CHANGE DETECTION OF FOREST COVER IN KHAMMAM DISTRICT, TELANGANA

G. Bhakta Thukaram, M.Tech

ABSTRACT

Land cover (LC) refers to the physical and biological cover and the surface of the land including, water, bare soil and artificial structure. Land use (LU) is a more complicated term involving human activities such as building construction that alter land surface processes including biogeochemistry, hydrology and biodiversity. Land use land cover (LULC) is an important component in understanding the interaction of the human activities with the environment and thus it is necessary understand changes, in the context of nature resource management.It is envisaged that the study would prove the usefulness of Remote Sensing and GIS in forest restoration planning.

This study aims at generation of land use land cover information using remote sensing data belonging to different time period and integration of remote sensing derived LULC information with socio-economic data to predict future scenarios in LULC pattern in the study area, using GIS capabilities.

I. INTRODUCTION

"Land Use" refers to human activities that take place on the earth's surface (how the land is being used) such as residential housing or agriculture cropping. "Land cover" refers to natural or man-made physical properties of the land surface. Both systems utilize multiple and varying classification schema with distinct overlaps and important differences.

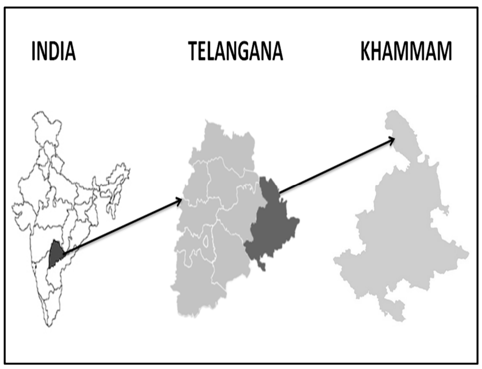
There are few landscapes remaining on the Earth's surface that have not been significantly altered or are not being altered by humans in some manner. Mankind's presence o the Earth and his modification of the landscape have had a profound effect upon the natural environment. These anthropogenic influences on shifting patterns of land use are a primary component of many current environmental concerns as land use and land cover change is gaining recognition as a key driver of environmental change. Changes in land use land cover are pervasive, increasingly rapid, and can have adverse impacts and implication at local, regional and global scales.

During the past millennium, humans have taken an increasingly large role in the modification of the global environment. With increasing numbers and developing technologies, man has emerged as the major, most powerful, and universal instrument change in the biosphere today.

Any conception of global change must include the pervasive influence of human action on land surface conditions and processes.

better understand the impact of land change on terrestrial ecosystems, the factors affecting land use must be more fully examined. Growing human population exert increasing pressure on the landscapes as demands multiply for resources such as food, water, shelter, and fuel. These socioeconomic factors often dictate how land is used regionally. Land use practices generally develop over a long period under different environment, political, demographic, and social conditions. These conditions often very yet have a direct impact on land use land cover. The interaction of nature and society and their implication on land use land cover is very complex phenomenon that encompasses a wide range of social and natural processes.

Land use and land cover change has become a central component in current strategies for managing natural resource and monitoring environmental change. Since the late 2006's the rapid development of the concept of vegetation mapping has lead to increased studies of land use and land cover worldwide. Providing an accurate assessment of the extent and health of the world's forest, grassland, and agricultural resources has become an important priority.



Viewing the Earth from space has become essential to comprehend the cumulative influence of human activities on its natural resource base. In a time of rapid, and often unrecorded, land use change, observation from space provides objective information of human utilization of the landscape. Over the past two decades, data from Earth sensing satellites has become important in mapping, and studying environmental change.

Once the areas of land use change had been delineated, an additional land assessment of these areas was conducted to determine the wisdom of such land use practices and land productivity classifications. The final hardcopy land use maps were produced in Arcview and portray the areal extent of land use land cover change in khammam District over a eight year span from 2006 to 2014. All the computer software and hardware required in this study was utilized at Telangana remote sensing application centre (TRAC),

STUDY AREA

The Khammam district is the easternmost of the ten districts of the Talanagana state. Area-wise, it is the second largest in the Talanagana Region and the third largest district in the entire state.

The district derives its name from Khammam, the district headquarters. Through the district is endowed with good rainfall, surface water resources and mineral wealth, it remained to be socio-economically backward over centuries and until fifties, perhaps due to its being far away from the capital of the rulers and being on the other bank of the Godavari River. It is heartening to note that 73.53 percent of the district population represents the rural populace whose mainstay is agriculture. It is the least literate district in the state. The district has also considerable tribal population scattered over the hilly and forest areas of the district

Location and Extent

Khammam district occupies an area of approximately 16,029 square kilometers (6,189 sq mi). Khammam District is a district in Telangana, India. It had a population of 2,797,370 of which 19.81% were urban as of 2001 census. Khammam district is located between 16 45` and 18 35` of Northern Latitude and 79 47` and 80 47` of the Eastern Longitude.

Administrative Set Up

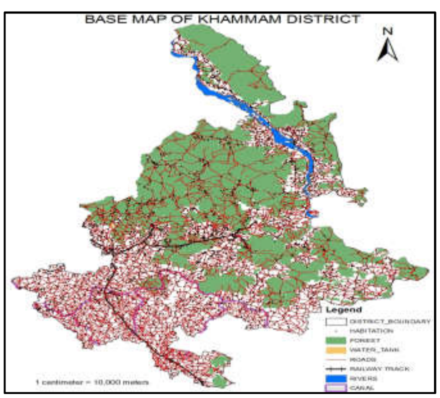
Khammam City, which was the seat of Taluk Administration, was part of the larger Warangal District, until 1 October 1953. Five taluks of the Warangal district viz., Khammam, Madhira, Yellandu, Burgampadu and Paloncha (now Kothagudem) were carved out and a new district Khammam with Khammam as District Headquarters. In 1959 Bhadrachalam Revenue Division consisting Bhadrachalam and Nuguru Venkatapuram Taluks of East Godawari district, which were on the other side of the river Godavari were merged into Khammam on grounds of geographical contiguity and administrative viability.

In 1973 a new taluk with Sathupalli as headquarters was formed carving out from Madhira and Kothagudem taluks. In the year 1976 four new taluks were formed viz., Tirumalayapalem, Sudimalla, Aswaraopeta and Khammam district was initially a part of larger Warangal District.

Administratively, Khammam is divided into 4 revenue areas and 37 Mandals.

Base Map

The base map is prepared from SOI toposheet. The base details like road network, railway track, settlements, drainage, boundary of the study the area forest boundary etc. using base map, various thematic maps are prepared.



Base map

General Description of the area

Climate:

Khammam experiences typical Indian climatic conditions. Summer season is hot and the temperatures can climb rapidly during the day. Monsoon season brings certain amount of rainfall and the temperatures gradually reduce during this period. After the onset of the monsoon day temperatures are much lower and as the winter approaches they reduce further.

The climate of Khammam district is characterized by hot summer season is from March and lasts till the end of May. During this time day temperatures are high and can reach 40 °C to 42 °C. Humidity is low as it is not located near the ocean. Conditions are generally dry during this period and the temperatures range from a minimum of 35 °C and can rise up to a maximum of 40 °C to 45 °C. Monsoon season brings much needed relief from the heat. Monsoon seasons are from the months of June to September. Temperatures average around 30 °C during this period. The place gets rain from the South West Monsoon. Some amount of rainfall can be experienced in the October as well. Winter season is from December to February. January is usually the coldest parts of the year. Temperatures range around 28 °C to 34 °C during this time during the 2015 India heat wave; Khammam experienced a maximum temperature of 48 °C (118 °F)

Physiography

The Khammam district is, by and large, characterized by undulating topography. The district exhibits very rugged topography formed by hills and fort ranges. Khammam Fort, constructed in 950 AD by the Kakatiya Dynasty, is on a hill overlooking the town, Lakaram lake Khammam city is another tourist attraction. Apart from these there are many places surrounding the town namely Bhadrachalam, Parnasala, Nelakondapalli,Kusumanchi etc.

Drainage

Though the entire district falls in the Godavari drainage basin, the Godavari River flows northern of the district forming the southern boundary of the district. the northern boundary of the district and joins the river Godavari near the corner of the district.

Geology

The Khammam district is underlain by various geological formations from the oldest Achaeans through the Gondwanas and Territories to the Recent Alluvia.

Achaeans: The Archaean crystallines are the oldest rocks met within the district. The crystalline rocks comprise granites and gneisses of pink and grey types; dolerite dykes are common in the area. Applies pegmatite and quartz veins, the end product of crystallization of granitic magma also occur as intrusive in the granites and gneisses. The crystalline rocks are exposed in the southern part (north of the Godavari River) south of Khammam and the northeast part of the district forming the basement for the younger formations. The crystalline rocks develop secondary porosity with weathering, jointing and fracturing, which property enables these rocks to become water-bearing and depth of weathering vary from place to place. The maximum depth to which the weathering extends is 1.6m below ground level.

Khammam is located at 17.25°N 80.15°E it has an average elevation of 107 metres (351 feet)

Deccan Traps: In the district, the Deccan Traps constitute a number of lava flows of basaltic composition and occur in the western and northern parts of the district. Flat toped hills and step-like terraces characterize the Trap country. Both vesicular and non-vesicular traps occur in the district. Individual flows vary in thickness from a few meters to 100m. The Deccan Traps, on weathering, give rise to the black cotton soils. The weathering at places extends down to about 10m.

Hydrogeology

Ground water occurrence in Khammam district, in almost all the geological formations through the conditions of occurrence depended on various factors. The occurrence and behaviour of ground water are controlled by the climate, distribution of rainfall, topography, geological setting, the fractures, and openings available for the recharge, movement of water through Primary and secondary of the area Porosities of the geological Hard rocks and the rest underlie more y than fifty percent of the district by the semi-consolidate sedimentary rocks and unconsolidated Alluvial deposits.

Irrigation

As per the Plan-1, about 84,000 acre will be irrigated by digging a channel from Godavari through Dummugudem-Bayyaram Palair -Marripeda. In the second plan, about 79,000 acre in Khammam district can be irrigated through Dummugudem-Rollapadu-Palair irrigation project

Agriculture

Khammam District is endowed with Agro climatic and soil conditions in which a wide range of horticulture crops like mango, banana , cashew, coconut, oil palm, cocoa, pepper etc. are grown. Production and distribution of various kinds of fruits, vegetables and flower sand their seeds are the major activities supported by the horticulture Department.

Irrigation projects include.

Agricultural land use Area (‘000 ha)

Cropping intensity % 109.7

Net sown area 453.4

Area sown more than once 44.0

Gross cropped area 497.4

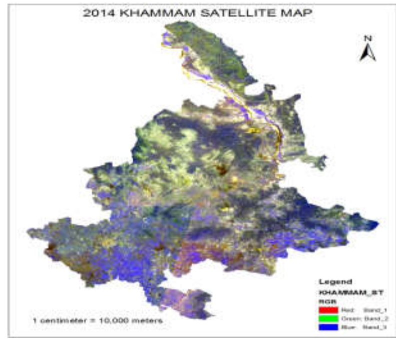
Soil

Red loamy soils of granitic origin cover the Archean country. Shales, limestone and to some extent sandstones of the Penganga and Sulluvai series yield fine, red or grey dusty to loamy soils. The soils over barakars and kamthis are coarse and reddish whereas those on Talchirs are fine and sandy with a yellowish tinge. The thickness of the soil over all formations rarely exceeds 1.5m except over gondavanas where it found to extend up to 5m.the traps on weathering give rise to deep brown or black cotton soil. In these, study area covers mainly moderate deep calcareous block soils and moderately gravelly clayey, deep dark brown soil, reddish soils.

II. OBJECTIVES AND METHODOLOGY

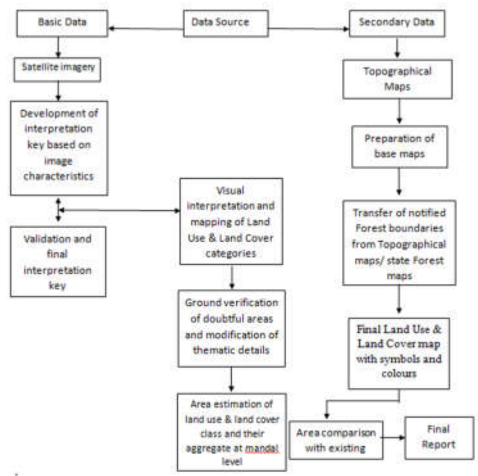
Objectives

- To Generation of land use land cover information using remote sensing data belonging to different time periods 2006 to 2014
- To determine the trend, rate location magnitude of land use land cover change
- Integration of remote sensing derived LULC information with socio economic data to predict future scenarios in LULC patterns in the study area
- To study and analyze the probable areas of LULC



Khammam Satellite Map

Flowchart



Flow Chart Showing Methodology for Mapping Land Use/Land Cover

The methodology of the study involved

1. Creation of base layers like district boundary, road network, drainage network, contours, mapping of water bodies, etc. from the SOI toposheets of scale 1:250000 and 1:50000.

2. Extraction of bands (Landsat TM with 30 m resolution of 1986 and LISSIII with resolution 23.5 m of 2003) from the data procured from NRSA.

3. Identification of ground control points (GCP's) and geo-correction of bands through resembling.

4. Cropping and mosaiming of data corresponding to the study area.

5. Computation and analysis of various vegetation indices.

6. Generation of FCC (False Colour Composite) and identification of training sites on FCC.
7. Collection of attribute information from field corresponding to the chosen training sites using GPS.
8. Classification of remote sensing data (1986 and 2003): Land cover and land use analyses. 9. Change detection analysis using different techniques (Image differencing, Image rationing, etc.).
10. Detection, visualisation and assessment of change analysis.
11. Statistical analysis and report generation.

III. RESULTS AND DISCUSSIONS

Land Use & Land Cover Classification

Land use and Land Cover maps have to be prepared adopting visual or digital interpretation techniques in conjunction with collateral data such as topo maps and census data. If the digital method is followed then digital output is converted into line maps with corresponds to other theme maps. The total number of classes are would vary from area to area. The imagery has to be interpreted and ground checked for corrections.

Land Use and Land Cover maps can be prepared adopting the following classification system. Digital image processing is the numerical manipulation enhancement and classification, pre-processing refers to the initial processing of the raw data to calibrate the image radiometry, correct, geometric distortion and remove noise the nature of the particular pre-processing required obviously depends strongly on the sensor characteristics

Supervised classification is much more accurate for mapping classes, but depends on heavily recognition and skills of the image specialist. There is a simple; specialist must recognize conventional classes, real and familiar, or meaningful, but somewhat artificial classes, in a scene from prior knowledge, such as personal experience with the region, by experience with thematic maps or imageries or by on-site visits. These familiarities allow the specialist to choose and set up discrete classes (thus supervising the selection) and the assign them category names the specialists also locate training site on the image to identify the classes' Training sites are area representing each known land cover category that appear correctly homogeneous on the image as determined by similarity in tone or color within shapes delineating the category specialists locate and tracing them with polygonal boundaries drawn using the computer mouse on the image display, for each class thus outline, mean values and variances of the for each band used to classify them are calculated from all the pixels enclosed in the site, more than one polygon can be established for any class, the result is a spectral signature or spectral response curve for that class, in reality the spectral signature is for all of the materials within the site that interact with the incoming radiation, classification now processed by statistical processing in which every pixel is compared with the various signatures and assigned to the class whose signature comes closest, a few pixels in a scene do not match and remain unclassified, because these may belong to a class not recognized or defined.

Built-up land:

Built-up land comprises of developed areas like Built-up buildings, industrial structures, and transportation network etc. the physical size or built-up land sprawl with transport network can be surrogate to classify settlements urban or rural. It is identifiable on the imagery by its dark bluish tone, definite size, shape and texture. Often built-up land with high density of buildings etc, appear in dark tone at the centre and lighter on the peripheries, because of being less dense and less developed. Transport network appear in shades of dark bluish green to light yellow (umettled or kaccha roads) to red (wherever vegetation occurs along the road) in color.

Agriculture land:

This is sub-divided into cropland, fallow land and plantation.

a) Cropland: The tonal contrast of cropland varies from bright red to red which may signify greenness of the foliage different stages of crop growth. ears yellow to greenish blue tone

b) Fallow land: It app ils and moisture depending on the topology, nature of so content on the ground .It appears light tone in sandy red soils and in coastal soils and dark tone in alluvial black cotton and soils rich in clay.

c) Plantations: These appear in dark red to red tone, small in size with regular shapes with sharp and smooth edges.

Forest:

a) Evergreen/ semi -evergreen forest:

b) These appear in bright red to dark red tone in all months of the year.

c) Deciduous forest: It is observed dark red to red tone (during maximum greenness period) except during the month of leaf fall in dry season/ autumn when the tonal changes occur.

d) Degraded or scrubland: It appears light red to dark brown tone.

e) Forest blank: Forest blanks appear distinctly on the imagery in light yellow to light brown tone, small in size with regular to irregular shapes.

f) Forest plantations: It appears light red to red in tone depending upon the foliage cover stage of growth and season etc.

g) Mangroves: It appears bright red to red in tone, small in size with irregular and discontinuous shapes, smooth to medium in texture and contiguous to linear.

Waste land

This can be sub-divided into salt affected land, waterlogged land, marshy/ swampy land, gullied/ ravenous land, land with or without scrub, sandy area, and barren rocky/stony waste sheetrock area.

a) Salt affected land: It appears white to light blue (subject to moisture content) tone, small to medium size, irregular discontinuous shape.

b) Waterlogged land: Light to dark blue tone (subjected to water spread and organic matter) varying in size, irregular and discontinuous shape.

c) Gullied / ravenous land: It appears light yellow to bluish green tone, irregular broken shape.

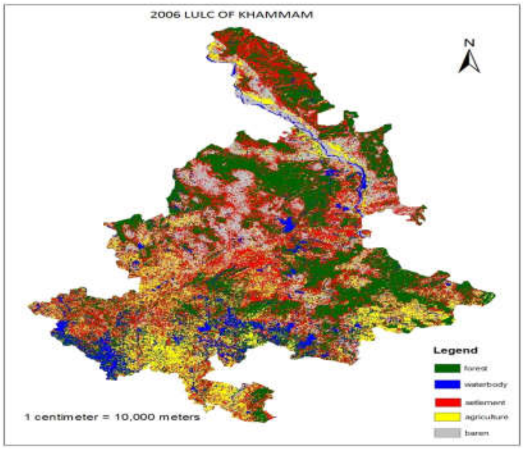
d) Land with or without scrub: Light yellow to brown to greenish blue, varying in size, irregular discontinuous shape.

e) Sandy area: White to light blue tone, regular to irregular shape.

f) Barren rocky land: Greenish blue to yellow to brownish, irregular and discontinuous shape.

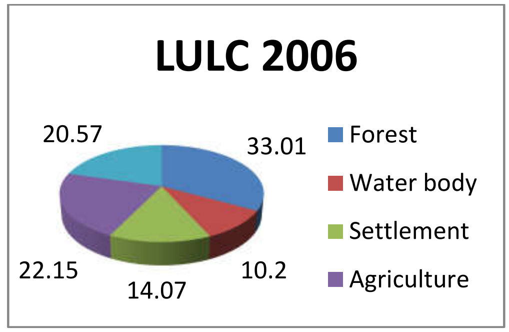
Water body

It appears in black color, irregular shape. Land use/ Land cover map is prepared from SOI toposheet base map. The base map is placed on satellite imagery and the only outlet is determined and all built —up land, agricultural, land forest, wastelands, water bodies are recognized.



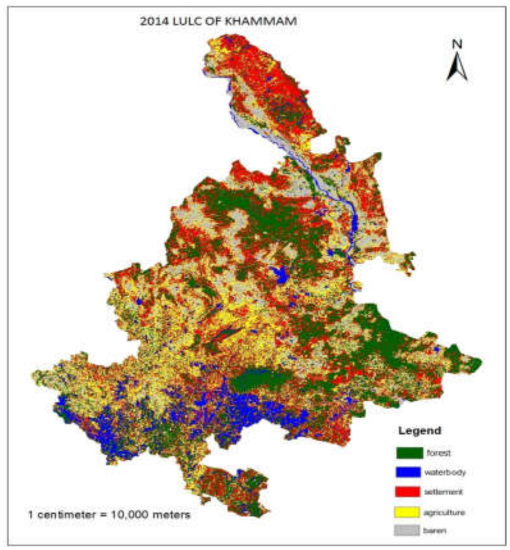
2006 LULC

Areal Extent of land use land cover 2006



Pie chat of land use land cover 2006

Description	Area **(Km^2)**
Forest Plantation	302.94
Forest	5841.20
Built Up(Urban)	19.45
Built Up(Rural)	241
Mining/Industrial	73.5
Agriculture Plantation	450.6
Aquaculture/Pisciculture	1.85
Agriculture Crop land	4715
Transportation	5.45
Barren	10.21
Scrub Land-Dense	16.11
Scrub Land-Open	745.58
Gullied/Ravenous	2.87
Salt Affected Land	6.57
Sandy Area	1.52
River/Stream/Dam	415
Reservoir/Tanks	272.52
Lakes/Ponds	5.74
Canal	16.32

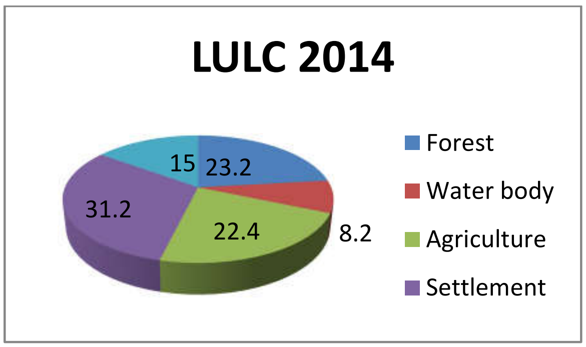


Area Extent of land use / land cover 2014

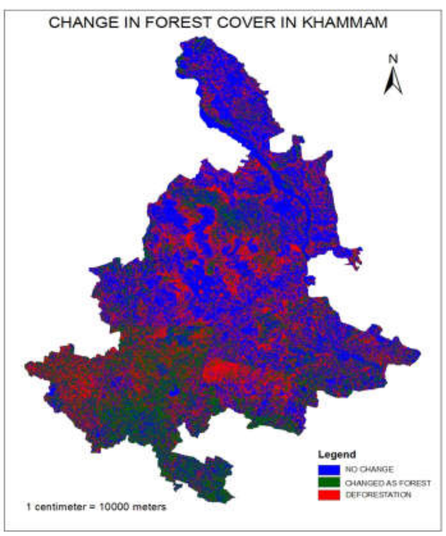
Description	Area **(Km^2)**
Forest Plantation	205.94
Forest	4533.75
Built Up(Urban)	28.75
Built Up(Rural)	296.55
Mining/Industrial	63.49
Agriculture Plantation	540.72
Aquaculture/Pisciculture	2.04
Agriculture Crop land	5959.48
Transportation	7.81
Barren	12.88

Scrub Land-Dense	16.11
Scrub Land-Open	605.42
Gullied/Ravenous	2.85
Salt Affected Land	6.31
Sandy Area	0.59
River/Stream/Dam	335.18
Reservoir/Tanks	288.08
Lakes/Ponds	2.83
Canal	16.32

Area Extent of Land use land cover 2014



pie chat of land use land cover 2014



Change detection of LULC

IV.NORMALIZED DIFFERENCE VEGITATION INDEX (NDVI)

Before chapter discuss about Land Use Land Cover study this study will determine the information about Settlements, Barren land, Water body and also find out Agriculture and Forest but this Project concerned find out one of the factor is vegetation changes so what changes in vegetation find out in more accuracy choose this process (NDVI).

The Normalized Difference Vegetation Index (NDVI) is a numerical indicator that uses the visible and near-infrared bands of the electromagnetic spectrum, and is adopted to analyze remote sensing measurements and assess whether the target being observed contains live green vegetation or not.

In an effort to monitor major fluctuations in vegetation and understand how they affect the environment, 20 years ago Earth scientists began using satellite remote sensors to measure and map the density of green vegetation over the Earth. Using NOAA's Advanced Very High Resolution Radiometer (AVHRR), scientists have been collecting images of our planet's surface. By carefully measuring the wavelengths and intensity of visible and near-infrared light reflected by the land surface back up into space, scientists use an algorithm called a "Vegetation Index" to quantify the concentrations of green leaf vegetation around the globe. Then by combining the daily Vegetation Indices into 8-, 16-, or 30-day composites, scientists create detailed maps of the Earth's green vegetation density that identify where plants are thriving and where they are under stress (i.e., due to lack of water).

In this technique, the change image is obtained by taking the differences of the Vegetation indices computed for multiple dates of images with using this technique. A vegetation index is common spectral index that identifies the presence of chlorophyll. The index is composed of reflectance in the red spectral region (620 to 700 nm) and a portion (700 to 1100 nm) of the near –infrared (NIR) spectral region.

Spectral satellite measurements in the red and infrared channels must be atmospherically corrected for interference from aerosols. Chlorophyll has a relative low reflectance in the red part of the electromagnetic spectrum (strong absorption) and relatively high reflectance in the near- infrared channels have been formulated.

The Normalized Difference Vegetation Index (NDVI) is a simple numerical indicator that can be used to assess whether the target being observed contains live green vegetation or not. Thus, NDVI was one of the most successful of many attempts to simply and quickly identify vegetated areas and their "condition," and it remains the most well-known and used index to detect live green plant canopies in multispectral remote sensing data. The normalized difference vegetation index (NDVI) is computed for each image.

$$NDVI = ((NIR - RED) / (NIR + RED))$$

Where

NIR is the near-infrared band

RED is the red band

The difference between the vegetation indices computed separately for each image gives a measure of the vegetation change in the area

NIR is the near-infrared band

RED is the red band

Procedure for NDVI

Open raster menu in ERDAS 10.1 And go to unsupervised then select NDVI potion.

Input raster layer then find output path in NDVI window.

Define sensor spot XS/XI and press ok then process will run.

Open the output NDVI image in viewer and add colours in attribute table and save.

Now open NDVI image in pseudo colour mode. Go to radiometric select rescale option.

Now input NDVI image in rescale window and define output in unsigned 16 bit format and then press ok.

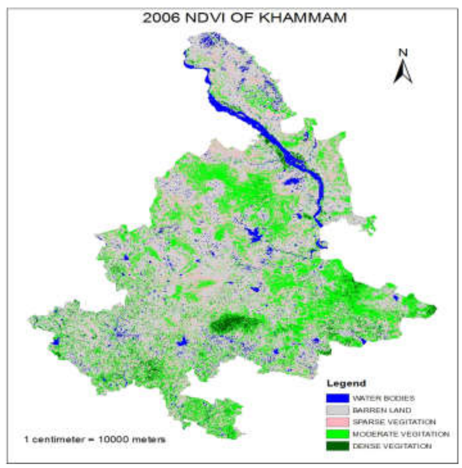
Now open created rescale file in pseudo colour mode and previous NDVI image now copy the attribute colours of NDVI image to rescale file.

Open metadata change layer type as thematic layer for rescale file.

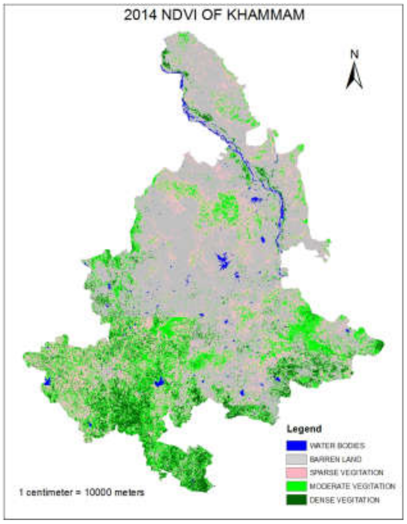
Go to raster menu select recode option from thematic tool.

Enter colour code values from 0 to 5, 6 based on classes. Then run the process.

Now open the recode image it will be in blue colour open attribute table change the number based on colours.



NDVI of 2006



NDVI of 2014

S.NO	Vegetation	2006 (Sq. Km)	2014 (Sq.km)	CHANGE
1	Sparse vegetation	3008	3560	-552
2	Moderate vegetation	5010	4785	225
3	Dense vegetation	8011	7684	327
		16029	16029	0

Change Detection of NDVI 2006-2014

Change Detection of NDVI 2006-2014

Conversion of water lands to agriculture lands:

out of the 100% of the wastelands , 50% of the wasteland cannot have the availability of water resources and ground water potential such as area under bhadrachalam, vajedu, yellandu, ect other 50% of the wasteland is covered by the scrub land , depending upon the availability of the natural resources , the lands can be brought under the cultivation lands

Socio-economic parameters like agriculture labour and SC-ST population density are taken into account for the development of the agriculture most of agriculture labours are based on the rain fed irrigation so , most of lands are fallow if the rain fall is not sufficient . Government should take initiative in providing water focalises in those lands such that fallow can also be brought into the agricultural land. Drip irrigation mush better than normal irrigation and gives the double output then the normal production. Govt should come out with the development schemes such as providing loans developing the nurseries and ect. SC-ST population density is also and important parameter for developing the agricultural land

The Sc St population and total population villages are identified , total irrigation , un- irrigation and cultivated wasteland etc are generated by agriculture is brought into development

By following the recommended suggestions, the wasteland can be reclaimed into useful lands (cultivable land). The model developed for stimulating the spatial dynamic process can be used as a planning tool to taste the affect of different land use change scenarios. Cellar automata are scene not only as a pradigisim for thinking about complex special temporal phenomena and experimental laboratory for testing ideas.

V.CONCLUSION:

Though information on land use land cover is very important and is in fact central to many natural resource planning programs but due consideration should be given to the existing wastelands .proper management and development of these wastelands should be proposed ,so that it is reclaimed to meet the needs of the rapidly growing populations .The study thus shows that remote sensing is the best tool in today's rapidly changing environments and it can be very effectively dm resources mapping and management. The basic of this research compares the multi temporal classification of Landsat thematic map per satellite imaginary to detect and map the conversation of forest to pastures in Khammam district, Telangana 2006 to 2014.Thus the aim of this project was to produce both current and past land use land cover maps of Khammam district from recent and past land cover changes in the period of 8 years.

In the study area the analysis of LULC changes during 2006-2014 revealed the following.

Built Up: Built up land in study area considerable increased by 27.13 km^2 from 2006 to 2014 (14.07 Km^2 to 31.2 Km^2)

Agriculture: Agriculture land has considerable increased by 0.25 Km^2 from 2006 to 2014 (22.15 Km^2 to 22.40 Km^2)

Forest: Forest area considerable decreased by 9.81 Km^2 because forest area not degraded most of the contently

Wasteland: Wasteland decreased by 5.57 Km^2 in 2014 because increasing land cover changes due to rapid population growth and cultivation of agricultural land

Water bodies: water bodies has considerable decreased 2 Km^2 in 2014

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