INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact Factor: 6.078

(Volume 8, Issue 2 - V8I2-1169)
Available online at: https://www.ijariit.com

Land use and land cover change due to mining activities in Ramagundam Area, Telangana State, using Change Detection Analysis

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ABSTRACT

Mining is going on continuously land use and cover studies are of vital importance, the present study is utilized Multi Spectral / multi-temporal data of Indian Remote Sensing Satellite (RS) geo-coded False Colour Composite (FCC), RESOURCESAT-2 LISS IV data 8th Feb 2012 and 10th May 2018 for land use and land cover mapping Survey of India Toposheet No 56N/5 On Scale 150:000 were used to derive the base map which was overlaid on the FCC for Land use, land cover mapping. Through visual interpretation and delineation of 7 land use land cover categories such as Vegetation, Village, Mining Area, Urban Cover, Barren Land, Forest, and Water Bodies. Ground truths verification was indicted in the key areas. The Comparative Analysis of land use/land cover derived from 2012 to 2018 data shows that loss of Tanks area and due to the Expansion of Coal mining activity, Settlement area has also interested from 14 km in 2012 to 55km, mining area increased from 48 km to 67 km from 2010 to 2018 as a result of coal mining areas.

Keywords: *Land Use Land Cover, Change Identification, Minting Activities, Urbanization, Remote Sensing and GIS*.

1. INTRODUCTION

Land use and land cover (LULC) constitutes a key variable of the Earth's system that has in general Shown a close correlation between human activities and The physical environment (Styers et al. 2009; Otaket And Blascke 2010). The fast development of human Societies, particularly since the beginning of Industrial Revolution, has intensified different types of human activities that have resulted in a Steady and significant effect on LULC (Zhang et al. 2010). As natural and semi-natural Habitats are continuously exposed to the growing Pressure due to various anthropogenic activities. Conservation and sustainable

land use has become A priority (Antwi et al, 2008) Quantifying the Temporal and spatial patterns of LULC change and its corresponding consequences have also been it is widely recognised as an important issue in land-change-related sciences.(Latifovic et al. 2005). Land is the most important physical parameter for any development activities of any nation, Land use/ Land cover is an important indicator for Regional Environmental change, it shows the influence of human activities on the physical environment. Land Use/Land cover changes area widespread and Accelerating process. Mainly due to natural processes and anthropogenic activities, which in turn drive

The rapid increase of Mining surrounding area of land use/land cover causes Environmental degradation to the landscape that changes the natural ecosystem. Anthropogenic activities are largely responsible for Land use/land cover changes such as land quality, Environmental change, and interaction of Human and natural driving forces. Coal extraction From the Earth's surface sub-surface through Mining operation tends to make a prominent impact on the Landscape, environment, and biological community. Mining activity may lead to water pollution, which can be monitored indirectly by green vegetation, (Latifovic et al. 2005: Du et al. 2010). Massive transfers of overburden material from land surface mining result in aesthetic degradation of the natural landscape (Gesch 2005). Remote Sensing technology has been widely used since the past few decades to monitor land use/land cover changes in time and space. The change Detection method can be used to monitor land use Land cover changes and to build a Spatio-temporal Pattern of change, By Using multi-date imagery, we can have a better understanding of the cause and impact of the Change. Remote

sensing becomes the only alternative to field observations in cases where a historical record is needed for studying mining and reclamation activities (Latifovic et al. 2005).

Change detection compares spectral signature differences between images obtained of the same location over time (Don, 2011). To discover the change, the precise procedure entails superimposing maps from multiple time periods on top of one other (Jessica et al., 2001). Change detection can be conducted using visualization and mapping techniques (Lunetta et al. 1998). Visualization techniques involve the interpretation of source data in order to reveal change events for specific purposes. Mapping techniques are automated data extraction methods that result in datasets that can be used to map and quantify changes. To detect and quantify mining activity and reclamation in the study sites, both approaches were utilized. The analysis was applied to the land cover maps derived. The present study makes an attempt to quantify land use/land cover change in Ramagundam mining area using multitemporal remote sensing data, support by topographical maps, Census of India, Revenue records, and ground truth data as other inputs. The main objective of the present study is to understand the dynamics of land use/land cover changes in time and space, in the back drop of coal mining activities.

2. STUDY AREA

The Study area Ramagundam falls in Survey of India toposheet No 56N/5 and bounded by latitudes 18° 35 to 18° 55' N and Longitudes 79° 15' to 45° 00' E, it lies in between Karimnagar and Adilabad district of Telangana State. The area is well connected from Hyderabad /by rail from Secunderabad to Mancherial Railway Station is about 244 km from Hyderabad and well connected by Road from karimnagar to Mancherial highway. Ramagundam Coal mine currently operation is divided into 4 regions viz. Medipally Open Cast, OC-1, OC-2, OC-3. The geological sequence of the area is represented by series of formations that have been recognized on broad lithic characteristics within the Gondwana rocks of Singareni coal feild.

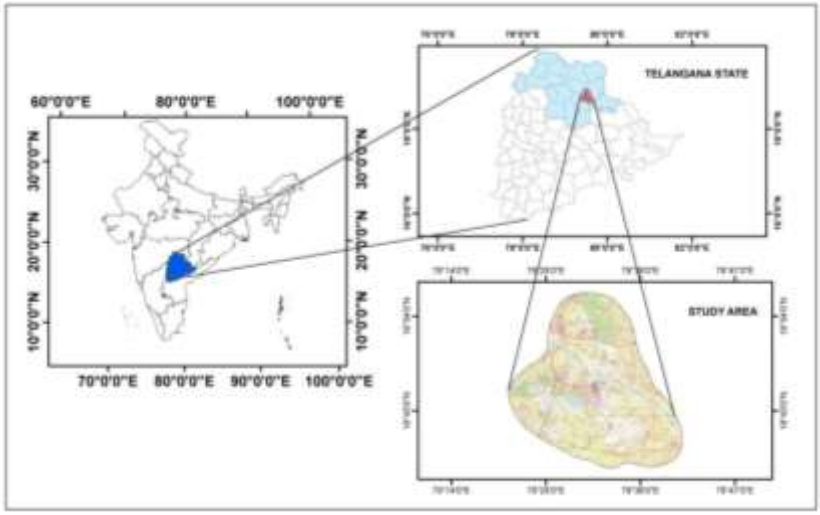


Fig. 1: Location map of the study area.

3. MATERIALS AND METHODS

To analyze the land use /land cover change in the study area, Indian Remote Sensing Satellite (IRS) geo coded false colour composite (FCC) RESOURCESAT-2 LISS IV data 8th Feb 2012 and 10th May 2018 were used, data from the same season gives uniform spectral variations, in spectral reflectance of land cover types. The survey of India topographic sheets no 56N/5 on scale 1: 50:000 was used to derive the base map. The methods and techniques used to monitor the land use\land cover change include visual.

Land-use / Land-cover change due to mining actvities

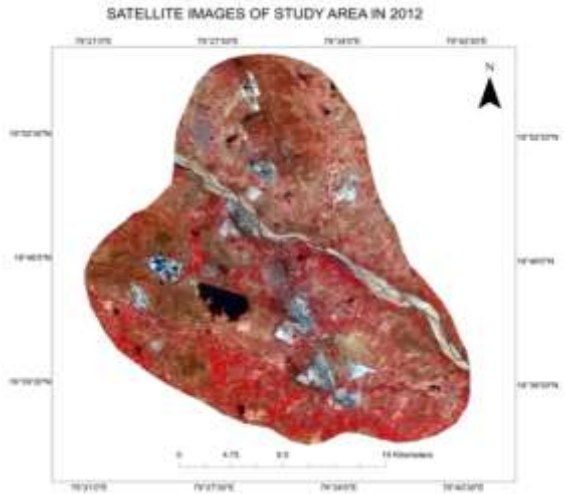


Fig. 2: Satellite image IRS LISS IV 2012

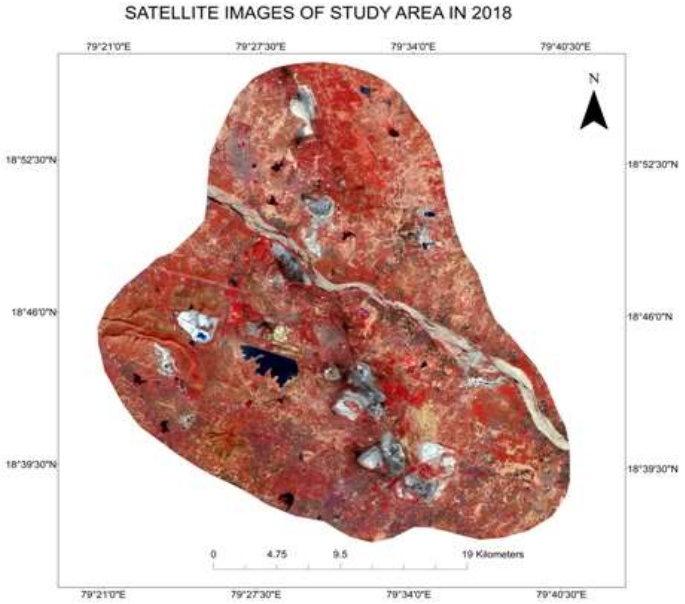


Fig. 3: Satellite image IRS LISS IV 2018

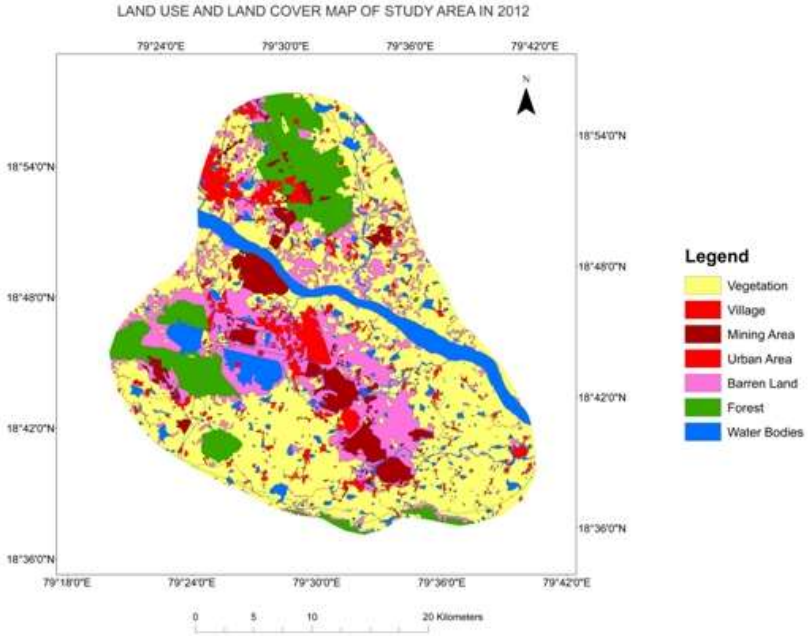


Fig. 4: Land use / Land Cover map of year 2012

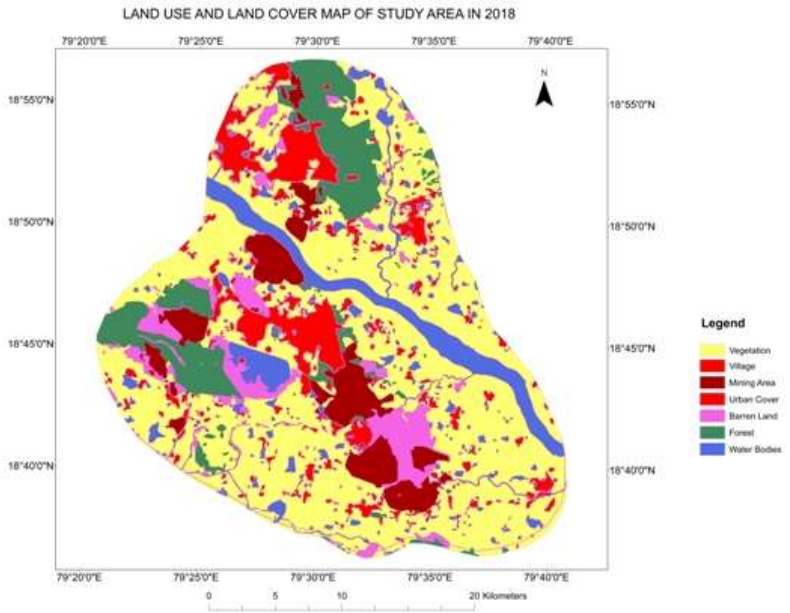


Fig. 5: Land use / Land Cover map of year 2018

Land-use/Land-cover changedue to opencast and underground minng activities

Table 1: Details of land see/land cover changes in the study area during 2012-2018 Land use categories Land use/Land cover RESOURCESAT-2 LISS IV

Land use categories	Land use/ Land cover RESOURCESAT-2 LISS IV 2012 (Area in Km2)	Land use/ Land cover RESOURCESAT-2 LISS IV 2018 (Area in Km2)
	2012	2018
Vegetation	383	436
Village	64	24
Mining Area	48	67
Urban Cover	14	55
Barren Land	121	115
Forest	115	88
Water Bodies	109	69

Interpretation and change detection analysis. Visual image interpretation is the major tool for getting information about land use/land cover from Satellite data various photographic and geotechnical elements such as tone, texture, shape, size, association, drainage, landform and soil and vegetation etc., are used to identify and delineate the different land use/land cover classes, land use /land cover change information can be obtained by either image to image comparison or map to map comparison, the image to image comparison will give or provide much information in the present study image to image comparison was used for land use/ land cover change detection.

The image of both the composite years (2012 and 2018) the false colour (FCC) fcr visual interpretation which led to the identification and delineation of 7 classes of land use/land cover namely Vegetation, Village, Mining Area, Urban Cover, Barren Land, Forest, and Water Bodies. These Categories were identified on the basis of visual interpretation of satellite imagery and subsequently, ground truth verification was done in the area. The map were then digitized and the database of land maps has been created using ArcGIS 10.8 software. The steps followed for analysis area. Digitization of land use b. Creation of polygon topology assigning unique identity (id) for each polygon and c. Editing area statistics of land use categories in sq.km., as well as in percentage. The change in the extent of different land use categories during the period from 2012-2018 was analyzed and computed.

4. RESULTS & DISCUSSION

The land use /land cover categories delineated in the study area are Vegetation, Village, Mining Area, Urban Cover, Barren Land, Forest, and Water Bodies. (Table 1.) Shows the change in land use/land cover statics in (km²) that was evident during the period 2012 to 2018. The results of the land use/land cover analysis are also graphically represented in the bar diagram (Fig.1).

Water bodies

Water bodies can be interpreted from the FCC Satellite Image by its light bluish – dark black tone. Smooth texture and irregular shape, the tanks cover an area of 109 sq.km of the total area during 2012 and 69sq.km during 2018, tanks shows a decrease of 40 km2 in the area from 2010 to 2018 during eight years. Most of the coal mining activities are taking place in tanks area because of it tanks are losing its volume and increase in mining activities.

Forest

Forest is generally recognised on FCC by its light red greenish colour, smooth medium texture, and contiguous to noncontiguous pattern with an irregular contour. Forest cover an area of 115km of the total area in 2012 was has remained same as 88km² of the total area in 2018.

Vegetation

Healthy Crops Cultivated can easily identify through remote sensing images and cropland in the study area is under kharif crops in this season which are Jowhar, Channa, and Cotton. Cultivated cropland is recognized on the FCC, by its red-light greenish tone, smooth-texture having noncontiguous pattern with regular-sub regular outline shape, cropland land which was 383km² in 2012 has been increased to 436km² in 2018. Due to stability in rainfall and interest of the farmers, it has gained some percentage.

Barren land

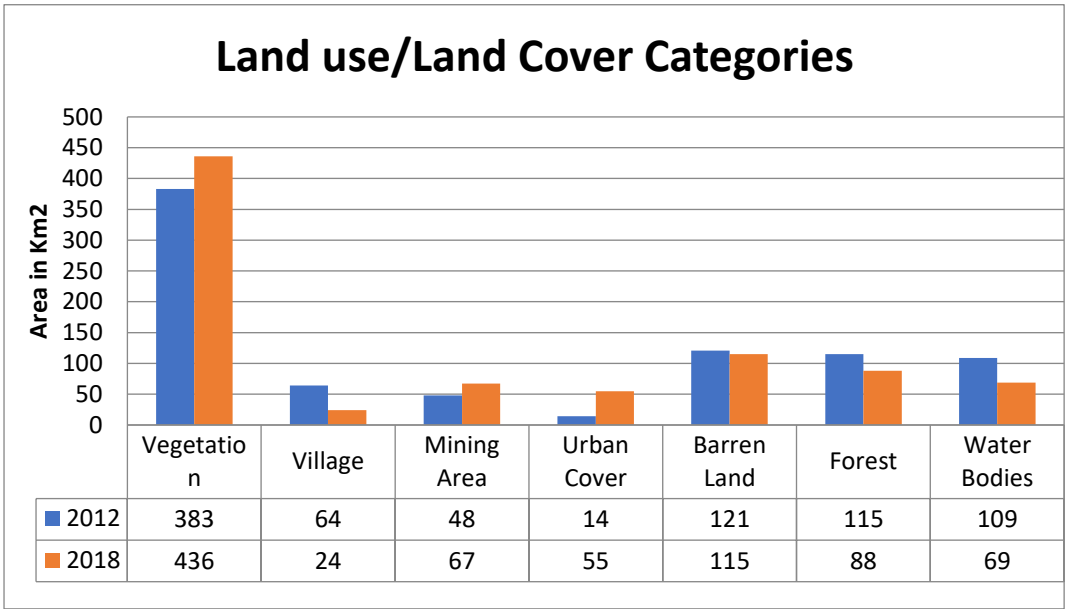
Barren Land on the FCC can be identified by its pink light yellow tone, coarse to medium texture scattered pattern, and irregular outline boundary. Open scrub also shows areas of 121 km² in 2012 and in 2018 it decreased to 88 km² areas. Open scrub are mostly on the plain area.

Villages & cities

The Urban settlement area is situated mostly in the center of mining area in the plain area. It is identified on FCC by its cyan-light grey tone, coarse texture scattered pattern, and irregular outline, the urban settlement occupies an area of 14km²in 2012 and increased to 55km² in 2018. The village area 64 km² in 2012 and 24 km² in 2018, decreased of the area because of migration of people towards the urban areas and the increase in settlement area is due to the development of the Industrial sector (SCCL and NTPC) which requires residential colonies, Industrial buildings, schools, community halls, etc, and increase demand for labour work has attracted people from other states to settle in this industrial Belt resulting in expansion of village, towns, and plants in the surrounding have also adversely Cities.

Mining

Coal mining is a prominent activity in the area due to abundant coal deposits. Mining areas interpreted on FCC by its black tone, medium to smooth texture have curvilinear pattern and irregular shape where the area under it is 2012 is 48 km and in the year 2018, it is increased to 67km².



	Vegetation	Village	Mining Area	Urban Cover	Barren Land	Forest	Water Bodies
2012	383	64	48	14	121	115	109
2018	436	24	67	55	115	88	69

5. CONCLUSION

The Present study has revealed that considerable land use/land cover changes have taken place in and around Singareni Collieries Company Limited (SCCL) coal field during 2012 to 2018. Before three decade the coal mining and other industrial activities the region was covered with water bodies mostly. Coal mining on a large scale has drastically altered the pre-mining environment.. The mining shows increase of 19 km² during eight years which is due to rapid increase in the coal production forest are going to decrease but plantations at overburden dumps under reclamation schemes have also been going on. In addition to mining activities, the industrialization especially thermal power plant in surrounding have adversely Affected the land use/land cover, air and water quality of the study are due to the discharge of waste chemical effluents. It may be concluded that the land use/land cover change in the Singareni colleries company limited (SCCL) coal field has taken place due to the rapid expansion of mining and industrial activity during the period 2012 to 2018. This has resulted in the rapid changes in the land cover dynamics of the ecosystem.

In conclusion, our study can potentially provide basis for mine reclamation planning and monitoring in the studied areas, provided that satellite data at short intervals, can be made available. Change detection analysis can best be utilised for environmental degradation

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