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LANDUSE AND LANDCOVER ANALYSIS USING REMOTE SENSING AND GIS: A CASE STUDY IN K.V.B.PURAM MANDAL, CHITTOOR DISTRICT, ANDHRA PRADESH, INDIA

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Abstract

Land use/land cover (LULC) pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. The increase in density of population is directly proportional to the land use/land cover. The present study shows the spatio-temporal dynamics of land use/cover of K.V.B. Puram mandal, Chittoor District, Andhra Pradesh India. Land use/land cover map was prepared in ArcGIS, ERDAS Imagine 9.3 through visual interpretation of IRS P6 LISS-III data and multitemporal of the area. The area in terms of LULC can be divided into following classes: Barren land, fallow land, forest, built-up land, agriculture land and water bodies. Landsat satellite imageries of two special time intervals, landsat thematic mapper (TM) of 2008-2016 have been obtained via global land cover facility site (GLCF) and earth explorer website and Supervised and unsupervised type methods have been employed using most chance techniques in ERDAS Imagine 9.3. The images of the area have been categorized into six exceptional classes, specifically forest, barren/wastelands, built-up, water bodies, agriculture and fallow land.

Key Words: Land use/land cover Analysis in Remote sensing , change detection

INTRODUCTION

Land use/land cover details is one such aspect has become increasing importance in nation planning to overcome the problems of haphazard, uncontrolled development, deteriorating environmental quality, loss of

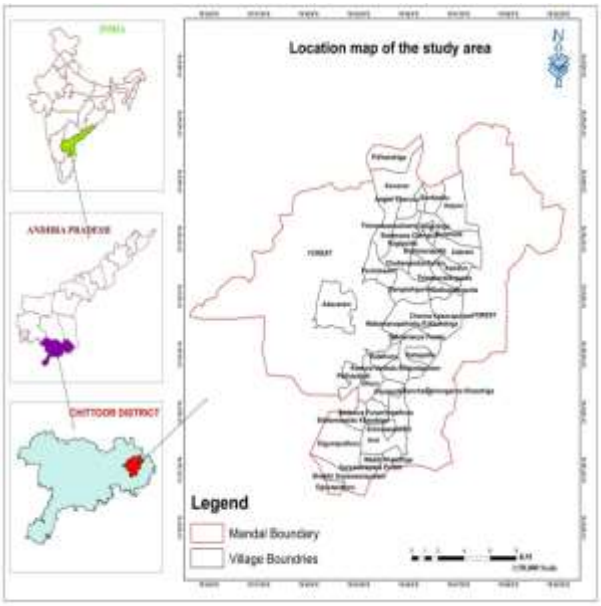
prime agricultural lands, destruction of important wetlands, and loss of fish and wildlife habitat. Land use/land cover is two separate terminologies which are often used interchangeably. Land cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities e.g., settlements. While land-use refers to the way in which land has been used by humans and their habitat, usually with accent on the functional role of land for economic activities. The land use/land cover pattern of a region is an outcome of natural and socioeconomic factors and their utilization by man in time and space.

This study is helpful for better understanding for the land and resource management (Yuan et al. 2005, Brondizio et al. 1994). Land use and land cover processes do not always mean degradation of the land and change by various social causes. The social causes like increase of urban activity and industrialization lead to modification of landscape feature and adverse effects on the biological community and atmosphere (Riebsame et al. 1994, Ruiz-Luna et al. 2003, Turner & Ruscher 2004, Veeraswamy et al. 2017, Rajasekhar et al. 2017). Nowadays, remote sensing possess, in addition to satellite based systems, which get physical data on a repetitive basis with a process of GIS are frequently used for monitoring the land cover changes. It helps us to do research on the information spatially producing diverse modelling, thereby optimizing the whole planning process. Application of remote sensed information makes it possible to study the various changes in land cover in less time with higher accuracy (Sreenivasulu et al. 2014). Remote sensing and geographical information systems (GIS) are indispensable tools to originate precise and timely information on the spatial distribution of land use/land cover changes over large extent areas (Selcuk et al. 2008). Land is becoming a scarce resource due to vast agricultural and static pressure. Optimal use of land cover is essential for the selection, planning and ratification of land use schemes to meet the increasing human demands. This information also helps in monitoring the dynamics of land use resulting due to changing demands of increasing population (Sreenivasulu et al. 2014). In overall, the change detection studies of land use/ land cover are helpful for the future generation for proper planning and management activities of the present study area.

Study Area

Study Area KVB Puram Mandal in Chittoor District derives its name from KVB Puram, its head quarters is KVB Puram. It belongs to Rayalaseema Region. It is located at 13°57'67"N 79°69'47"E. It is bordered by Sri Kalasthi and Thottambedu Mandals towards North, Pichatur and Nindra Mandals towards South, B.N. Khandriga and Varadhayalapalem Mandals towards East, Narayanavanam and Yerpedu Mandals towards West. It is located under the administration of Chittoor district. The KVB Puram mandal headquarters are located here. It is included in the Survey of India Topographical Toposheets of 57 O/10, 57 O/11, 57O/14 and57 O/ 15 on a scale of 1:50,000.

Fig. 1 : Location of Map of the Study Area

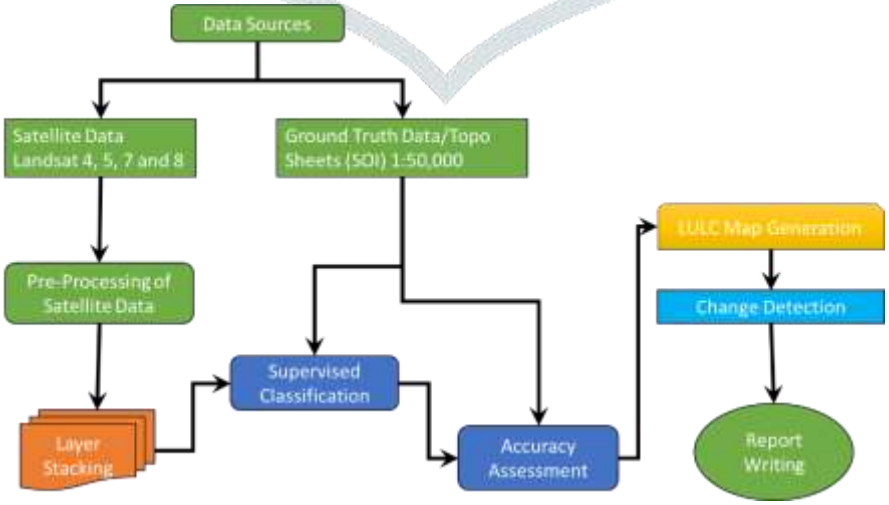


Data Sources and Research Methodology

For the study area LULC analysis were utilized Standard satellite data of United States Geological Survey Satellite data of LANDSAT 4-5 & LANDSAT 7 (Path-Row: 143-50, 51 & 142-51) of March, April and December months of 1997, 2008, 2016 having a spatial resolution of 30 meter and band combination of 1-7, 1-8 & 4-9. It Was Downloaded from USGS Earth Explorer, United States. Fallowing table will give the detailed data used for this study

Fallowing flow chat will give the entire methodology as a single picture of procedure for delineation of land use land cover analysis of the study area.

Fig. 2 : Flowchart : Detailed methodology steps flowchart



Source: Prepared by the researcher

Pre-Processing of Satellite Data

In general, NASA LANDSAT TM, ETM has radiometric resolution of 8 bit so it can store DN values in the range of 0-255. But the spectral signature of the Earth surface is not measured by the DN values. As spectral signature of the surface depends mainly on location of sun, viewing geometry of the satellite at moment the image has taken, and earth to sun distance. So, it is necessary to convert all the DN values to radiance and reflectance.

Result and Discussion

Analysis of landuse/landcover by using remote sensing data: In the present day, land use/land cover change detection is very important method in geospatial technology.

Settlements

The classification shows that there is a positive increase in the built-up land during the study period. The total area under built up was 3.90 sq. kms in 2008 which increased to 8.96 sq. kms in 2016. By the year 2016 built-up area physically expanded. The built up area increased commercial as well as educational factors were dominating forces behind the growth of the settlements. The residential areas or built-up areas are mainly at KVB Puram mandal head quarterand its surrounding places.

Water bodies

The class comprises areas of surface water either impounded in the form of lake and reservoirs or flowing streams, river, cannels etc. The water spread area of water bodies depends on the rainfall of the region and utilization of water for different purposes. Due to urbanization water bodies like tanks has encroached in urban areas. The total area covered by water bodies in 2008 was 8.25 sq. kms. which reduced to 6.50 sq. kms. in 2016. Rainfall plays an important factor in increasing the spread area of the water bodies.

Barren-Fallow land

Barren/Fallow land which classifies as the waste land or non-cropped area. The total area under waste land is estimated of about 110.96 sq. kms in 2008, which increased to 178.66 sq. kms in 2016.

Agriculture

Agriculture is defined as the land primarily used for farming and for production of food and cash crops. It comprises land under crop (irrigated and unirrigated), fallow, plantations etc. The agricultural land shows a negative change i.e. the area under agricultural land is decreasing due to water availability and rainfall, it was 87.00 Sq. kms. in 2008 it decreased to 44.12 sq. kms. in 2016. of the total study unit. Most of the cropland is

Rabi which includes Paddy, Sugar cane, Groundnut and small millet crops during. It coincides with the southwest monsoon season.

Forest

Forest has been defined as land where the potential natural vegetation is predominantly trees, grasses, grass like plants, shrubs. The vegetation of this area is dry deciduous mixed forest with patches of moist deciduous forests in the valleys. It is having Nagari hills which falls on the southern part of the Eastern Ghats and its became the first biosphere reserve in the combined Andhra Pradesh. Nagari Hills mostly carry red sanders forests with its associates, while the plateau portions carry sandal and the plains dry deciduous forests. In the year 2008 the total area covered by vegetation was 270.18 sq. kms. Which reduced to 242.07 sq. Kms. in 2016.

CHANGE DETECTION ANALYSIS OF LULC

Land Use and Land Cover transformation over a time period based on remote sensing/satellite data has been established as a tool for providing good and suitable information to various decision making support systems for natural resource management. Land use and land cover is the major influencing factor for change of landscape.

There are many number of LULC change detection techniques developed over decades. The present change detection analysis study is carried out in the two seasons namely, Pre-monsoon and Post-monsoon analysis; the changes occurred during the period of 2008 to 2016.

Post monsoon change detection

The analysis of post-monsoon period of change detection analysis and the change characteristics parts covers a period of 9 years (2008-2016). The changes in the LULC pattern have been identified by using multi-temporal Landsat satellite images of 2008 and 2016 on a GIS based platform. The period follows the same change in pattern as mentioned in above with the areas of coverage by different LULC categories has been changing.

2008-2016 post monsoon change detection

Fig. 3 : Change detection Image of the study Area (2008-2016 Post-Monsoon)

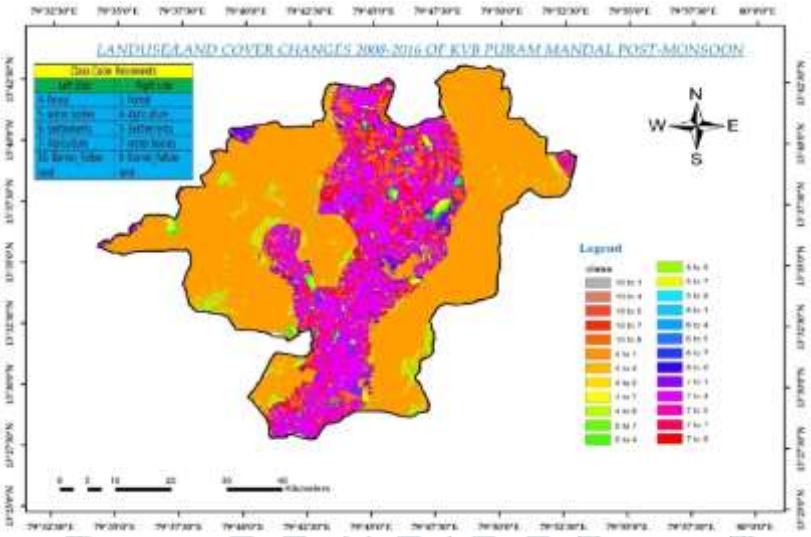


Table 1 : LULC change from 2008-2016 post monsoons

CD values 2008-2016 POST MONSOON						
Row Labels	**Agriculture**	**Barren_Fallow land**	**Forest**	**Settlements**	**Water bodies**	**Grand Total**
Agriculture	72	10.5	0.99	1.5	2	86.99
Barren_Fallowland	10.5	89	6.5	1.2	3.7	110.9
Forest	32.9	10.18	225	0.7	1.4	270.18
Settlements	0.1	0.6	0.01	3.18	0.01	3.9
Water bodies	2.05	1	0.2	0.3	4.7	8.25
Grand Total	117.55	111.28	232.7	6.88	11.81	480.22

Table 2 : Post-monsoon Change Analysis 2008-2016 (A Period of 9 Years)

LULC categories	Area covered (Sq.km) in 2008	% of Area in 2008	Area covered (Sq.km) in 2016	% of Area in 2016	Change	
Settlements	3.90	0.8	9.12	1.9	1.1	+ve
Forest	270.18	56.3	256.69	53.4	-3.1	-ve
Barren-Fallow land	110.96	23.1	129.13	26.9	3.8	+ve
Agriculture	87.00	18.1	78.34	16.3	-1.8	-ve
Water bodies	8.25	1.7	7.03	1.5	-0.02	-ve
Grand Total	480.31	100	480.31	100		

The study area covers an area of 480.31 sq. km. During the change detection analysis of 2008-2016 period, negative changes are marked in the use of Agriculture, Forest and Water bodies LULC categories. The calculated area by satellite images shows that the total area under agriculture was 87.00 sq. km. in 2008 which decreased to an extent of 78.34 sq. km. in 2016.

The settlements are increased from 3.90 sq. km. in 2008 to 9.12 sq. km. in 2016. The urban development has taken place predominantly through major change in the urban expansion observed. The increase in the settlement areas is 1.9 % by 2016. The other category barren/fallow land which is also showing positive change by 3.8% in 2016. The decrease in the forest areas by 3.1% by 2016 in the upper north and south-east of the study area where Seshachalam and Eastern Ghats forests covering major part of the forests in our study area. With little or less surface water spread areas shows negative growth and these has directly or indirectly affected the vegetation growth. Finally the agriculture area has decreased by 1.8 % by 2016.

Pre-monsoon change detection

The analysis of pre-monsoon period of change detection analysis and the change characteristics parts covers a period of 9 years (2008-2016). The changes in the LULC pattern have been identified by using multi-temporal Landsat satellite images of 2008 and 2016 on a GIS based platform. The period follows the same change in pattern as mentioned in above with the areas of coverage by different LULC categories has been changing.

2008-2016 pre monsoon

Fig 4 : Change detection Image of the study Area (2008-2016 Pre-Monsoon)

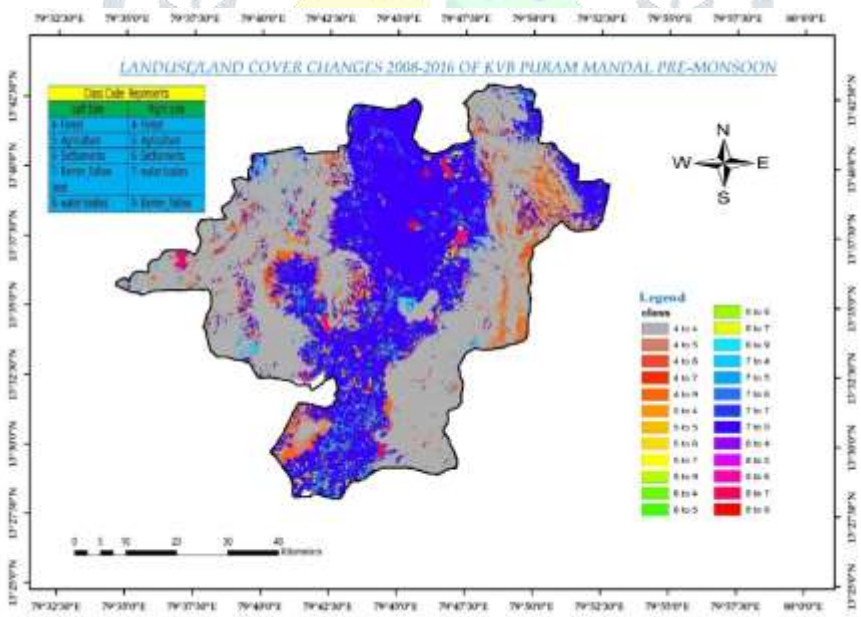


Table 3 : LULC change from 2008-2016 pre monsoons

CD values 2008-2016 POST MONSOON						
Row Labels	Agriculture	Barren_Fallow land	Forest	Settlements	Water bodies	Grand Total
Agriculture	61.5	21	0.99	1.5	2	86.99
Barren_Fallowland	5.5	94	6.5	1.2	3.7	110.9
Forest	29.9	13.18	225	0.8	1.4	270.28
Settlements	0.1	0.6	0.01	3.18	0.01	3.9
Water bodies	1.05	2	0.2	0.3	4.7	8.25
Grand Total	98.05	130.78	232.7	6.98	11.81	480.31

Table 4 : Pre-monsoon Change Analysis 2008-2016 (A Period of 9 Years)

LULC categories	Area covered (Sq.km) in 2008	% of Area in 2008	Area covered (Sq.km) in 2016	% of Area in 2016	Change	
Settlements	3.90	0.8	8.96	1.9	1.1	+ve
Forest	270.18	55.6	242.07	50.3	-5.3	-ve
Barren-Fallow land	110.96	28.9	178.66	37.2	8.3	+ve
Agriculture	87.00	13.2	44.12	9.3	-3.9	-ve
Water bodies	8.25	1.5	6.50	1.3	-0.02	-ve
Grand Total	480.31	100	480.31	100		

The study area covers an area of 480.31 sq. km. During the change detection analysis of 2008-2016 period. Negative changes are marked in the use of Agriculture, Water bodies and Forest LULC categories. The calculated areas by satellite images shows that the total area under agriculture was 87.00 sq. km. in 2008 which decreased to an extent of 44.12 sq. km. in 2016 and the agriculture area has decreased by 3.9 % by 2016. Forest also same decreased manner with 5.3 % change was happen from 2008 to 2016. Finally the change in the water body areas is approximately 0.02 % only.

The positive increase in the Settlements and Barren/Fallow land has happen in these LULC categories. And the settlements are increased from 0.8 sq. km. in 2008 to 1.9 sq. km. in 2016 which shows an 1.1 % increase in urban expansion by 2016. Whereas the Barren/Fallow land category has increased by 8.3 % by 2016 this is simply because the most of the rainfed areas was not covering with vegetation.

CONCLUSION

In the K.V.B. Puam Mandal, Chittoor district of Andhra Pradesh. Accordingly Srikalahasti famous place of lord Shiva temple, nationwide known as dhakshinakhasi is the major reason for increase of population and urbanization in Thottambedu and K.V.B Puram along with Srikalahasti. Therefore above said reasons are affecting to convert urban surroundings Agricultural land, Forest and Barren-Fallow land into settlements (Built up Area). As well as real-estate boom and effective utilization and wide exploitation of ground water in this region is one of the reason of is to convert agricultural land as a Barren-Fallow land and Forest land and water bodies are converting as Agricultural land for the reason of land encroachment. Further to this region industrial corridor like Sri city Special Economic Zone is one more factor for agricultural to built up and barren/fallow land conversion. This study inferred that satellite data has the unique ability to recognize the changes in the land use rapidly and precisely.

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