover/land-use has become one of the most rapid, credible, and effective methods (Dr. Swapan Kumar Deb, 2012). The land use/land cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. The land is becoming a scarce resource due to immense agricultural and demographic pressure. Hence, information on land use/land cover and possibilities for their optimal use is essential for the selection, planning, and implementation of land use schemes to meet the increasing demands for basic human needs and welfare. This information also assists in monitoring the dynamics of land use resulting out of changing demands of the increasing population (ZUBAIR, 2006). Timely and precise information about Land Use Land Cover (LULC) change detection of the Earth's surface is extremely important for understanding relationships and interactions between human and natural phenomena for better management of decision making (Horvat, 2012).

Objectives

- To prepare temporal Land Use/Land Cover maps of the study area and
- To analyze major land use land cover classification and identify the changes of LULC in the study area

Study area

The study was conducted in Kasaragod blocks, one among the block of the Kasaragod district of Kerala. It is situated at the central part of the region at latitudes 12º 29”0’ North latitudes and between 74º 55”30’East longitudes with a population of 29,97,00. The municipality falls the average mean monthly maximum temperature ranges from 29º.2 to 33.4^0 C the heat is oppressive in the moisture-laden plains. Dry weather prevails from December to February and the night will be colder during this period. March, April, and May are generally very hot. The average mean monthly minimum temperature ranges from 19.7 to 25^0 C. It also experiences an average of about 3500 mm rainfall annually. The major source of rainfall is the southwest monsoon from June to September which contributes nearly 85.3% of the total rainfall of the year. Out of the 106 rainy days in a year, 87 rainy days occur during the southwest monsoon season. The relative humidity is more during morning hours and is less during evening hours. During the morning hours, it ranges from 87.1 to 98.7%, and during evening hours it ranges from 54.4 to 86.5%. Evaporation is more during the summer months of March to May. However, as a result of unsustainable agricultural practices, infrastructural and residential development, and other anthropogenic activities in the rapidly growing city, reserves have been severely degraded.

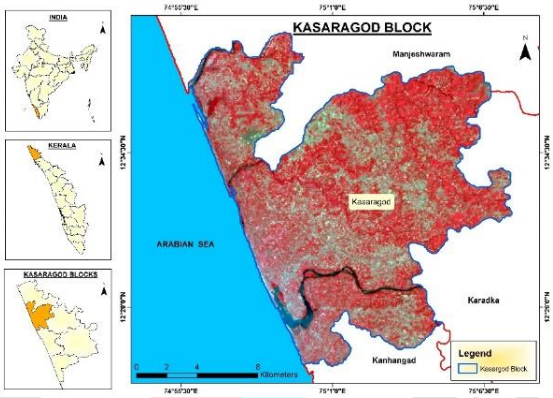

Figure. 1. Location map of the study area

Materials and Methodology

For identifying the changes in land use land cover of Kasaragod District Landsat images of 1991 2001 and 2021 are collected from the USGS web portal. The collected TM and OLI/TIRS images were extracted to the area of interest by applying extract by mask in ArcGIS software. The extracted images were mosaiced and all the bands (red, green, blue, and near-infrared) were composited, to view in natural color/color infrared band combination for the better identification of features and easy classification. Linear stretch image enhancement technique was applied for better visualization and easy differentiation of different land use land cover features. Maximum likelihood algorithm under supervised classification technique was applied for classifying the image into different classes under ENVI environment. The major number of training sites were collected for each class for a better output. The images of 1991, 2001and 2021 were classified into 5 major classes, Agriculture, Built-up, Vegetation, Open land, and Waterbody. The classified images have consisted of several errors and misclassifications, all these errors and misclassifications were rectified by applying post-classification and editing techniques in the ArcGIS software. The difference in area coverage by different LULC classes in two different periods was calculated and the changes that occurred in land use land cover pattern are identified by intersecting the classified images of 1991,2001 and 2021.

Results and discussion

ANALYSIS OF LULC STATUS FOR THE YEAR 1991 LANDSAT IMAGE

Table. 1. LULC classification1991

LULC CLASS	AREA in hectare
AGRICULTURE	15752.1 (62%)
BUILTUP	4162.73(16%)
OPEN LAND	2088.42(8%)
VEGETATION	2676.52(11%)
WATERBODY	649.265(3%)

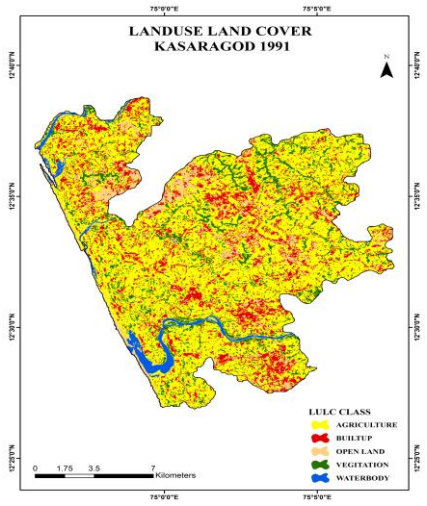

Figure 2. LULC classification 1991

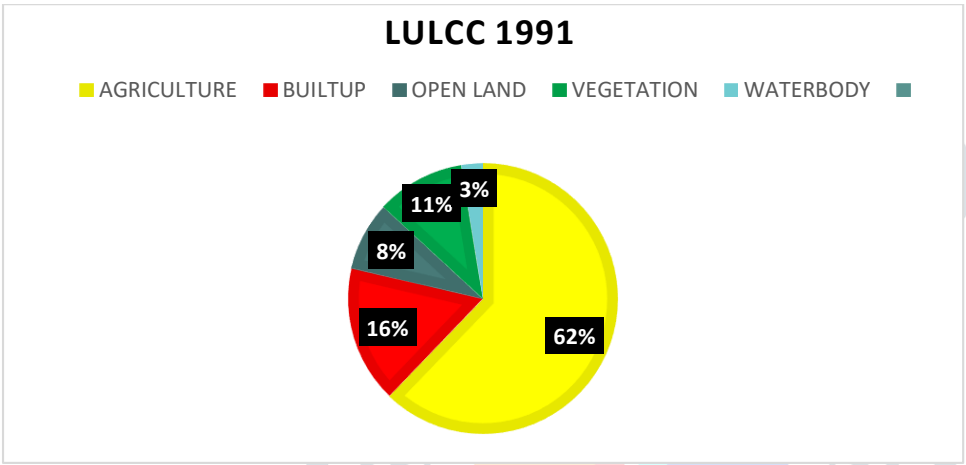

Figure 3. LULC classification 1991

From the LU/LC classification map of the year, 1991 Fig.2 & 3 and the results of statistics of land use land cover classes Table 1, the agricultural land was 62%, 16% covered by built-up land, 8% area was under open land. Vegetation is is another important classification and it covered around 11% of the total area. 649.265hecters area covered by water body.

ANALYSIS OF LULC STATUS FOR THE YEAR 2001 LANDSAT IMAGE

Table. 2. LULC classification2001

LULC CLASS	AREA (hectare)
AGRICULTURE	15038.8(59%)
BUILTUP	5019(20%)
OPEN LAND	1765.62(7%)
VEGITATION	3031.87(12%)
WATERBODY	473.785(2%)

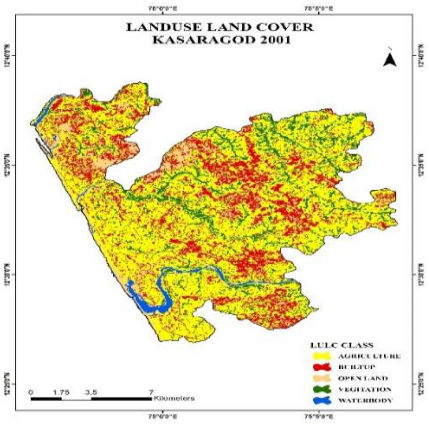

Figure 3. LULC classification 2001

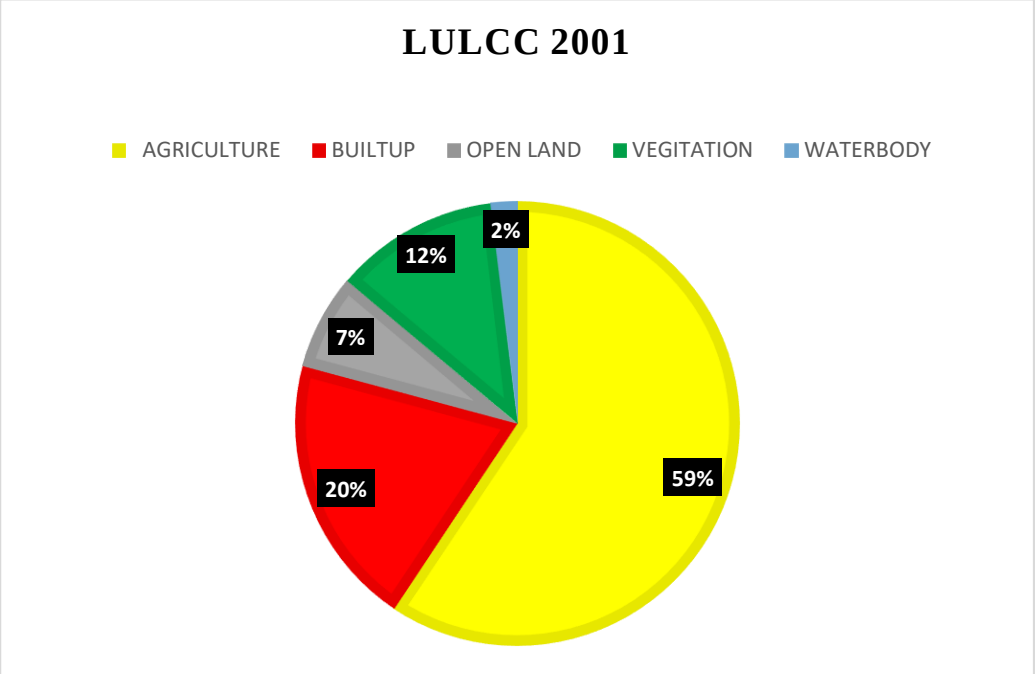

Figure 4. LULC classification 2001

From the LU/LC classification map of the year, 2001 Fig.3 and 4, the results of statistics of land use land cover classes Table 2, the agricultural land was 59 %, while comparing 1991 and 2001, the agricultural land was reducing. 20%, covered by built-up land, there was an increasing trend of built-up have seen. 7% of the area was under open land. The decreasing trend of open land has been seen in this area from 1991 to 2001. Vegetation is is another important classification and it covered around 12%. The area under vegetation was increasing because some portion of agricultural land was converted into vegetation. The area under the water body was also reduced. In 1991 the area covered 3% and in 2001 it was 2 % of the total area.

ANALYSIS OF LULC STATUS FOR THE YEAR 2021 LANDSAT IMAGE

Table. 3. LULC classification 2021

LULC CLASS	AREA (hectares)
AGRICULTURE	16053.6 (63%)
BUILTUP	6500.5 (26%)
OPEN LAND	616.785 (2%)
VEGITATION	1695.06 (7%)
WATERBODY	463.087 (2%)

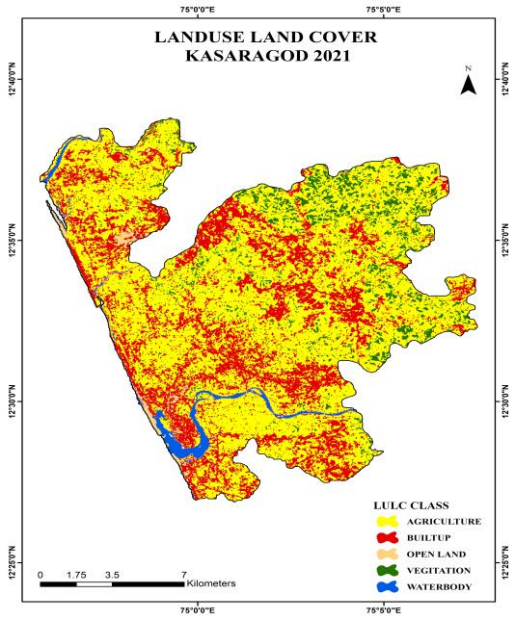

Figure 4. LULC classification 2021

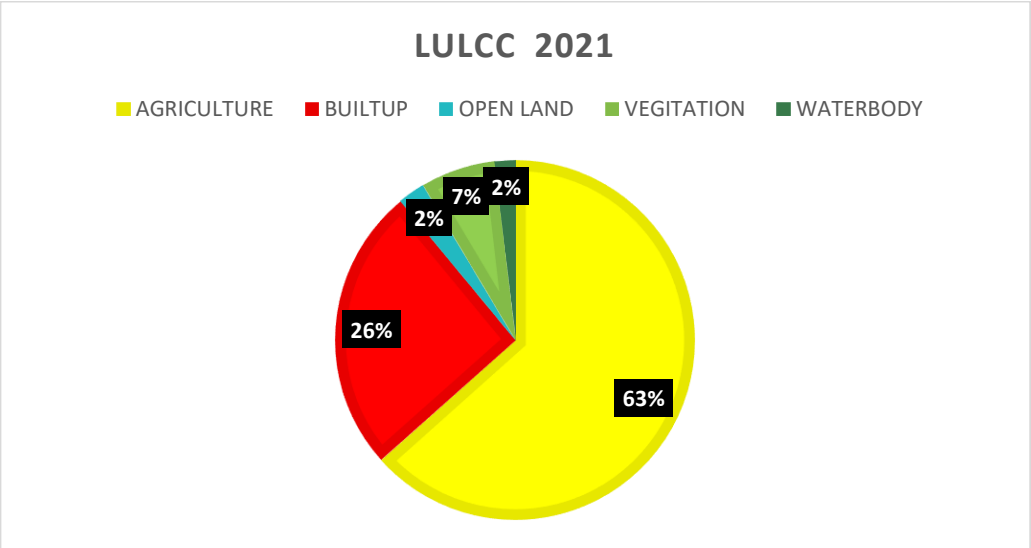

Figure 5. LULC classification 2021

From the LU/LC classification map of the year, 2021 Fig.4 and the results of statistics of land use land cover classes Table 3, the agricultural land was 16053.6 hectares, while comparing 2001and 2021, the agricultural land was increased. 6500.5 hectares covered by built-up land, there was an increasing trend of built-up have seen. 616.785 hectares area was under open land. The decreasing trend of open land has been seen in this area. Vegetation is is another important classification and it covered around 1695.06 hectares. The area under vegetation was reducing because some portions of the area under agricultural land increased. The area under the water body is the constant same area, it is 463.087 hectares.

CHANGE DETECTION ANALYSIS OF LANDSAT 1991 AND LANDSAT 2001

Table. 4. LULC change 1991-2001

LULC CHANGE	AREA CHANGE
Agriculture - agriculture	12639.9
Agriculture - builtup	1544.01
Agriculture - open land	222.02
Agriculture - vegitation	1345.85
Agricultue- waterbody	0.36
Builtup – built up	4162.73
Open land - agriculture	67.43
Open land - built up	807.54
Open land - open land	1169.08
Open land - vegetation	10.53
Open land - waterbody	33.83
Vegitation - agriculture	1095.43
Vegitation - builtup	6.21
Vegetation - open land	6.66
Vegitation - vegitation	1567.77
Vegetation- waterbody	0.45
Waterbody - open land	160.11
Waterbody - vegetation	2.25
Waterbody - waterbody	486.9

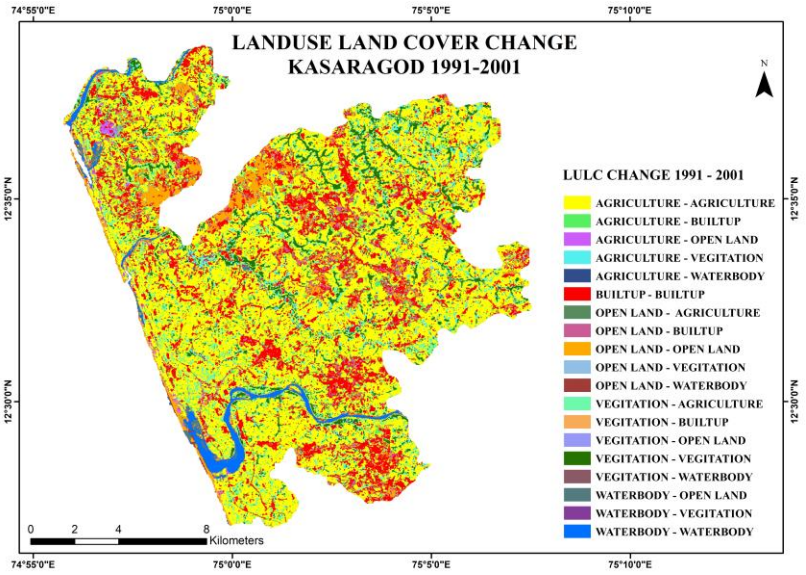

Figure 6. LULC change 1991-2001

To analyze the change detection phenomenon of land use and land cover from 1991 to 2001, it is very necessary to compare the different land use and land cover categories from 1991 and 2001. The area of Kasaragod blocks has undergone various changes in the LULC pattern as depicted in Fig. 6. 12639.9 hectares area has remained as agricultural lands. 1544.01 area converted from agricultural land use to built-up land. Agricultural land was converted into open land also, 222.02 hectares area changed. Around 1345.85 hectares area under agricultural area changed into vegetation. 0.36 hectares area of agricultural land use was replaced by water body. 4162.73 hectares continue to exist as built-up land. Some open land space the farmers started some farming, 67.43 hectares open land converted to agricultural land use. Kasaragod block is a fast-growing town. As a part of urbanization, 807.54 hectares of land were converted to built upland. 1169.08 hectares area carried by open land from 1991 to 2001. 10.53 hectares area commuted to vegetation. Some portion of the area under open land changed to the water body, 33.83 hectares area changed. Vegetation is an important land use classification of the earth. Here, some areas under vegetation converted to other land-use classifications such as agriculture, open land, built up, and waterbody. 1095.43hecteres area under vegetation changed to agricultural land use. 1567.77 hectares continued to exist as vegetation cover. 6.21 hectares area under vegetation converted to built-up land. The area under vegetation converted to the water body and open land, 0.45 and 6.66 hectares respectively. The area underwater is a very important classification of land use. Here, 486.9 hectares area underwater body has remained from 1991 to 2001. And it converted to open land and vegetation, 160.11, 2.25 hectares respectively.

CHANGE DETECTION ANALYSIS OF LANDSAT 2001AND LANDSAT 2021

Table. 4. LULC change 2001-2021

Lulc change	AREA CHANGE
Agriculture - agriculture	11585.1
Agriculture - builtup	2421.54
Agriculture - open land	67.58
Agriculture - vegitation	964.54
Builtup - builtup	5019
Open land - agriculture	200.94
Open land - builtup	1096.11

Open land - open land	417.47
Open land - vegetation	7.91
Open land - waterbody	43.18
Vegitation - agriculture	2300.3
Vegitation - builtup	37.32
Vegetation - open land	11.59
Vegitation - vegitation	682.66
Waterbody - open land	48.25
Waterbody - vegitation	0.18
Waterbody - waterbody	425.36

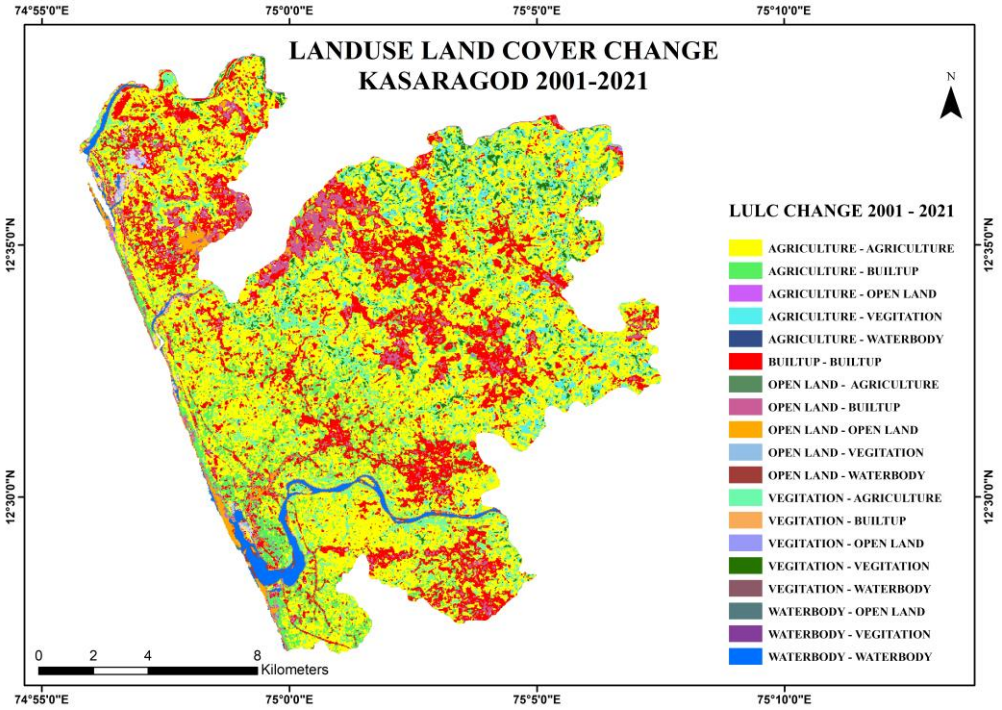

Figure 7. LULC change 1991-2001

To analyze the change detection phenomenon of land use and land cover from 2001 to 2021, it is very necessary to compare the different land use and land cover categories. The area of Kasaragod blocks has undergone various changes in the LULC pattern as depicted in Fig. 6. 11585.1hectares area has remained as agricultural lands. 2421.54 area converted from agricultural land use to built-up land. Agricultural land was converted into open land also, 67.58 hectares area changed. Around 964.54 hectares area under agricultural area changed into vegetation. 5019 hectares continue to exist as built-up land. Some open land space the farmers started some farming, 200.94 hectares open land converted to agricultural land use. Kasaragod block is a fast-growing town. As a part of urbanization, 1096.11hectares of land were converted to built upland. 417.47 hectares area carried by open land from 1991 to 2001. 7.91 hectares area commuted to vegetation. Some portion of the area under open land changed to the water body, 43.18 hectares area changed. Vegetation is an important land use classification of the earth. Here, some areas under vegetation converted to other land-use classifications such as agriculture, open land, built up, and waterbody. 2300.3 hectares area under vegetation changed to agricultural land use. 682.66 hectares continued to exist as vegetation cover. 37.32 hectares area under vegetation converted to built-up land. The area under vegetation converted to the open land, 11.59 hectares land use changed. The area underwater is a very important classification of land use. Here, 425.36 hectares area underwater body has remained from 2001 to 2021. And it converted to open land and vegetation, 48.25 and 0.18 hectares respectively

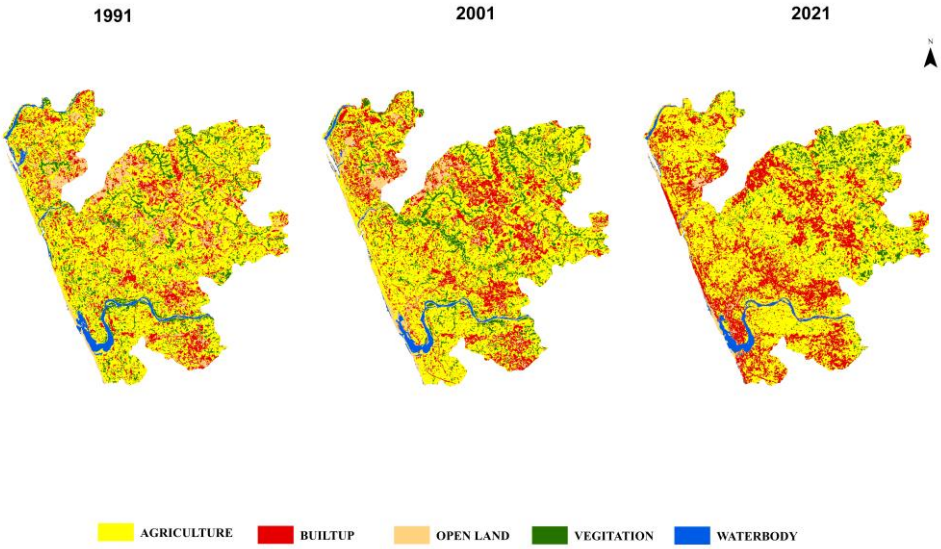

Figure 8. LULC change (1991,2001&2021)

Table. 6 LULC classification (1991,2001&2021)

Land use Class	1991 (area in hectares)	2001 (area in hectares	2021 (area in hectares)
Agriculture	15752.1	15038.8	16053.6
Builtup	4162.73	5019	6500.5
Open land	2088.42	1765.62	616.785
Vegitation	2676.52	3031.87	1695.06
Waterbody	649.265	473.785	463.087

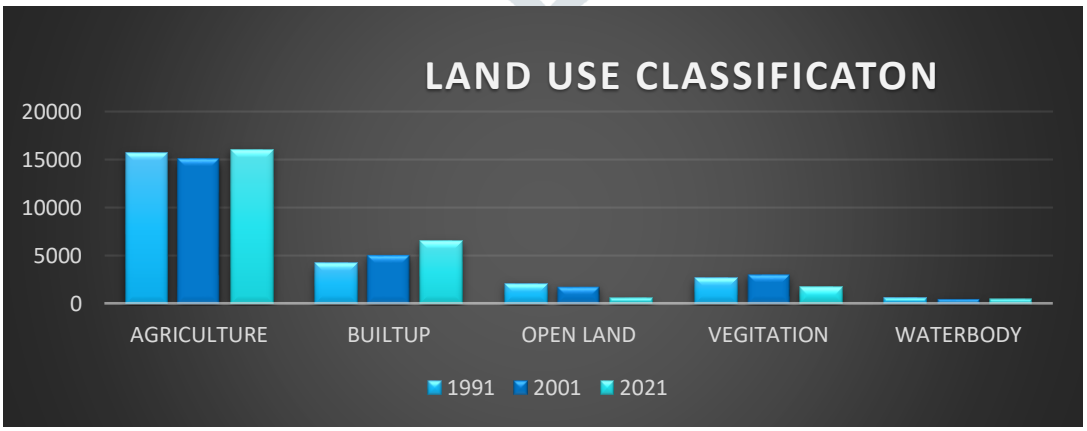

Figure9. LULC change (1991,2001&2021)

There is a wide variation in land use classification from 1991 to 2021. Agricultural land-use changes from 1991 to 2001, the area under agriculture decreased and recently that is 2021 area under agriculture increased. There is an increasing trend of built-up land from 1991 to 2021. as a part of development transportation facilities and urbanization is also happening there. Open land area is

decreasing and this area is converting into built-up land. When analyzing the area, there was increased trend have seen in vegetation from 1991 to 2001. because that time area under agriculture was decreased. After that area under agriculture is increased, the same time vegetation cover decreased.

CONCLUSION

In this study, the LULC data set was created using time-series Landsat imageries from 1991 to 2021 for the Kasaragod block, Kerala, India. The study adopted a combination of remote sensing and GIS methods to quantitatively characterize the LULC change of the study area. There is some fluctuation in the land use and land cover from 1991 to 2021. When analyzing the land use classification of Kasaragod district, agricultural land use changed into another land use type such as barren land, forest area, and build up the land. The face of transition from rural to urban structure can be seen. Well, connected transportation and roads can see in Kasaragod. As part of urbanization, some open spaces are emerging in this area, like parks, ground, etc. The area under mixed vegetation also changed into open space. The farmers of the Kasaragod are concentrating on plantation agriculture. So they are utilizing this area for commercial crops rather than food crops. The land use classification changes between10 to 15 years. In essence, the outcomes of this study signify greater importance to sustainable planning and policies to better management of Kasaragod district.

REFERENCES

1. Biswajit Nath, Zheng Niu ,and Ramesh P. Singh(2018), Sustainability(10, 4631)
2. Chen Liping, Sun Yujun, Sajjad Saeed(2018), "Monitoring and predicting land use and land cover changes using remote sensing and GIS techniques-A case study of a hilly area,Jiangle, China", PLoS ONE 13(7), University of Copenhagen, DENMAR
3. Gopinathan Nair, A, Mohammed-Aslam and K. Ibrahim – Bathis,(2017)"Land use and land cover change detection in m-Mogral river basin, Kasaragod district, Kerala using remote sensing and gis", Eco chronicle, Vol. 12, No. 3, September
4. G.Veeraswamy , A.Nagaraju , E.Balaji , Y.Sreedhar (**2017**), "Land use and Land Cover analysis using Remote Sensing and GIS:A case study In Gudur area , Nellore District, Andhra Pradesh, India, International Journal of Research, Volume 04 Issue-17
5. Harshika A. Kaul and Ingle Sopan (2012), "Land Use Land Cover Classification and ChangDetection Using High Resolution Temporal Satellite Data", Journal of Environment, Issue 04.
6. Jamal Suliman Alawamy, Siva K. Balasundram, Ahmad Husni Mohd. Hanif and Christopher Teh Boon Sung (2020), "Detecting and Analyzing Land Use and Land CoverChanges in the Region of Al-Jabal Al-Akhdar, LibyaUsing Time-Series Landsat Data from 1985 to 2017" sustainability
7. K. Dhanaraj. Dasharatha P. Angadi(2020)Land use land cover mapping and monitoring urban growth using remote sensing and GIS techniques in Mangaluru, India, GeoJournal,
8. K M Kafi, H Z M Shafri and A B M Shariff**,** (2014) **'**An analysis of LULC change detection using remotely sensed data; A Case study of Bauchi City", International Remote Sensing & GIS Conference and Exhibition, IOP Conf. Series: Earth and Environmental Science 20
9. Obang Owar Othow, Sintayehu Legesse Gebre and Dessalegn Obsi Gemeda, (2017) "Analyzing the Rate of Land Use and Land Cover Change and Determining the Causes of Forest Cover Change in Gog District, Gambella regional state, Ethiopia, J Remote Sensing & GIS, Jimma University, Jimma, Ethiopia.
10. Prabuddh Kumar Mishra Aman Rai and Suresh Chand Rai (2020), "Land use and land cover change detection using geospatial techniques in the Sikkim Himalaya, India, The Egyptian Journal of Remote Sensing and Space Sciences,

11. R. Sivasankari and N. Siva Vignesh **(** 2017**), "**Study of land use and land cover (lulc) dynamics using remote sensing and geographic information system (gis) in virudhunagar district, Tamilnadu, India" International Journal of Civil Engineering and Technology, Volume 8, Issue 12
12. Syed Kaiser Bukhari,(2019) " Spatio-Temporal Land Use/Land Cover Dynamics In Ningli Watershed Of Jehlum Catchment In Kashmir Valley, North-Western Himalaya Using Remote Sensing & Gis", International Journal of Innovative Technology and Exploring Engineering(Volume-8 Issue-5 March)
13. S. Poongothai, N. Sridhar, R. Arun Shourie, (2014)"Change Detection of Land use/ Land Cover of a watershed using Remote Sensing and GIS", International Journal of Engineering and Advanced Technology (IJEAT) Volume-3 Issue-6.
14. Zhang Xianchun, Shan Zhuoran (2012), "The Research Review of Land-Use and Land-Management Problems in the Joint of Urban and Rural Area for the last two Decades", Energy Procedia 16.