Land Use Land Cover Change Detection of Gulbarga City Using Remote Sensing and GIS

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Abstract— Land use and land cover(LULC) recently these days became a major component to handle natural resources and managing changes occurring in the environment.which is due to expansion of the urban area it has lead to critical losses of agriculture land,vegetation land and water bodies.followed by this the urban sprawl created a environmental issues. For example :decreased air quality and increase in the temperature etc. Land use and land cover change is driven by human actions and also drives changes that limit availability of products and services for human and animals, and it can undermine ecological wellbeing also. Land use and land cover is an important component in understanding various interactions of the human activities with the environment and thus it is necessary to be able to simulate changes. Therefore, this study was aimed at understanding land use and land cover change in Gulbarga city. In this work we took Gulbarga city to study the urban expansion and LULC change that took place in 2001 and 2012 to know the changes happened in the year 2012 by comparing with data of 2001.remote sensing methodology is used in this study which provides major coverage mapping & classification of land cover features such as vegetation,soil,water,forest etc. A wide range of environmental parameters can be measured including the land use, vegetation types, surface temperatures , soil types, precipitation, phytoplankton, turbidity, surface elevation and geology.satellite images of two different years i.e 2001 and 2012 are taken in to consideration.after image processing classification is done so as to classify images in to various different land use categories.

Keywords: land use land cover (LULC), remote sensing, gis,change detection, classification

I. INTRODUCTION

Land-use refers human Land use refers human exercises ashore for gigantic uses like farming, woods advancement, settlement improvement,etc. Land-cover refers to natural covering of land by vegetation, water body, rocky land, etc.change detection is a method of identifying the enormous differences in LULC overtime. Land-use and land-cover are linked to climate and weather in critical ways. Key links between changes in land cover and climate include the exchange of greenhouse gases (such as the water vapor, the carbon dioxide, the methane, and the nitrous oxide) between the land surface and the atmosphere, the radiation (both solar and longwave) balance of the land surface, the exchange of heat between the land surface and the atmosphere, and the hardness of the land surface and its uptake of momentum from the atmosphere. Because of these strong links between land cover and climate,the changes in land use and land cover can be important contributors to climate change and variability. Land use/ Land-cover change information has an important role to play at local and regional as well as at macro level planning.. The land use land-cover changes occur naturally in a progressive and gradual way.

II. LITRATURE REVIEW

A. Innocent Ezeomedo And Joel Igbokwe,(Nigeria) :

He reported The center of this paper is to portray the fast and commonsense methodology to Mapping and Analysis of Landuse and Landcover examples and progressions utilizing high determination satellite pictures. The study was done in Onitsha urban and its environs in south-eastern Nigeria. For this reason, multitemporal information comprising of existing Topographical guide, SPOT-5, and IKONOS pictures were transformed utilizing spatial examination devices of resampling, georeferencing, grouping and post-characterization overlay, to guide the examples and degree of landuse and landcover in the study zone and additionally focus the greatness of progressions between the years of investment, 1964, 2005 and 2008 separately. The aftereffect of the study demonstrates that the fabricated up territories have been on a steady positive and basically uncontrolled extension from 8.12% of the study territory in 1964 to 41.64% in 2005 and to 67.62% in 2008. Then again, vegetation, including developed and uncultivated horticultural grounds has been on an unfaltering decay, from 79.10% in 1964 to 51.78% in 2005 and an unimportant 18.74% in 2008. The study prescribed that the Government and open orgs concerned ought to create approaches and methodologies to attain an adjusted, facilitated and reasonable improvement in the urban zone and its environs.finally reasoned that the present study exhibits the value of satellite information for the readiness of precise and avant-garde area utilization/area spread maps portraying existing area classes for breaking down their change design by usage of computerized picture transforming techniques.result of order obviously indicates consistent positive increment in urbanization and adjusted decrease in the urban vegetation.it is presumed that satellite symbolism might be extremely successful and quick in change identification of landuse and landcover changes. [1]

B. Hussain Ali Oumer (Ethiopia):

He reported that the Land utilize and area spread change is determined by human activities furthermore drives changes that point of confinement accessibility of items and administrations for human and domesticated animals, and it can undermine ecological wellbeing also. Thusly, this study was gone for comprehension area utilize and area spread change within Lenche Dima and Kuhar Michael of Amhara district, Ethiopia. Time-arrangement satellite pictures that included Landsat MSS, TM, Etm+ and ASTER, which secured the timeline between 1972/3 to 2005, were utilized.

Financial Survey and survey of reports was done to comprehend recorded patterns, gather ground truth and other optional data needed. Investigation of information and other information was fulfilled through incorporated utilization of ERDAS envision (form 9.1), ENVI (adaptation 4.3) and Arcgis (rendition 9.2) product bundles alongside Microsoft office systematic tools.remote sensing dissection uncovered scene level change of developed area to have a net increment in Kuhar Michael, while a decay is found for Lenche Dima. Nonetheless, financial overviews demonstrated that family level developed area has diminished from 1.2ha to 1ha and from 2.2ha to 1.8ha in Kuhar Michael and Lenche Dima individually, in the course of the last 30years. Real helping variables included populace expand, event of dry spell, land redistribution, and area debasement. Likewise, normal area holding for every family unit has diminished from 1.6ha to 1.5ha and from 2.9ha to 2.2ha in Kuhar Michael and Lenche Dima, respectively.his Key Objective was to comprehend changes in area utilize and area spread happening within Kuhar Michael and Lenche Dima catchments focused around examination of remotely sensed data.to recognize and analyze drivers of area utilize and area spread change as a part of the study areas.to examine the effect on vegetation, crop generation and creature sustain motion in the study areas.finally Concluded that Remote sensing results demonstrated that the region of developed land in both studyareas has experienced a change, yet with varying greatness and rates In Kuhar Michael, an augmentation was found in the midst of the introductory two periods with yearly rates of 1.7% and 0.6% , while an abatement was uncovered in the midst of the third period at yearly rate of -1% . Notwithstanding the occasional varieties in change of developed area, the general rate of progress amid the entire time of examination (1972-2005) is discovered to be 0.8% for every annum, which brought about a net increase.however, in Lenche Dima, developed area demonstrated a declining pattern both at family and scene level amid most investigation periods generally because of area corruption .[2]

C. Prakasam.c (A research endeavor of KODAIKANAL TALUK, Tamil nadu) :

He reported that Land utilize and area spread is an essential segment in understanding the communications of the human exercises with nature's domain and in this manner it is important to have the capacity to mimic progressions. Observational perception uncovered a change in area utilization area spread characterization in Kodaikanal taluk, an a piece of Western Ghats found in Tamilnadu state. In this paper an endeavor is rolled out to study the improvements in area utilize and area blanket within Kodaikanal Taluk in excess of 40 years period (1969-2008).the study has been carried out through remote sensing methodology utilizing SOI Taluk guide of Kodaikanal (1969), and Land Sat symbolisms of May 2003 and April 2008. The area utilization area spread characterization was performed focused around the Survey of India Kodaikanal Taluk guide and Satellite symbolisms. GIS programming is utilized to set up the topical maps. Ground truth perceptions were likewise performed to check the exactness of the grouping. The present study has brought to light that timberland region that involved around 70 for every penny of the Taluk's zone in 1969 has diminished to 33 for every penny in 2008. Agrarian area, Built up range, Harvested land and Waste land additionally have encountered change. Builtup grounds (Settlement) have expanded from 3 for every penny to 21 for every penny of the aggregate region. Kodaikanal range is recognized as one of the biodiversity zone in India. Fitting area use arranging is vital for a manageable improvement of Kodaikanal Taluk.the Key Objective was to break down the nature and degree area utilization/area spread changes in Kodaikanal Taluk in the past 40 years and to recognize the principle constrains behind the changes.so at last reasoned that Kodaikanal is a celebrated slope station in south India the real wellspring of pay is through tourism. The real land use in Kodaikanal Taluk is woods. Anyhow the area under woodland spread has encountered a declining pattern in the previous forty years. Here woodland area changed over to Agricultural land, Builtup, and Harvested land because of this progressions we misfortune our common biological system and biodiversity additionally. The increment in horticultural area is an inviting pattern. Anyhow observational perception uncovers that because of increment in expense of development, issues because of lack of work, supply of low quality defiled composts and value vacillation in the business sector the agriculturists like to offer their property to property promoters. Thus there is a danger of decrease in the degree of area under horticulture within a brief period of time. The increment in the zone under developed grounds may prompt a ton of ecological and biological issues. [3]

III. STUDY AREA

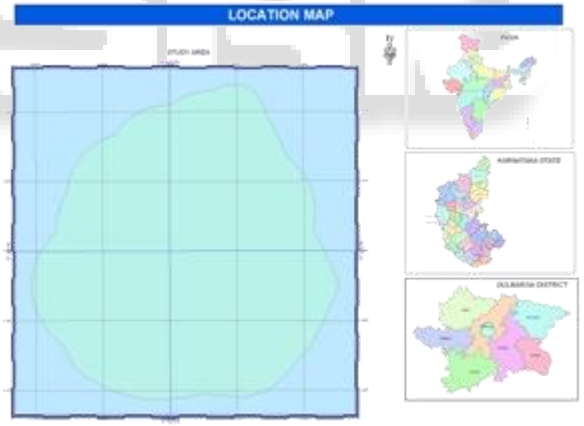

Fig.1: Location Map of Gulbarga city

Gulbarga City is arranged in North piece of Gulbarga region. It reaches out from 76° 02' to 77° 42' 0" East Longitude and 16° 11' to 17° 46' 0" North Latitude..area is of 64.00sq.kms & populace is of 5.43 lakhs,number of properties are 50459 & number of wards are of 55. Two real waterways, Krishna and substantial number of tanks which, notwithstanding the streams, water the area. The Bhima, stream in the locale. Dark soil is overwhelming soil sort in the region.. Bajra, toor, sugarcane, groundnut, sunflower, sesame, castor bean, dark gram, jowar, wheat, cotton, ragi, Bengal gram, and linseed are developed in this district.the aggregate water supply is 50mld & for every capita water supply is 100 Lpcd.the climate in Gulbarga comprises of 3 primary seasons. The late spring period is from late February to mid June. It is trailed by the south west storm which begins from the late

June to late September substantial precipitation may go up to 750mm.fig-1 shows location map of Gulbarga city.[4]
The temperatures amid the diverse seasons are:

- Summer : 38 to 44 °C
- Monsoon: 27 to 37 °C
- Winter : 11 to 26 °C

IV. MATERIALS AND METHODOLOGY

The materials utilized for this study will be GIS and RS related programming models. These delicate products help us to make maps furthermore help in the administration of information. By utilizing these product models, altering and investigation of the information is possible in shorter time of time.

A. Geographic Information System (GIS):

The Geographic Information System (GIS) is a machine supported framework for obtaining, stockpiling, investigation and showcase of geographic information. Geographic Information System (GIS) is an incorporated situated of fittings and programming devices utilized for the control and administration of spatial (geographic) and related credit information to digitally speak to and examine the geographic gimmicks exhibit on the world's surface and the occasions occurring on it.

GIS takes into consideration making, keeping up and questioning electronic databases of data ordinarily showed on maps. These databases are spatially turned, the crucial incorporating component being their position on the world's surface. This framework comprises of a set of automated devices and methodology that could be utilized to adequately encode, store, recover, overlay, relate, control, dissect, inquiry, and showcase area related data. They additionally encourage the determination and exchange of information to application particular scientific models equipped for evaluating the effect of options on the earth. The underlying establishment of sound GIS is a successful advanced guide database, fixing to a precise level control overview structure.

B. Remote Sensing (RS):

Remote sensing is the investigation of obtaining data about earth's surface without really being in contact with it. This is carried out by sensing & recording reflected or emitted vitality & handling, investigating & applying that data. A further venture of picture examination and understanding is needed with a specific end goal to concentrate helpful data from the picture. The human visual framework is an illustration of a remote sensing framework in this general sense. In a more confined sense, remote sensing generally alludes to the engineering of obtaining data about the world's surface (area and sea) and environment utilizing sensors installed airborne(aircraft, inflatables) or space borne (satellites, space shuttles) stages. In Optical Remote Sensing, optical sensors distinguish sun based radiation reflected or scattered from the earth, shaping pictures taking after photos taken by a cam high up in space. The wavelength district generally stretches out from the Visible and Near Infrared (VNIR) to the Short-Wave Infrared (SWIR). Diverse materials, for example, water, soil, vegetation, structures and streets reflect unmistakable and infrared light in distinctive ways. They have distinctive colors and shine when seen under the sun. The translations of optical pictures require the learning of the ghastly reflectance marks of the different materials (regular or man-made) coating the surface of the earth. There are additionally infrared sensors measuring the warm infrared radiation emitted from the earth, from which the area or ocean surface temperature might be inferred. [5]

C. Programming Model Used For The Study

(1) arcgis 10.0
(2) erdas IMAGINE 8.7

Arcgis 10.0 is a product model which incorporates a gathering of geographic data framework (GIS). This product model is created by ESRI.

Arcgis 10.0 is constructed around the geodatabase, which utilizes an item social database approach for putting away spatial information. A geodatabase is a "holder" for holding datasets, entwining the spatial peculiarities with properties. The geodatabase can additionally contain topology data, and can display conduct of peculiarities, for example, street crossing points, with guidelines on how gimmicks identify with each other. At the point when working with geodatabases, it is vital to see about peculiarity classes which are a situated of gimmicks, spoke to with focuses, lines, or polygons. With shape records, each one record can just handle one kind of gimmick. A geodatabase can store numerous peculiarity classes or sort of gimmicks inside one document. Arcgis for Desktop comprises of a few incorporated applications, including Arc Map, Arc Catalog, Arc Toolbox, and Arc Globe. Circular segment Catalog is the information administration application, used to scan datasets and records on one's machine, database, or different sources. Notwithstanding indicating what information is accessible, Arc Catalog likewise permits clients to see the information on a guide. Circular segment Catalog additionally gives the capacity to view and oversee metadata for spatial datasets. Bend Map is the application used to view, alter and inquiry geospatial information, and make maps. The Arc Map interface has two fundamental segments, including a list of chapters on the left and the information frame(s) which show the guide. Things in the list of chapters compare with layers on the guide. Circular segment Toolbox contains geo handling, information transformation, and dissection instruments, alongside a great part of the usefulness in Arcinfo. It is likewise conceivable to utilize group preparing with Arc Toolbox, for regularly rehashed undertakings.

ERDAS IMAGINE 8.7 is basically utilized for handling of geo-spatial raster information and permitting the client to show the computerized pictures for mapping in GIS programming. This product model permits the client to perform distinctive operations on a picture. ERDAS IMAGINE Suite which has developed to backing most optical and radar mapping satellites, airborne mapping cams, advanced sensors utilized for mapping. It was discharged on a Sun Workstation utilizing Sunos giving a Graphical User Interface to support in envisioning symbolism utilized within mapping, vector GIS information, making map.

D. Generation of Thematic Maps

- Survey of India toposheets No.56C/15 on 1:50,000 scale.
- Acquisition of the LISS-III & the satellite data of the year 2001&2012 from NRSC,Bangalore&toposheet from survey of India Bangalore.
- Geo-referencing of toposheet based on latitude & longitudinal values.

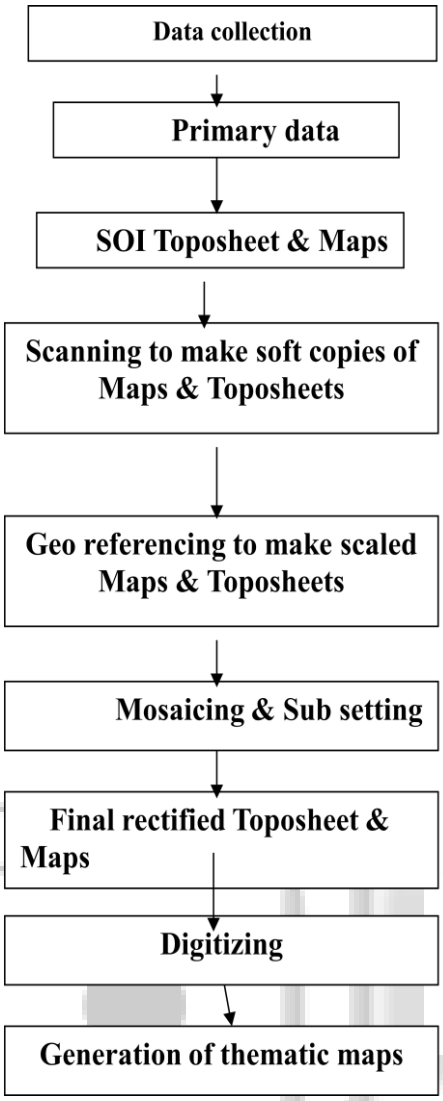

Chart 1: Flowchart for methodology adopted for generation of thematic maps.

- Geo-coding & geo referencing of LISS-III &digital data by extracting the ground control points from SOI toposheet.
- LISS- III for merged product.this is FCC mode & used for visual interpretation.
- The Generation of thematic maps using ARC GIS software.

E. Processing of satellite data

- In this case the remote sensing data in the digitalized format has been used.which is obtained by LISS- III. LISS- III is a multispectral imagery with a resolution of ground of about 23m.
- hence it is necessary to give sensor parameters of LISS- III which operates in 4 spectral bands.map of scale 1:50,000 used from SOI covering the whole area to obtain the ground control points.hence this information is used for image registration of LISS-III using software ARC GIS 10.
- To create the raster file for study area toposheet of scale 1:50,000 are scanned which are geo-referenced with respect to latitudinal & longitudinal co-ordinates.
- Enough number of ground distributed points is been selected on map & imagery respectively.
- Finally at the end with the help of visual image analysis techniques classification for LULC map is prepared.

V. RESULTS AND DISCUSSIONS

PARTICULARS	2001 Area %	2001 Area (Ha)	2012 Area (Ha)	2012 Area %
Agriculture_Land	66%	12980.52	12064.59	61%
Built Up Land	17%	3402.49	5051.34	26%
Industrial Area	1%	212.34	390.20	2%
Tank	16%	70.44	22.57	11%
Vacant Land/Wastelands	0.3%	3087.29	2213.75	0.1%
Total	**100%**	**19753.08**	**19742.46**	**100%**

Table 1: change detection (2001-2012)

- LISS- III satellite data for the year 2001 & 2012 are represented in figure 2 and 3 respectively.
- LULC map for the year 2001 &2012 are prepared for agricultural land,built up land, industrial area,tank,waste land which is shown in figure 4 &5 respectively.
- To show the major roads & railways a base map is prepared as shown in figure 6.
- A drainage map showing tank & some irregular branch of channels is observed which is shown in figure 7.
- The contour map of Gulbarga city is shown in the figure 8.A pie chart which shows a change detection observed between the years 2001 &2012 as shown in chart-2 below.

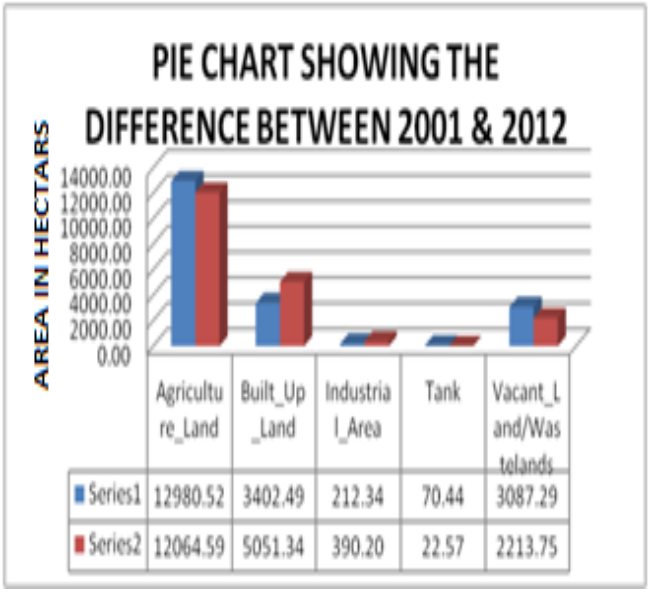

Chart 2 **:** Pie chart (2001-2012)

The Generated thematic maps are as follows.

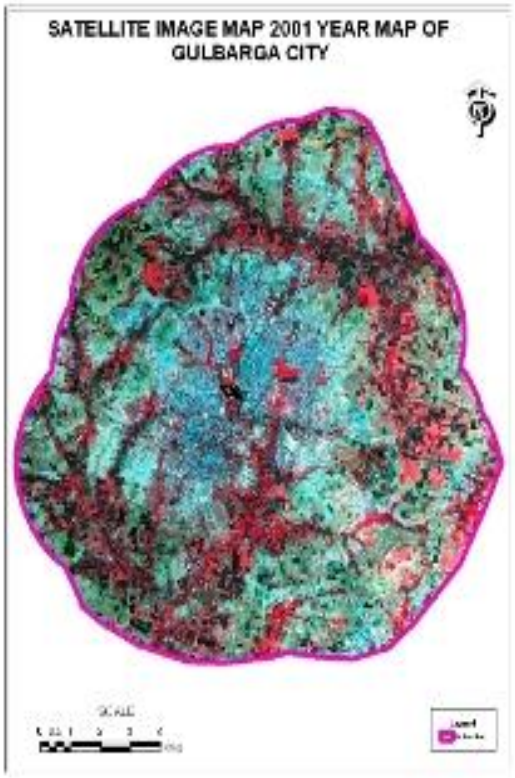

Fig. 2: Liss-Iii Satellite Imagery- 2001

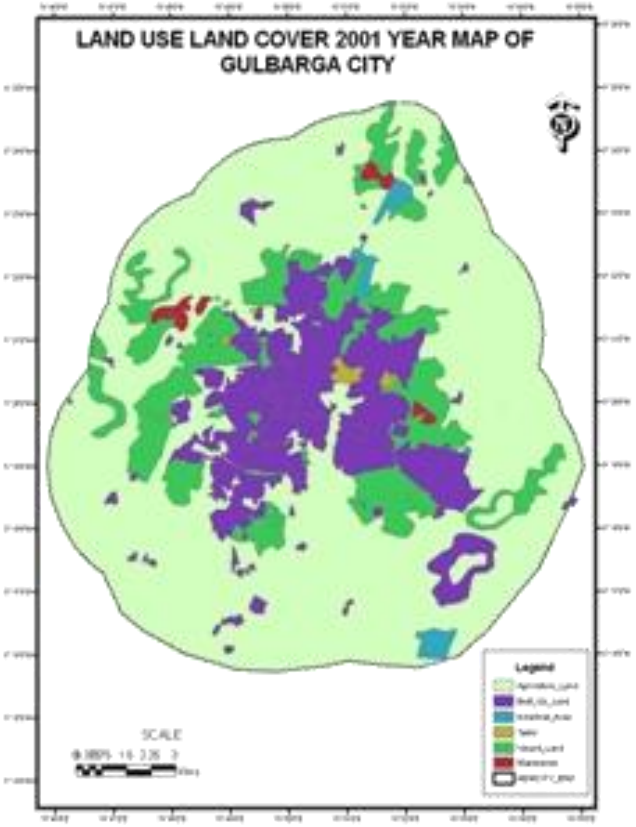

Fig.4: Land use/Land cover map-2001

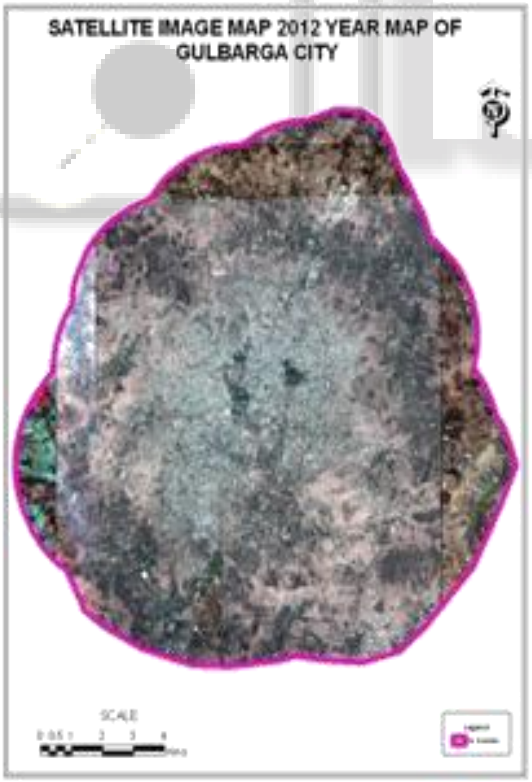

Fig.3: Liss- Iii Satellite Imagery-2012

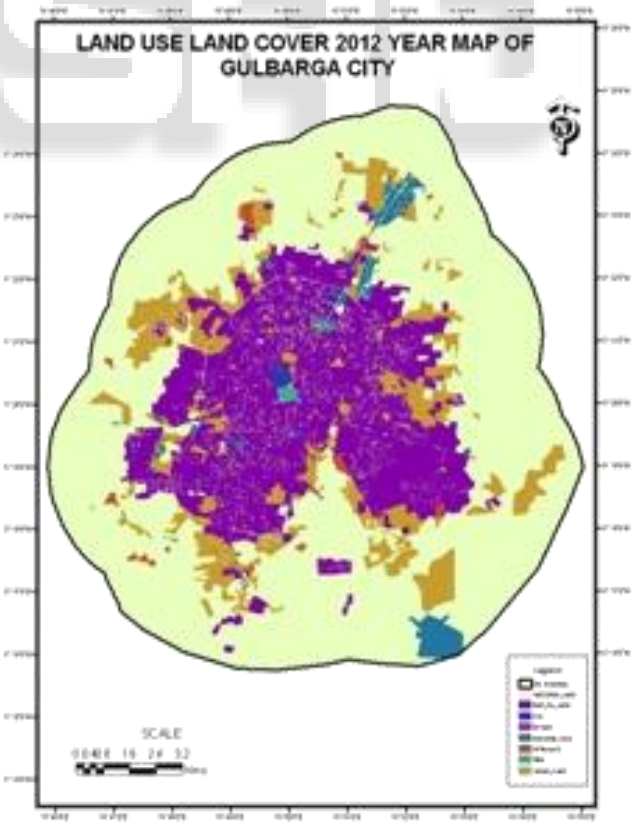

Fig. 5: Land use/Land cover map-2012

Fig.6: Base map of study area

Fig.7: Drainage map of study area

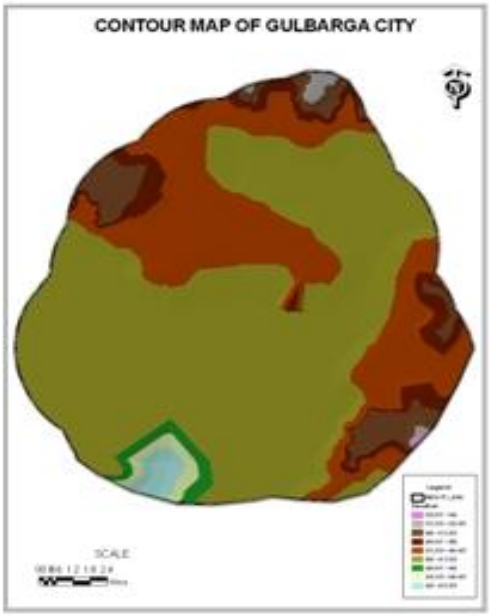

Fig.8: contour map of Gulbarga city

VI. CONCLUSION

Gulbarga City LULC process is very rapid in recent years because of location of industrial area within the City, , establishment of Central University of Karnataka in 2009, 1000 bedded ESI hospital,Buddha vihar and airport along Sedam road, new engineering and medical colleges, establishment of High Court, widening of City roads and highways and addition of new trains to important destinations, and improvement in railway services. The present study is an attempt to measure the LULC during a decade i.e. from year 2001 to 2012 using RS and GIS techniques. The results show that there was an increase of about 26% built up land. The land use land cover classification of the city was done which is a very useful for the Urban Planning department.

The accompanying concluns might be construed from the maps got from the study:

Change detection analyses describes and quantify differences between images of the same scene at different times. This analysis is very much helpful to identify various changes occurring in different classes of land use like increase in urban built-up area or decrease in shrub and as the Gulbargacity,which involes Agricultural land,built up land,industrial area,tank,vacant land/waste land so on.so from the above study we can directly say that there is decline in the agricultural land(61%).there is increase in the built up land(26%) but decrease in water bodies or tank(11%) & there is increase in the industrial area(2%)but decline in the vacant land/waste land(0.1%).Due to increase in the cost of cultivation there is a decline in agricultural land this is because of labour shortage,supply of poor quality fertilizers to farmers & variation in the rates in market. Hence the farmers prefer to sell their land to the land developers. Finally due to this there will be a decrease in the agricultural land in coming future. increase in the builtup land seriously results to lot of ecological & environmental problems. Rapid urban LULC change causes lot of environment problems.the urban areas grow

normally at the cost of surrounding agriculture & other lands. the waste generated by these urban areas(solid & liquid) pose threat to quality of life..the industrial effluents pollutes the surface water & ground water. Plumes from industry causes air pollution.The Growth of city at a rate of agricultural, forest & other land also results in the environmental imbalance. Remote sensing data, satellite& aerial accompanied by ground investigations are found useful in mapping the urban land use/land cover etc..suitable sites for 1.disposal of solid waste& 2.sewage treatment plants can also be identified using remote sensing data. LULC play a very important role in the climate change @ different scales such as regional, local&global.At global scale LULC change is responsible for releasing greenhouse gases to the atmosphere which results in the global warming .LULC change is capable to increase the carbon dioxide balance to the atmosphere by disturbance of terrestrial soils and vegetation. most important is LULC change plays very important role in emission of green house gases. Hence the government should think seriously & take the necessary steps to protect agricultural land which is a major parameter & deforestation should be avoided for widening of roads .As good as best land use planning is needed or else we definitely loose our natural resourcesi.e water bodies, agricultural soil. Hence finally it is concluded that satellite imagery can be very effective and fast in change detection of landuse and landcover changes.

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