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Temporal study of Bawana Industrial Area using Remote Sensing Data

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Abstract : *Change detection is an image enhancement technique that compares two images of same area from different time period. It is useful in land use/land cover change analysis. To better understand image has to classify. It is the process of classifying according to shared qualities, some common characteristics and affinities. There are two types of classification. In unsupervised classification, software classifies an image based on natural groupings of the spectral properties of the pixels, without any input from user. Unsupervised classification yields an output image in which a number of classes are identified and each pixel is assigned to a class. Supervised classification can be very effective and accurate in classifying and can be applied at the individual pixel level. However, for the process to work effectively, the user processing the image needs to have a prior knowledge of where the classes of interest are located, or be able to identify them directly from the imagery. In the present study, images of 2002 to 2012 time period the Bawana area which is located between 28º46'22 " N to 28º44' 53" N and 77º07'18" to 77º08'23" are registered, then change detection as well as classification is done using ERDAS IMAGINE. The study area is characterized by vegetal cover and industrial buildings based on results of supervised and unsupervised classification. Moreover, temporal changes are also discussed in the end.*

Keywords: Classification, ERDAS Imagine, temporal resolution.

I. Introduction

Change detection is the process of identifying differences in the state of a feature or phenomenon by observing it at different times. In remote sensing it is useful in land use/land cover change analysis such as monitoring deforestation or vegetation. [1][2][3] However, there are many remote sensor system and environmental parameters that must be considered whenever performing change detection. Failure to understand the impact of the various parameters on the change detection process can lead to inaccurate results. Ideally, the remotely sensed data used should be acquired by a remote sensor system that holds temporal, spatial, spectral, and radiometric resolutions constant. For example, changes in radiance values between images may be caused by a number of different factors such as a field which may have different soil moisture content and therefore appear different in two individual images. Unsupervised classification algorithms are optimal in cases where detailed knowledge such as ground truth data is not readily available for a study region. Based on user-defined parameters, unknown image pixel data is iteratively grouped together in clusters until either some proportion of pixels' class values remain unchanged or maximum number of iterations has been reached.[4] [5] Classes can be determined by spectral distinctions inherent in the data. Three major unsupervised classification methods generally used are: K-Means, Fuzzy C Means and ISODATA (Iterative Self-Organizing Data Analysis Technique). Supervised algorithms rely on user-defined training sets defined by Regions of Interest (ROIs), image areas whose classifications are assumed to be known. [6][7][8]These regions are selected so as to be reasonably representative of only one class. Several significant methods of supervised classification are: Maximum Likelihood, Minimum Distance, Mahalanobis Distance and Spectral Angle Mapper Classification.

II. Study Area

Geography : Bawana is located in Delhi and extends between 28º46'22" N to 28º44' 53" N and 77º 07'18" to 77º08'23" in Delhi. The study area is characterized by vegetal cover and industrial building between the years 2002 to 2012. [9][10] The area of the village under farming used to be 52000 hactare but now most of it has been acquired by Delhi government for industrial area. Bawana has khaddar soil and very fertile area with very high water table.

Demographics: As of 2001 India census, Bawana had a population of 23,095. Males constitute 56% of the population and females 44%. [11][12]Bawana has an average literacy rate of 72%, higher than the national

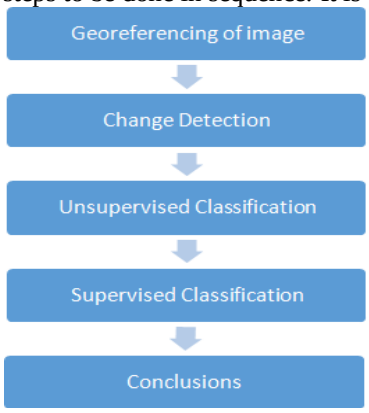
average of 59.5%; with 61% of the males and 39% of females literate. 14% of the population is under 6 years of age.

III. Review Of Software

ERDAS IMAGINE is a remote sensing application with raster graphics editor abilities designed by ERDAS for geospatial applications. The version is 9.2. ERDAS IMAGINE is aimed primarily at geospatial raster data processing and allows the user to prepare, display and enhance digital images for mapping use in geographic information system (GIS) or in computer-aided design (CADD) software.

IV. Methodology

Methodology adopted includes various steps to be done in sequence. It is depicted below in tabular form.



Georeferencing of Image

Georeferencing means associating something with locations in physical space. Georeferencing is crucial to making aerial and satellite imagery, usually raster images, useful for mapping as it explains how other data, such as the above GPS points, relate to the imagery. Very essential information may be contained in data or images that were produced at a different point of time. [13][14]It may be desired either to combine or compare this data with that currently available. The latter can be used to analyses the changes in the features under study over a period of time. For geo-referencing of image, ERDAS IMAGINE is used which gives us the registered image with the coordinate system.

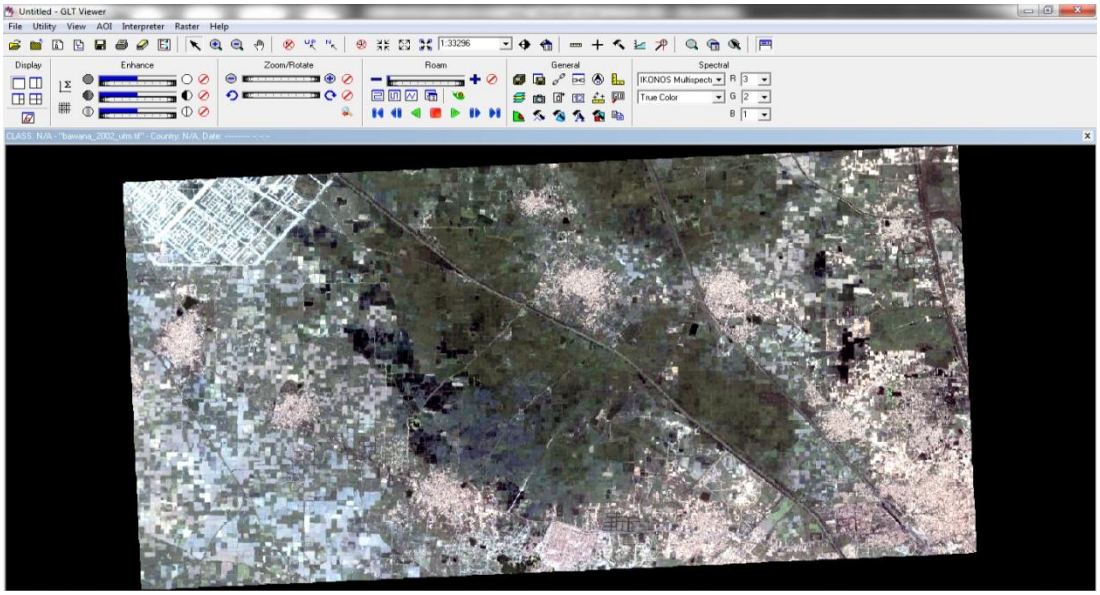


Fig 1: Registered Image

Change Detection

Change detection gives us image difference file and highlight change file of 2002 and 2012.

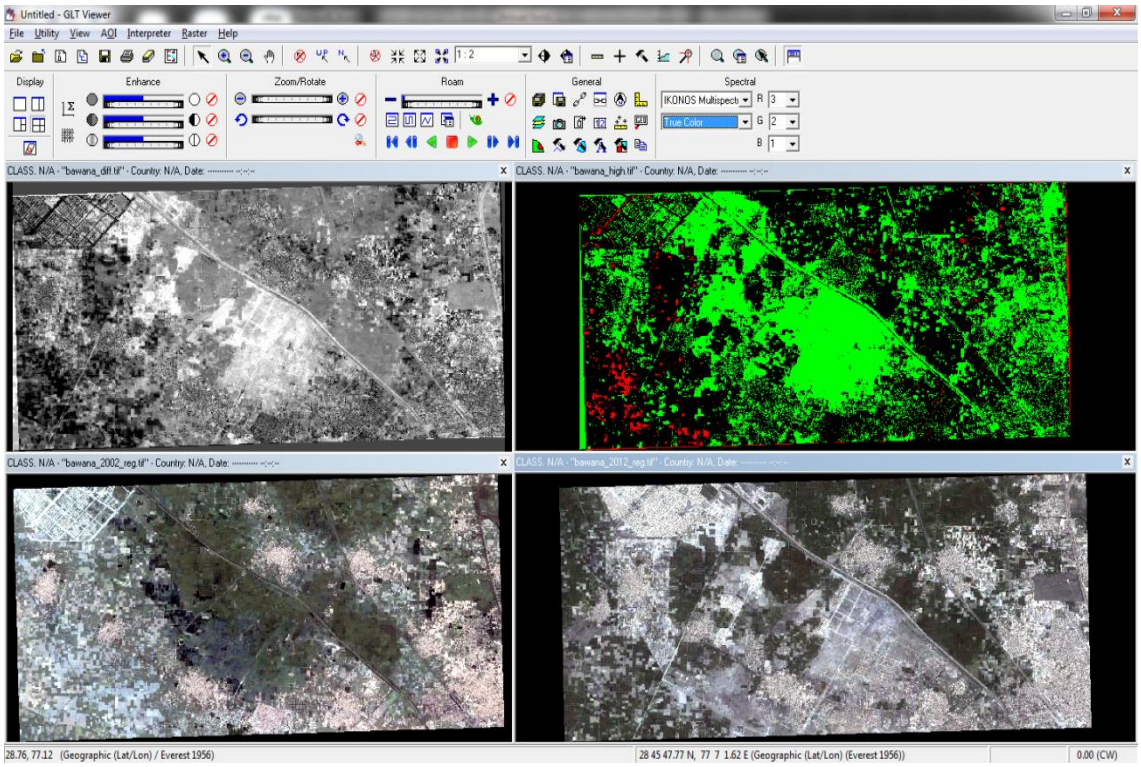


Fig 2: Results for Change detection.

Unsupervised Classification

In this classification, no training site or sample is given, only the desired number of output classes is stated i.e. 5. Software itself analyzed the image and grouped the pixels with common characteristics and area in hectares for different classes for both images of 2002 and 2012 is known.

Table.1. Study Area Stats

Area (Hectare) 2002	Area (Hectare) 2012	Class
643.823	676.893	Unclassified
1591.49	1858.11	Vegetation
1653.31	1364.1	Densely Populated
1234.96	1661.01	Moderately Populated
1084.54	1112.02	Barren Land

Supervised Classification

In this classification training sample like residential area is provided. Number of classes are also designated into which image is to be classified. Output file is obtained along with data of different area (in hectares) for different classes for both images of Bawana 2002 and 2012.

Table.2. Study Area Stats

Area (Hectares) 2002	Area (Hectares) 2012	Class
459.823	516.893	Unclassified
1534.49	1904.44	Vegetation
1533.31	1389.1	Densely Populated
1109.96	1655.01	Moderately Populated
988.54	1113.02	Barren Land

V. Conclusion

The results obtained by the different methods of classification are compared and it can be derived that supervised method is much more accurate and precise than that of unsupervised. This can be easily derived by the plotted graphs. Following conclusions can be drawn by this study:

1. Classification study shows that vegetation cover has increased by 23.7% from 2002 to 2012, mainly because of go green programs in Delhi.
2. The irrigated land increased by 26.7%, due to rise in population.
3. The area under densely populated zone decreased by 9.4% of the pre-existing in 2012.
4. The area under moderately populated zone increase by 49.09%.
5. The change in area under barren land is negligible from the year 2002 to 2012.

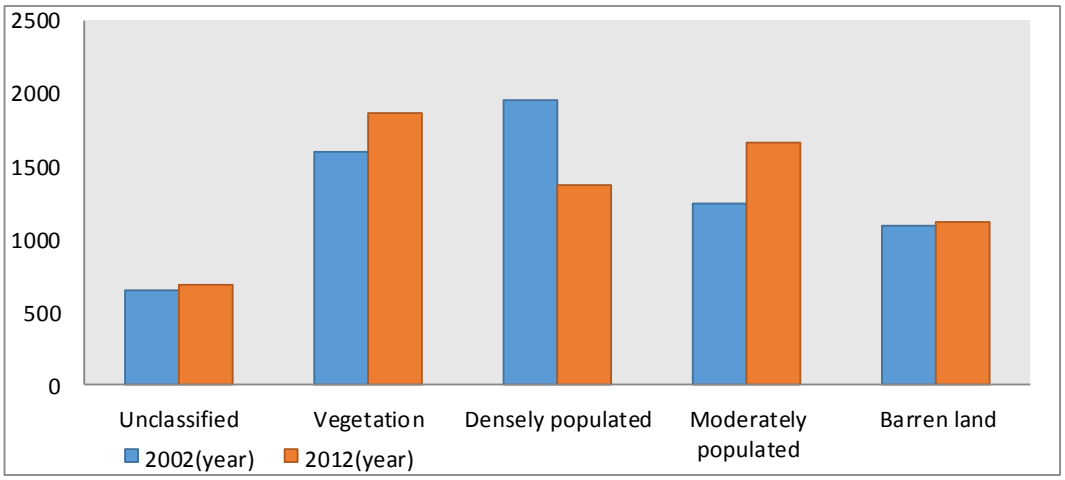


Fig 3: Graph showing variation in Area in unsupervised classification

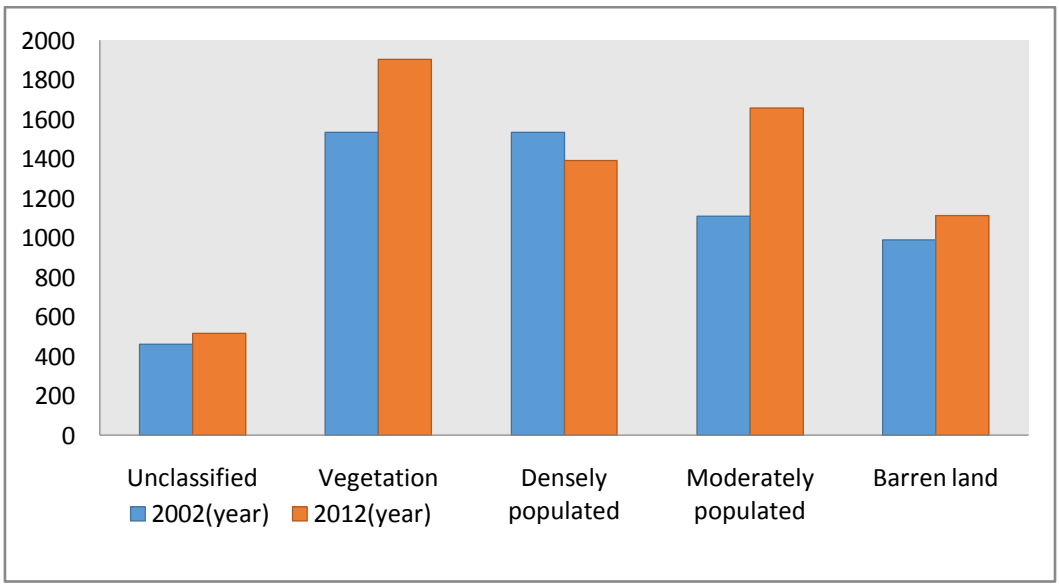


Fig 4: Graph showing variation in Area in supervised classification

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