

Landuse and Landcover analysis using Remote Sensing and GIS: A case study in Uravakonda, Anantapur District, Andhra Pradesh, India

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Abstract - Digital change detection techniques by way of using multi-temporal satellite imagery facilitates in information landuse dynamics. The present look at illustrates the spatio-temporal dynamics of Land use/cover of Uravakonda, Anantapur District, Andhra Pradesh India. Landsat satellite imageries of two special time intervals, Landsat Thematic Mapper (TM) of 2000 and 2010 have been obtained via Global Land Cover Facility Site (GLCF) and earth explorer website and quantify the changes in the years 2000-2001 to 2009-10 over a length of 10 years. Supervised type method has been employed using most chance techniques in ERDAS imagine. The images of the area have been categorized into five exceptional classes, specifically vegetation, agriculture, barren, built-up and water body. The outcomes indicate that over the past 10 years, Barren/Waste Land and built-up land have been changed by 8.00% (31.5 Sq km) and 3.5% (13.8 Sq km) while agriculture, plants and water body have decreased by 6.4% (25.5 Sq km), 4.3% (16.8 Sq km) and 0.7% (2.8 Sq km), respectively.

Key Words: Land use/ Land cover, Remote Sensing, Digital change detection techniques, Landsat Imagine.

1. INTRODUCTION

Landuse/cover is two different technologies which are often used interchangeably (J.SRawat et al., 2015). Landcover refers to the physical characteristics of the Earth's surface, captured the distribution of vegetation, water, soil and other physical features of the land, including those created merely 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 the accent on the functional role of the land for economic activities. The landuse/cover pattern of a region is an outcome of natural and socio-economic factors and their utilization by man in time and space. Landuse/cover resulting the demands of increasing urbanization and results to increasing of population in presents years. Changes in land cover by land use do not necessarily imply degradation of the land. However, many shifting land use patterns driven by a variety of social causes, result in land cover changes that affects biodiversity, water and radiation budgets, trace gas emissions and other processes that come together to affect the atmosphere and biosphere (Riebsame et al., 1994). Land use/cover change

detection is very essential for better understanding of landscape dynamic during a known period of time having sustainable management. Land use/cover changes is a widespread and accelerating process, mainly driven by natural phenomena and anthropogenic activities, which in turn drive changes that would impact natural ecosystems (Ruiz-Luna et al, 2003; Turner and Ruscher, 2004) Understanding landscape patterns, changes and interactions between human activities and natural phenomenon are essential for proper land management and decision improvement. Today, earth resource satellite data are very applicable and useful for land use/cover change detection studies (Yuan et al., 2005; Brondizio et al., 1994).

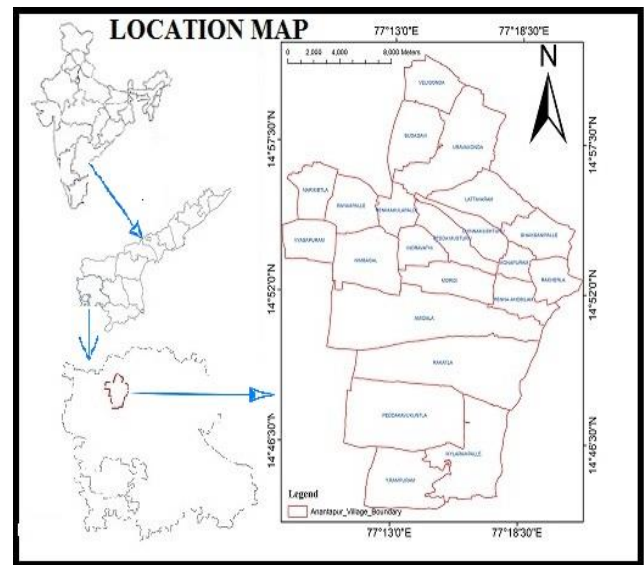
Landuse/cover is one of a kind technology which might be regularly used interchangeably (J.SRawat et al., 2015). Landcover refers to the physical characteristics of the Earth's surface, captured the distribution of plant life, water, soil and other physical features of the land, along with the ones created merely via human sports e.g., settlements. While land-use refers to the way in which land has been utilized by human beings and their habitat, usually with the accessory on the useful function of the land for economic activities. The landuse/cover sample of a vicinity is an final results of natural and socio-economic factors and their utilization by means of man in time and area. Landuse/cover ensuing the needs of growing urbanization and consequences to increasing of population in present years. Changes in land cover by land use do not always imply degradation of the land. However, many transferring land use patterns driven through a diffusion of social causes, result in land cover modifications that impacts biodiversity, water and radiation budgets, trace gasoline emissions and other processes that come collectively to have an effect on the atmosphere and biosphere (Riebsame et al., 1994). Land use/cover change detection may be very crucial for better understanding of landscape dynamic during a known period of time having sustainable management. Land use/cowl adjustments is a sizeable and accelerating technique, specially pushed by way of herbal phenomena and anthropogenic sports, which in flip drive modifications that could effect herbal ecosystems (Ruiz-Luna et al, 2003; Turner and Ruscher, 2004) Understanding landscape styles, changes and interactions among human activities and natural phenomenon are critical for correct land control and choice development. Today, earth useful resource satellite imageries statistics are very

applicable and beneficial for land use/cover alternate detection studies (Yuan et al., 2005; Brondizio et al., 1994). The modern era of remote sensing consists of each aerial as well as satellite based systems which gather collect physical data on a repetitive basis with speed along with GIS helps us to research the information spatially producing diverse modeling, thereby optimizing the whole planning procedure. Application of remotely sensed information made possible to study the various changes in land cover in less time with higher accuracy. (Sreenivasulu.G et al 2014). Remote sensing and geographical information systems (GIS) are influential tools to originate precise and timely information on the spatial distribution of land use/ land cover changes over huge areas (Selcuk Reis, 2008) flexible environment for capturing, storing, checking, integrating, manipulating, analyzing, and displaying geographic data necessary for change detection. The land use/land cover pattern of a region is an result of natural and socio-economic factors and their exploitation by man in time. Land is becoming a scarce resource due to vast agricultural and statistic pressure. Hence, information on land use/ land cover and possibilities for their optimal use is essential for the selection, planning and ratification of land use schemes meet the expanding demands for basic human needs. This information also assists in monitoring the dynamics of land use resulting out of changing demands of increasing population. (Sreenivasulu.G et al 2014). In this fact studies on land use land cover change detection are necessary to understand the presented situation and plan for the prospect generation.

2. Study Area:

Study area lies in the north western part of Anantapur district, a highly drought affected region. The study area is located in the Survey of India Toposheet Nos: 57 F/1 and 57 F/5 on 1:50,000 scale and lies between North longitudes 77° 10' to 78° 20' and East latitudes 14° 45' to 15° 00' (Fig.1). The study area comprises total geographical area of 395.17 sq. km and covers parts of Amidala, Chinnamustur, Uravakonda, Lathavaram, Konapuram, Nerimetla, Renimakulapalli, Vyasapuram etc villages. The study area comprises pink granites, schists, composite gneisses of Dharwar intruded by a few pegmatite dykes and abundant dolerite dykes and the possible diamondiferous volcanic pipes. The major geomorphic units of the study area are denudational hills, dissected pedimonts, pediplain and alluvium.

Fig 1 Location map of the study area.



3. Material and methods:

3.1. Database preparation

Landsat Thematic Mapper at a resolution of 30 m of 2000 and 2010 were used for land use/cover classification. The satellite data covering the study area were obtained from NRSC (<http://bhuvan.nrsc.gov.in/data/download/index.php#>) and earth explorer site (<http://earthexplorer.usgs.gov/>). These data sets were imported in ERDAS Imagine, satellite image processing software to generate a false color composite (FCC). The layer stack selection in the image interpreter tool box was used to produce FCCs for the study area. The sub-setting of satellite images were performed in the extracting study area from both images by taking Geo-referenced out line boundary of the study area map as AOI (Area of Interest).

3.2. Land use/cover detection and analysis

The land use/cover classification, supervised classification method with maximum likelihood algorithm was applied in the ERDAS Imagine Software. Supervised classification methods used with remote sensing image data. This method is based on the prospect that a pixel belongs to a particular class. The basic theory assumes that these probabilities are equivalent for all classes and that the input bands have normal distributions. However, this method needs long time of computation, relies heavily on a usual distribution of the data in each input band and tends to classify signatures. Based on the signature classification five land use/cover types are identified in the study area viz., (i) vegetation (ii) agricultural land (iii) barren land (iv) built-up land (v) water body.

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4. Results & Discussion

4.1 Analysis of Landuse / Landcover by using Remote Sensing data

Change detection is an important application of remote sensing technology. This gives us the changes of detailed features within a certain time gap. For a given research purpose, when the remotely sensed data and study areas are recognized, the selection of an appropriate change detection method has considerable significance in producing a high quality change detection product. The land use/land cover categories of the study area were mapped using Landsat Thematic Mapper at a resolution of 30 m of 2000 and 2010 were used for land use/cover classification. The satellite data was visually interpreted and after making a thorough field check, the map was finalized. The various land use and land cover classes interpreted in the study area include agriculture land, built-up land, barren/waste land, vegetation/scrub and water bodies. The change detection of the study area diagrammatically illustrated in Figs. 2 & 3 and data are registered in Tables 1. Fig.2 & 3 depicts land use/cover status and land use/cover change in different land use categories.

3.2. Land use/cover detection and analysis

To work out the land use/cover classification, supervised classification method with maximum likelihood algorithm was applied in the ERDAS Imagine 9.2 Software. Supervised classification methods used with remote sensing image data. This method is based on the probability that a pixel belongs to a particular class. The basic theory assumes that these probabilities are equal for all classes and that the input bands have normal distributions. However, this method needs long time of computation, relies heavily on a normal distribution of the data in each input band and tends to over-classify signatures. Based on the signature classification five land use/cover types are identified in the study area viz., (i)

vegetation (ii) agricultural land (iii) barren land (iv) built-up land (v) water body.

3.3. Land use/cover change detection and analysis

For performing land use/cover change detection, a post-classification detection method was employed. A pixel-based comparison was used to produce change information on pixel basis and thus, interpret the changes more efficiently taking the advantage of “-from, -to” information. Classified image pairs of one different decade data were compared using cross-tabulation in order to determine qualitative and quantitative aspects of the changes for the periods from 2000 to 2010. A change matrix (Weng, 2001) was produced with the help of ERDAS Imagine software. Quantitative areal data of the overall land use/cover changes as well as gains and losses in each category between 2000 and 2010 were then compiled.

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4.2 Agriculture Land

Agriculture land with crops and plantations are consider in this class. Total agriculture land in the study area decreased from 78.4 sq.km to 52.9 sq.km (19.8% to 13.4%). Crop lands are the agricultural lands under crop. In the study area the crop lands have wet cultivation and dry cultivation. Wet cultivation includes food crops such as paddy, groundnut and vegetables, etc. Dry cultivation includes bengal gram, redgram and groundnut, etc

4.3 Vegetation/Scrub

Vegetation comprises of thick and dense scrub of trees. Vegetation/scrub is identified by their red to dark green tone and varying in size. They are asymmetrical in shape with smooth texture. The forests are found on the north west and north east parts of the study area. The over all area of vegetation decreased from 83.8 sq.km to 67.0 sq.km in one decade (21.2% to 16.9%). The study area covers mostly the dense and scrub forest. The relative concentration of scrubs, bushes and smaller trees are predominant in this category. In the satellite image such vegetation/scrub is identified by green tone with smooth texture. These lands are subject to degradation, erosion or prickly bushes, such areas are identified from their yellowish tone and their association with uplands, and their asymmetrical shapes.

4.4 Built up Land

Built up land is composed of areas of exhaustive with much of the land covered by structures and the overall area of built-up land increased from 79.1 sq. km to 92.7 sq.km (20% to 23.5%). In this category are cities, towns, villages, industrialized and viable complexes and institutions. In the study area major towns or villages are Uravakonda, Amidala, Chinnamustur, Lathavaram, Konapuram, Nerimetla, Renimakulapalli, Vyasapuram etc. The transportation facilities in the study area are roads. The highway roads are present in the area are routes between, Anantapur-Uravakonda, Urakonda-Kalyandurg, Uravakonda to Bellary and Uravakonda to Guntakal.

4.5 Water bodies

The water bodies contain both natural and artificial water features, namely streams, lakes, canals, tanks and reservoirs. The water features show black in tone in the satellite image. The shallow water and deep water features show in light blue to dark blue in color. Tanks with plantation are recognized by the square/rectangle shape and blue color tone. Small canals are identified in the vegetation area. Tanks are mostly concentrated in the middle part of the study area with few dry tanks spotted around in the eastern parts. Water bodies of the study area decreased from 7.1 sq.km to 4.3 sq.km (1.1% to 0.7%).

4.6 Barren/Waste Land

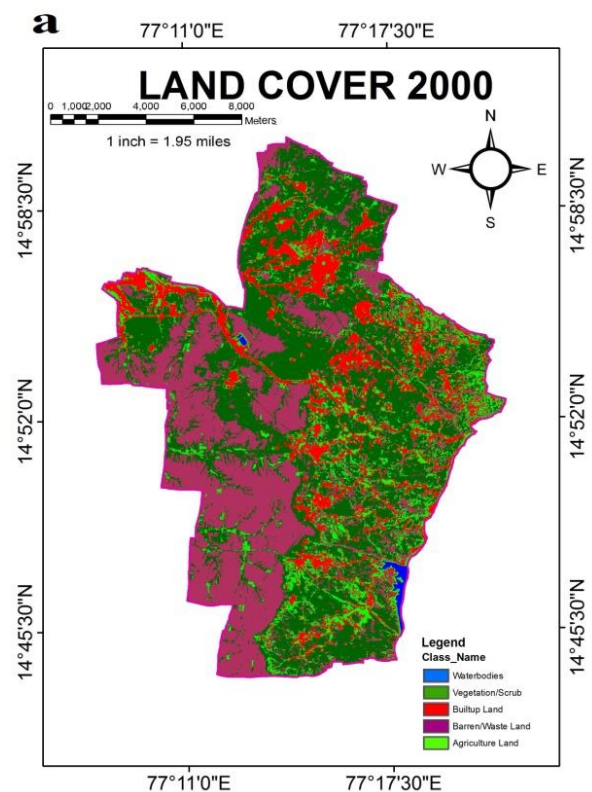
Land, which does not aid any vegetation are referred to as barren lands or waste lands. Barren rocky, salt affected land, land with and without scrub, sandy area, sheet rocks and stony regions include in this group. Such lands are formed due to the substantial properties of soil, temperature, rainfall and local environmental circumstances. The study area of barren/waste land increased from 146.8 sq. km to 178.3

sq.km (37.2% to 45.2%) in the study area and is present in the south west part of the area.

5. Conclusions

The change detection of the study advocates that multi temporal satellite imagery plays a important function in quantifying spatial and temporal phenomena which is in any other case now not possible to try through conventional mapping. study reveals that the major land use in the study area is barren/waste land. The area under barren/waste land has increased by 8.00% (31.5 sq.km) due to deforestation work during 2000 to 2010. The second major category of land in the study area is agriculture which was decreased by 6.4% (25.5 sq.km) due to adaptation in vegetation, barren land and built-up land. The third major category of land in the study area is water bodies have also decreasing. During the study period (i.e., 2000–2010), built-up land has been increased by 3.5% (13.8 sq.km) due to alteration into urbanization and industrial areas. Thus, the present study illustrates that remote sensing and GIS are important technologies for analysis and quantification of spatial phenomenon which is otherwise not possible to attempt through conventional mapping techniques. Change detection is made possible by these technologies in less time, at low cost and with higher accuracy.

Figure 2. Land use/cover status of the Uravakonda; (a) in 2000, (b) in 2010 (based on Landsat Thematic Mapper Satellite Imagery).



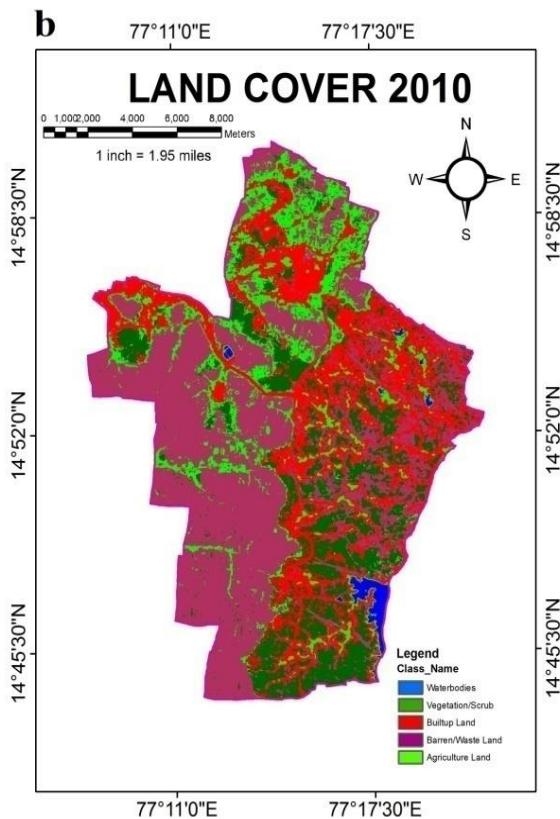
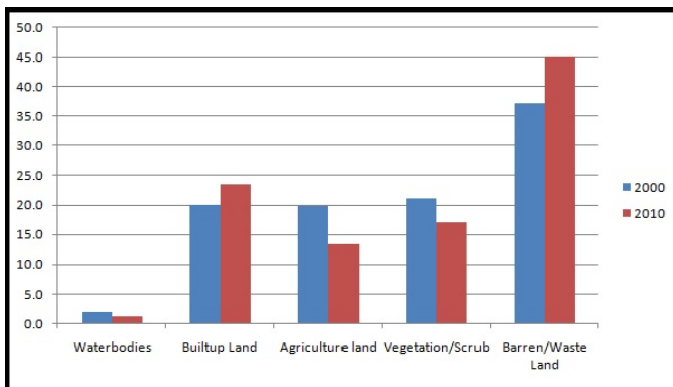


Figure 3 Graphical representation of land use/cover change in percent during 2000–2010



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Landuse/cover Categories	2000	
	Sq.km	%
Waterbodies	7.1	1.8
Builtup Land	79.1	20
Agriculture land	78.4	19.8
Vegetation/Scrub	83.8	21.2
Barren/Waste Land	146.8	37.2

Landuse/cover Categories	2010	
	Sq.km	%
Waterbodies	4.3	1.1
Builtup Land	92.7	23.5
Agriculture land	52.9	13.4
Vegetation/Scrub	67	16.9
Barren/Waste Land	178.3	45.1

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