



LAND COVER CHANGE ANALYSIS BY USING RS & GIS A SPATIAL TEMPORAL STUDY ON GVMC, VISAKHAPATNAM DISTRICT

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This paper investigates the Spatio- Temporal change of vegetation cover of Visakhapatnam. For this study landsat images (TM and ETM+) of 17 Nov, 2005 and 02 Nov, 2015 were used. For recognition of vegetation reflectance, layer stacking of band 4, 3 and 2 (false color composite) for TM and ETM+ was performed. GCP were taken with a GPS device in strategic locations of the study area; this was to establish ground information on vegetation cover. The images were then classified into dense shrubs, less dense shrubs, cropland/grassland, built-up area, bare surface and water body. The GCP were plotted on ETM+ which was used to evaluate the vegetation change in TM. Supervised classification was done and maximum likelihood operation was performed to generate vegetation cover maps. Afterwards, vegetation cover map of 1986 and 2001, were crossed to generate the map of change of vegetation cover for the respective dates and to find out the changing pattern of vegetation cover. In addition, the use of spectral vegetation index, namely the Normalized Difference Vegetation Index (NDVI) was applied to detect areas of vegetation cover decrease. The study then reveals that vegetation cover of the area has changed significantly during 2005 to 2015.

I. INTRODUCTION

Vegetation serves several critical functions in the biosphere, at all possible spatial scales. Firstly, vegetation regulates the flow of numerous biochemical cycles, most critically those of water carbon and nitrogen; it is also of great importance in local and global energy balances. Vegetative cover refers to trees, perennial bunch grasses and grassland and shrubs with an expected life span for atleast 5yrs. Owing to industrialization and urbanization Indian metropolitan cities, were constructed unscientifically leading to irrational urban planning. Unless the need for scientific planning is realized, it is sure to clear up the environment. In coastal cities like Visakhapatnam, another major problem is seawater intrusion. As the seawater moves, inland groundwater aquifers become contaminated with salts, which may cause permanent damage to the aquifer.

The Greater Visakhapatnam Municipal Corporation (GVMC) city forms the area of the study in the present investigation. The population in the city is increasing at a rapid pace due to migration from surrounding areas, with corresponding increase in sub-urban areas also. The extensive growth of residential apartments along the coastal stretch resulted in excess withdrawal of groundwater initiating seawater intrusion in these tracts. All these factors combined, leading to an acute environmental crisis in the area. Forecasting urban water demand can be of use in the management of water utilities (Salvatore Campisi-Pinto, 2012). Hence, it is necessary to manage the available water resources in an efficient manner. This is done using advanced technologies like Remote Sensing and Geographical Information System.

II. OBJECTIVES

- To study the forest cover of the Greater Visakhapatnam Municipal Corporation area.
- To study and characterize the vegetal cover in Greater Visakhapatnam Municipal Corporation area.
- To demarcate/assess different types of vegetation such as forest degraded, scrub land, plantation etc.
- To study the land use/land cover and its importance in assessment of vegetation.

III. STUDY AREA**A. LOCATION**

The study area is located in between $17^{\circ} 51' 16.26''$ northern latitude and $83^{\circ} 21' 49.54''$ eastern longitude with an area of 540 km^2 . The area has been divided into 72 municipal wards. The city is abutting Bay of Bengal on the eastern side, Duvvada hills on the western side, Yaradakonda on the southern side and Madhurawada dome is on the Northern side. The entire urban agglomeration is located in a saucer shape basin of Visakhapatnam. The hills have an altitude of 350 to 550 meters above mean sea level.

B. DESCRIPTION

The GVMC is the second largest municipal corporation in the state of Andhra Pradesh. The Visakhapatnam municipal corporation has increased its jurisdiction limit to the fringe areas and renamed as Greater Visakhapatnam Municipal Corporation (GVMC). It is often called as Industrial City or Visakha Steel City. It has been observed that the population is tremendously increasing in recent years. As a result urban slums and fringe areas are developing in a big way. In this process, forest cover of the hills is removed and is being covered by urban slums, urban agglomeration, IT and cine Studios, etc. The study area has 1663 hectares of forest in the year 1991.

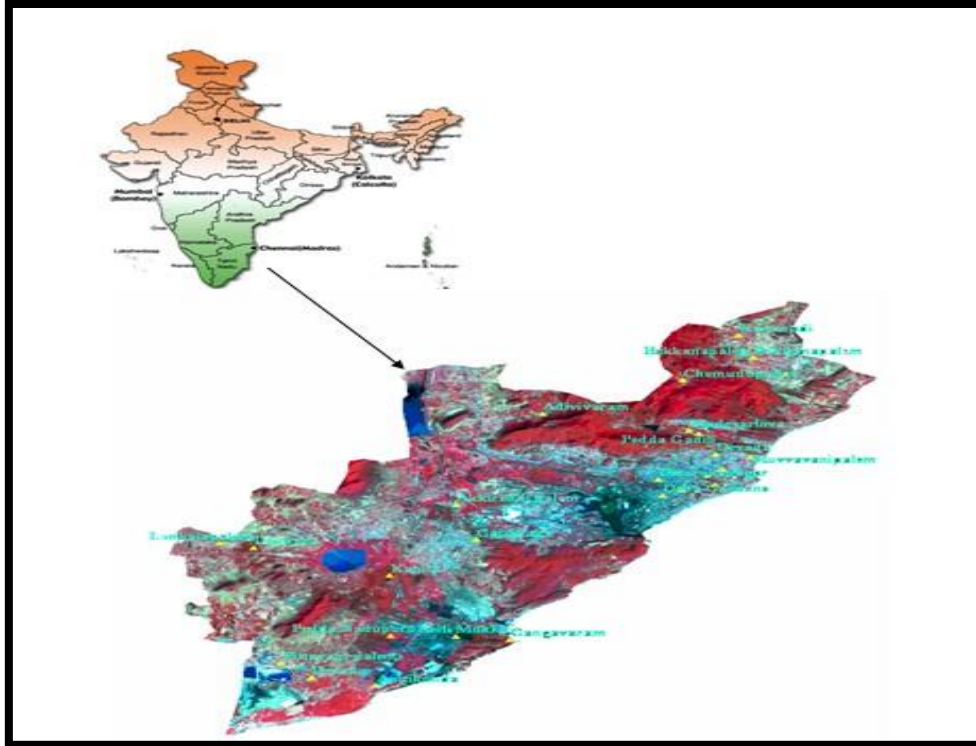
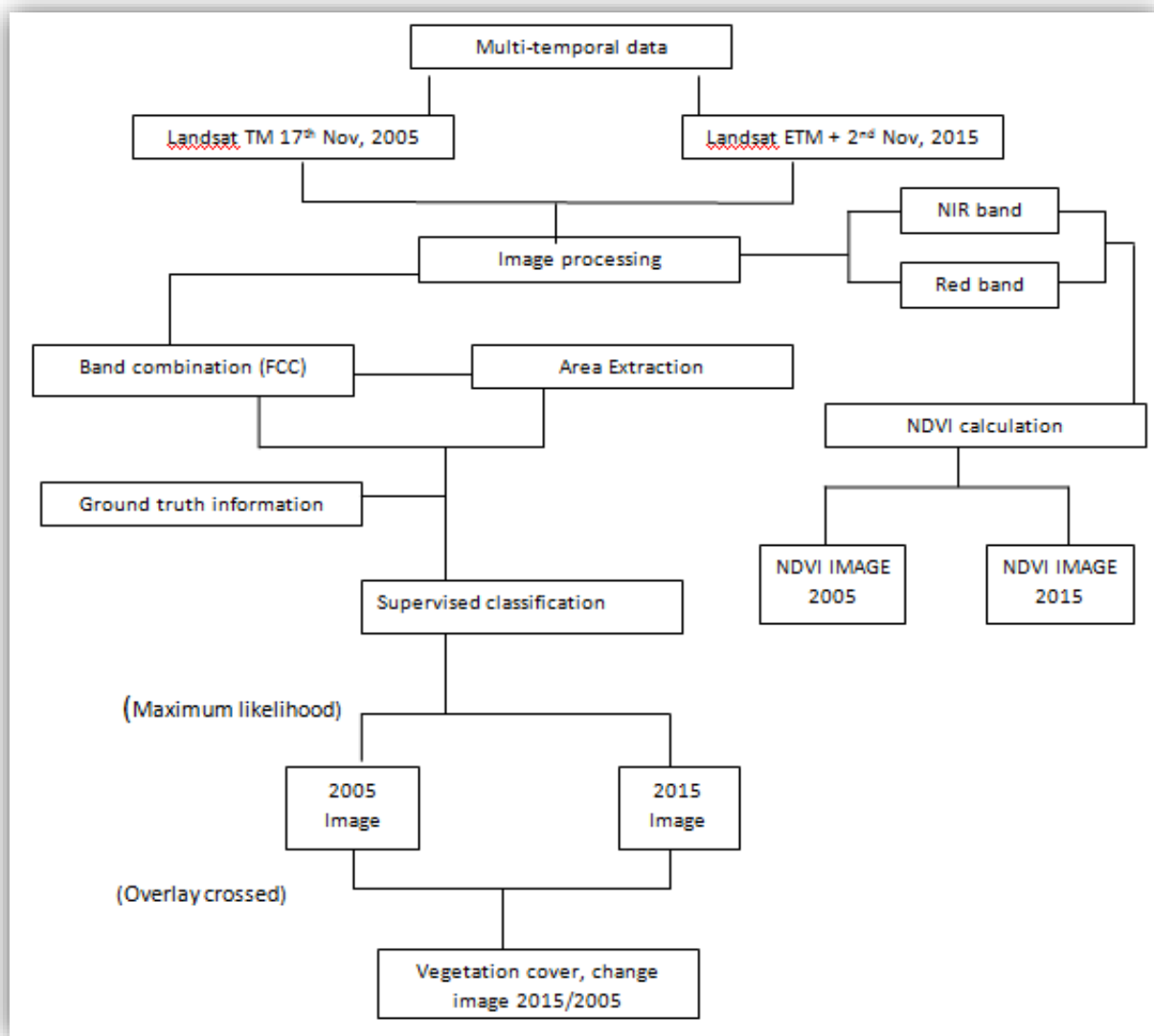


Figure.1 Study Area

IV. METHODOLOGY



The main goal of this study is to reveal vegetation change using multi-temporal satellite data, in order to extract changes. Digital image-processing software Erdas imagine 8.6 and Ilwis 3.3 were used for the processing, analysis and integration of spatial data to reach the objectives of the study. Erdas Imagine was used to generate the false colour composite, by combining near infrared, red and green which are bands 4, 3, 2 together for both images. This was done for vegetation recognition, because chlorophyll in plants reflects very well to near infrared than the visible. For image classification, six classes was defined which are Dense shrubs, Less dense shrubs, Cropland/ grassland, Built-up area, Bare surface and Water body. Ground control points obtained using a Global positioning System from locations in relation to the classes of the study area was plotted on landsat ETM+ image, which was used to verify the training sites (defined classes) as regards the spectral signature. Supervised classification for the various classes was performed using Ilwis 3.3 for both images. Finally maximum likelihood classification was used for the classification of the images. Calculation of NDVI was performed. NDVI can be calculated as a ratio of red and near infrared bands of a sensor system.

$NDVI = \frac{\text{Near Infrared Band} - \text{Red band}}{\text{Near Infrared Band} + \text{Red Band}}$

Its value ranges from -1 to +1

As a result NDVI values between -1.0 and 0 represents non-vegetative features such as bare surface, built-up area and water body. Conversely, greater than 0 display vegetation covers.

To find out the changing pattern of vegetation during 2005- 2015 both images were crossed in ilwis environment.

V. RESULTS

A. Creating NDVI for LANDSAT

In general, NDVI uses two properties to quantify healthy vegetation. It uses near-infrared (NIR) because vegetation strongly reflects it. And it also uses red light, because plants strongly absorb it. For this same reason, this is why our eyes see vegetation as the color green.

Now that you have a bit of background on NDVI, you can easily create NDVI maps in ArcGIS.

Simply, follow these 4 steps.

i) Enable Image Analysis Toolbar

First, enable the Image Analysis Toolbar (Windows > Image Analysis). The image analysis window will be displayed in ArcMap.

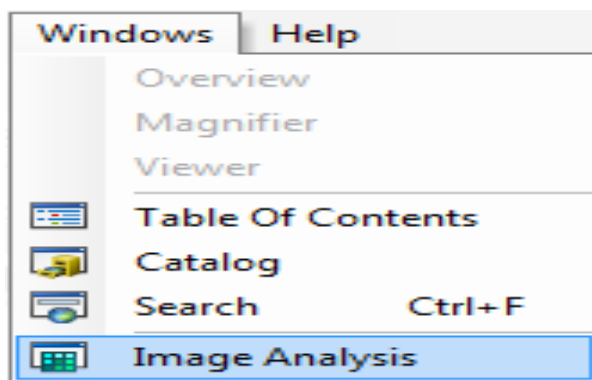


Fig 2. Image analysis tool bar

ii) Check Scientific Output Properties

Second, under image analysis options, select the red band and the near infrared band.

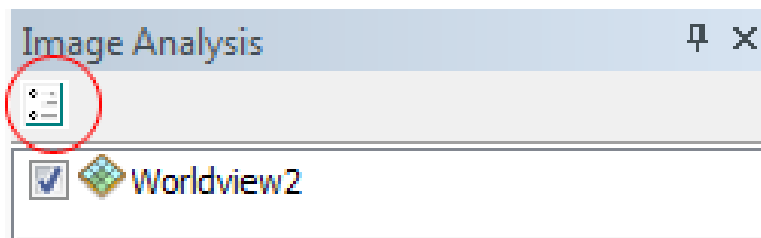


Fig 3. For Worldview-2 imagery, under the NDVI tab – the red band is “band 5” and the NIR band is “band 7”.

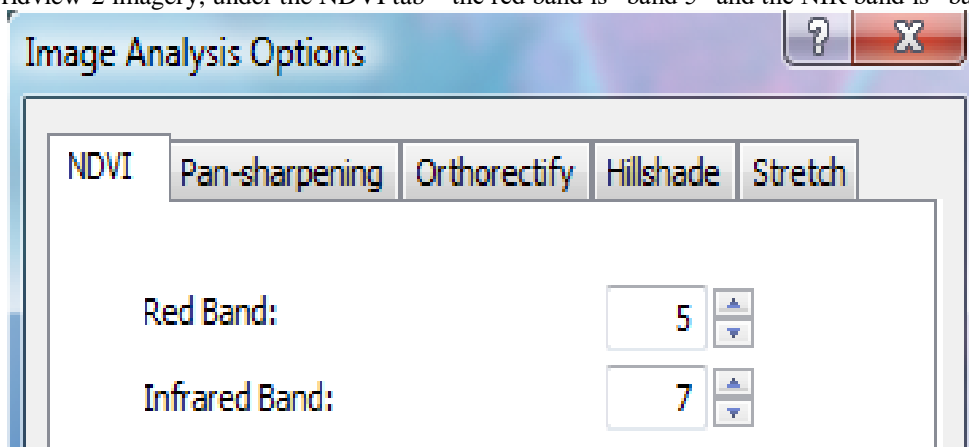


Fig 4. Optionally select “Scientific Output” so your values range from -1 to 1.

iii) Click the NDVI Icon

Highlight your layer by clicking it.

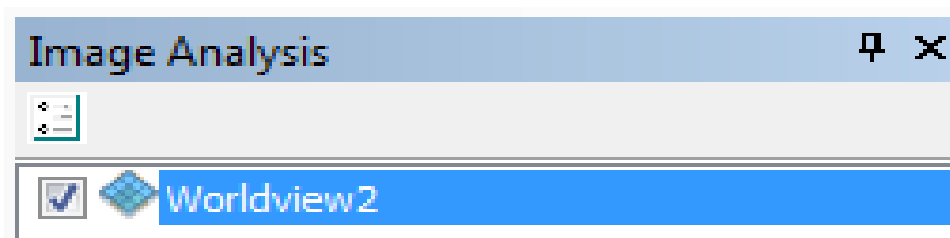


Fig 5. Under properties, Select the NDVI icon which looks like a leaf.

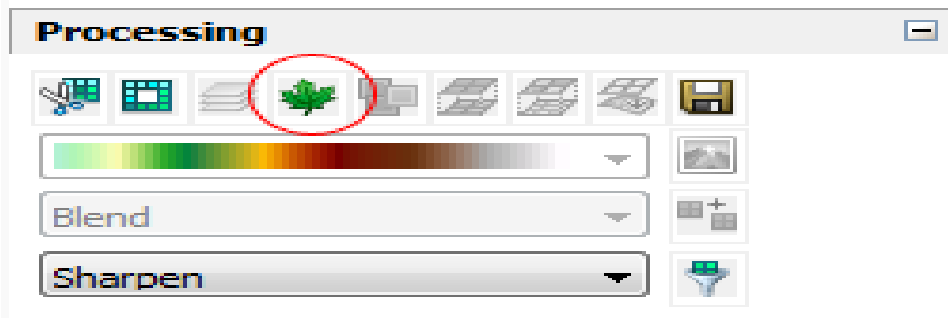
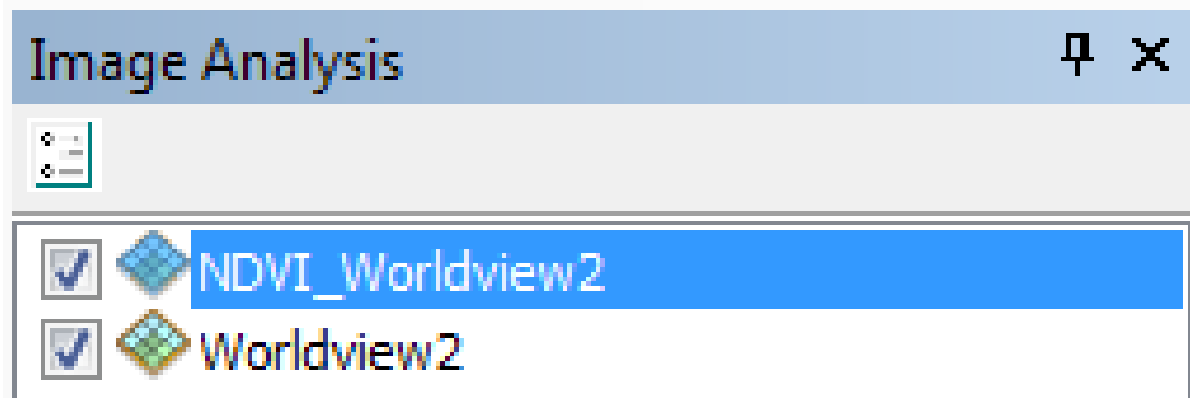


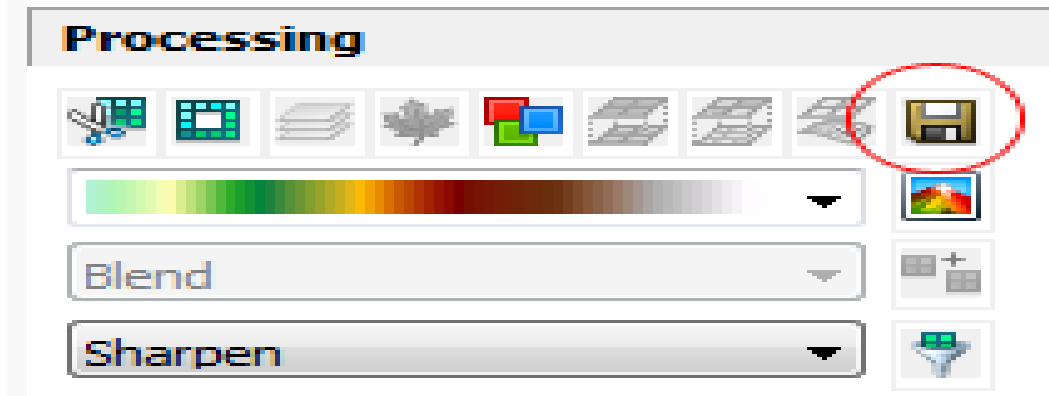
Fig 6. This will create temporary layer in the table of contents. Bright green indicates high NDVI. Whereas red has low NDVI

iv) Export Raster

Highlight the new NDVI layer that you want to export by selecting it in the image analysis toolbar.



Right click layer, and export raster to save into memory.



High positive NDVI values (green) means high vegetation. Water usually has negative NDVI values (yellow and red). In general, urban features usually are near zero.
 NDVI MAP IN THE YEAR 2005

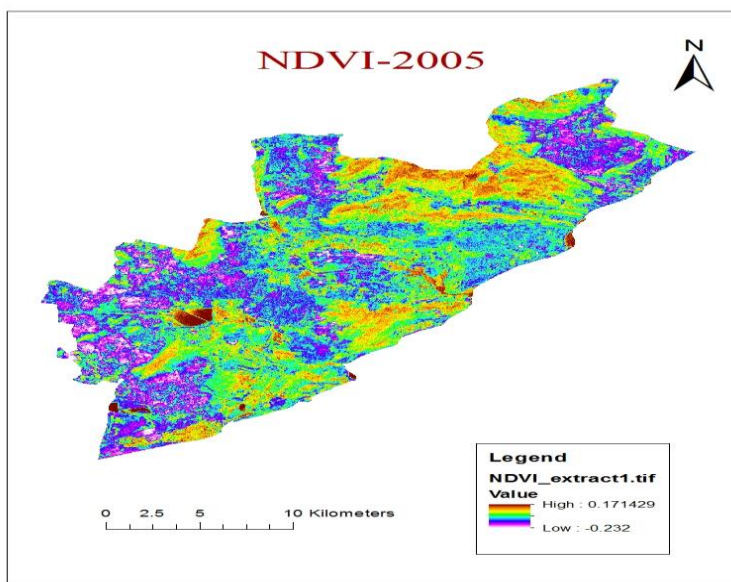


Fig 7 From the NDVI map the yellow cover gives us the forest area
NDVI MAP IN THE YEAR 2015

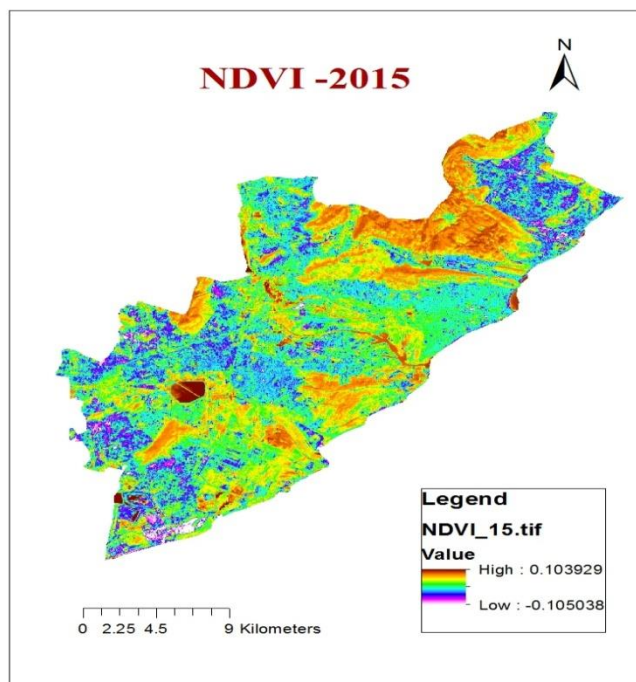


Fig 8. NDVI MAP IN THR YEAR 2015

So it is now very clearly can be seen through the naked eye that there is a considerable decrease in the forest area, that is the yellow color indicates the forest area.

CONCLUSION

This research work demonstrates the ability of GIS and Remote Sensing in capturing spatial-temporal data. Attempt was made to capture as accurate as possible land use land cover classes as they change through time. Classes were distinctly produced for each study year but with more emphasis on built-up land as it is a combination of anthropogenic activities that make up this class; and indeed, it is one that affects the other classes.

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