Analysis of LU/LC (Land Use/Land Cover) Change Detection Using GIS

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Abstract:- Change detection is playing vital role in the environment studies to obtain necessary changes occurred day by day. In this paper we try our best to made an attempt to study the changes in land use land cover of Nanded city which is located in Maharashtra state, here we are studying the urban expansion and land cover change that took place in different time span such as 1973-2009, 1992-2009, here we have adopted remote sensing technology to study the environmental changes during different time span. Landsat images MSS, TM, ETM are collected from glcf.umd.edu website, these LU/LC classes are divided into six different categories from the years 1973-2009. These categories are as follows. A) Built up area b) Water body c) Vegetation d) Wasteland e) Agricultural. This study is always helpful for the local government for better planning of city.

Keywords:- *Geographic Information System (GIS), Multispectral Scanner (MSS), Thematic Mapper (TM), Enhanced Thematic Mapper (ETM), Change Detection, LU/LC, Bands.*

Introduction: - Change detection is the method of identify differences in the status of an object or incident by observing it at unlike times, Timely and accurate change detection of Earth's surface features provides the foundation for better understanding relationships and interactions between human and natural phenomena to better manage and use resources.[1][2]GIS is a set of tools for collecting, storing, retrieving, transforming and displaying spatial data from the genuine earth. Economic development and population growth have triggered rapid changes to Earth's land cover over the last two centuries, and there is every indication that the pace of these changes will accelerate in the future. These rapid changes are superposed on long-term dynamics associated with climate variability.[4][5] Land cover change can affect the ability of the land to sustain human activities through the provision of multiple ecosystem services and because the resultant economic activities cause feedbacks affecting climate and other facets of global change. Accordingly, systematic assessments of Earth's land cover must be repeated, at a frequency that permits monitoring of both long-term trends as well as interannual variability, and at a level of spatial detail to allow the study of human-induced changes. Although the terms "land cover (LC)" and "land use (LU)" are sometimes used interchangeably, they are actually different. Simply put, land cover is what covers the plane of the earth and land use describes how the land is used. Examples of land cover classes contain: water, snow, grassland, deciduous forest, and bare soil. [7][8].Change detection involves comparing changes between aerial photographs taken over different time periods that cover the exact same geographic area. Change detection frequently involves comparing aerial photographs or satellite imagery of the area taken at different times. Change detection has been extensively used to review variable agriculture, deforestation, town growth, brunt of natural disasters like Tsunamis, earthquakes and use/land cover changes etc.[6][3]

Study Area:

Nanded tahsil is situated in Nanded district in Maharashtra state and located between 18^0 57' and 19^0 21' North latitudes, 77^0 9' and 77^0 24' East longitudes by covering an area of 335.79 Sq. km Nanded tahsil is bounded by Ardhapur on the north, Purna tahsil on the west of the Prabhani district, Mudkhed tahsil on the east and Loha tahsil in the south.

Data Acquisition:-

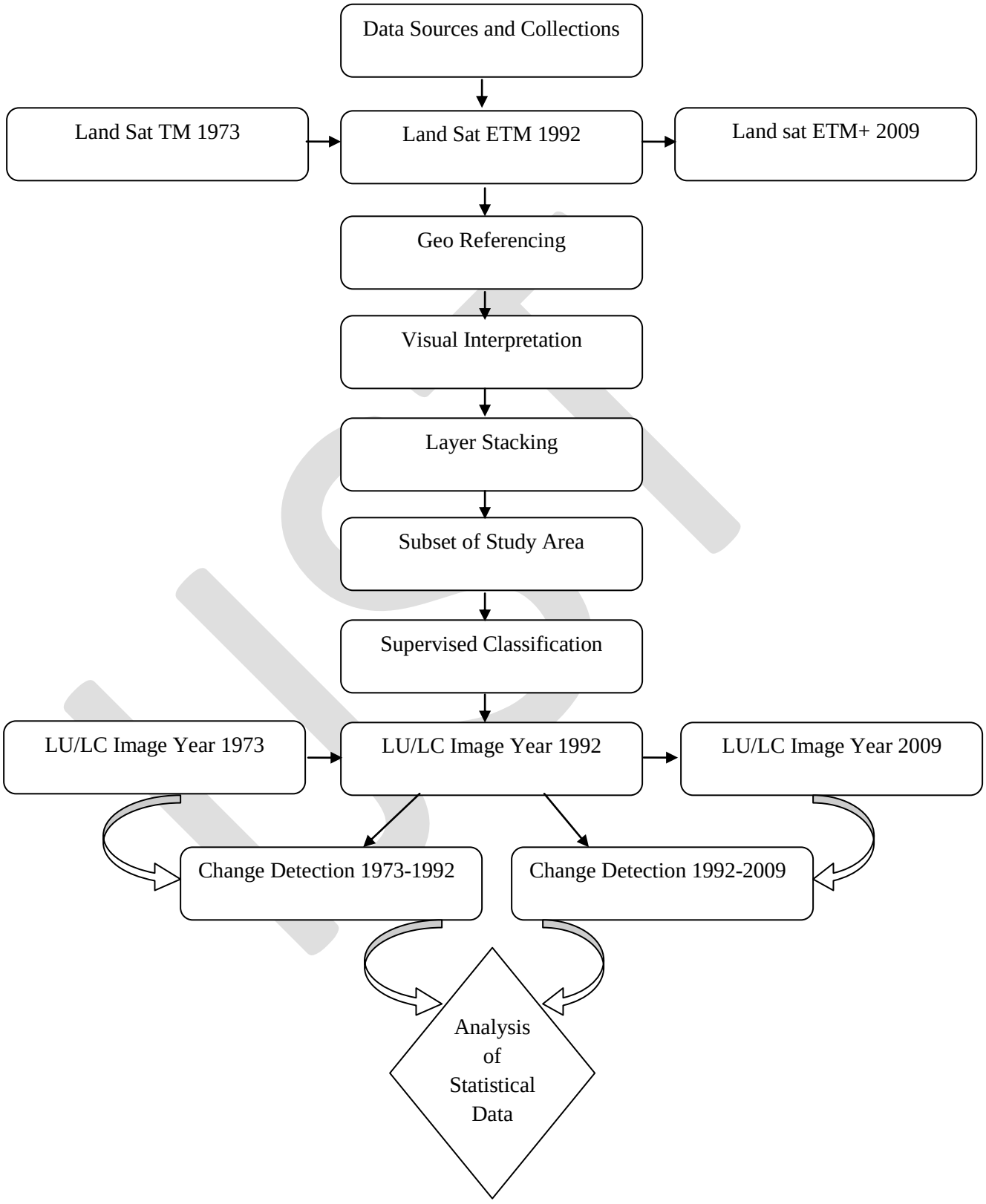
Landsat (name indicating Land + Satellite) imagery is available since 1972 from six satellites in the Landsat series. These satellites have been a major component of NASA's Earth observation program, with three primary sensors evolving over thirty years: MSS (Multi-spectral Scanner), TM (Thematic Mapper), and ETM+ (Enhanced Thematic Mapper Plus). Landsat supplies high resolution visible and infrared imagery, with thermal imagery and a panchromatic image also available from the ETM+ sensor. These data is shown in following table 1.All these images are downloaded from glcf.umd.edu [9]

Satellite	Sensor	Band#s	Spectral Range	Scene Size	Pixel Res
L 1-4	MSS multi-spectral	1,2,3,4	0.5 - 1.1 µm	185 X 185 km	60 meter
L 4-5	TM multi-spectral	1,2,3,4,5,7	0.45 - 2.35 µm		30 meter
L 4-5	TM thermal	6	10.40 - 12.50 µm		120 meter
L 7	ETM+ multi-spectral	1,2,3,4,5,7	0.450 - 2.35 µm		30 meter
L 7	ETM+ thermal	6.1, 6.2	10.40 - 12.50 µm		60 meter
Panchromatic	ETM+ thermal	8	0.52 - 0.90 µm		15 meter

Table 1: Data Acquisition Table

Satellite images details: - 1)1973 MSS 2)1992 TM 3)2009 TM

Research methodology:-



1) **Data Sources and Collection:-** All these images are downloaded from glcf.umd.edu
   a) **1972:-** MSS (Multi Spectral Scanner)
   b) **1992:-** TM (Thematic Mapper)
   c) **2009 :-** ETM (Enhanced Thematic Mapper)
2) **Georeferencing: -** Most GIS projects have need of georeferencing some raster data. *Georeferencing* is the method of transmission real-world coordinates to each pixel of the raster.
3) **Visual Interpretation: -** The visual interpretation of satellite images is a composite process. It includes the meaning of the image content but also goes beyond what can be seen on the image in order to identify spatial and scenery patterns. This progression can be approximately separated into 2 levels:

   a) The identification of objects such as streets, fields, rivers, etc. The quality of recognition depends on the capability in image interpretation and visual perception.

   b) A accurate explanation can be ascertained through conclusions (from previously recognized objects) of situations, recovery, etc. Subject specific information and expertise are critical.

4) **Layer Stacking: -** The Images are available in different bands so we have to combine the image into one band and create stack so all layers get into one.

5) **Subset of Study Area: -** After layer stacking we have to extract the area of interest from the given layer stacking.

6) **Supervised Classification: -** In this method we have selected some sample pixel point and from those points we started doing classifications.

7) **LU/LC Maps:** - Now we have generated LU/LC maps, and from those maps we come to know that classification of various classes

8) **Change Detection: -** Here we have actually obtained differences in various maps of different classes'

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Result and Discussion:

Following table 2 shows the result of Land use /land cover during the year 1973 ,1992 and 2009.

Sr.No	LULC Class	1973	1992	2009
1	Agricultural Land	103383	111505	120452
2	Water Body	10129	7839	9913
3	Vegetation	130011	136638	74537
4	Waste Land	119800	94687	86031
	Settlement	71403	84057	143793

Table 2: Land use / land cover Statistics of the study area

The following figure 1, 2 and 3 shows the unsupervised classification of classes:

1) Water 2) Agriculture 3) Waste Land 4) Vegetation 5) Built-up Area.

The following pie chart (graphs) represents LU/LC maps.

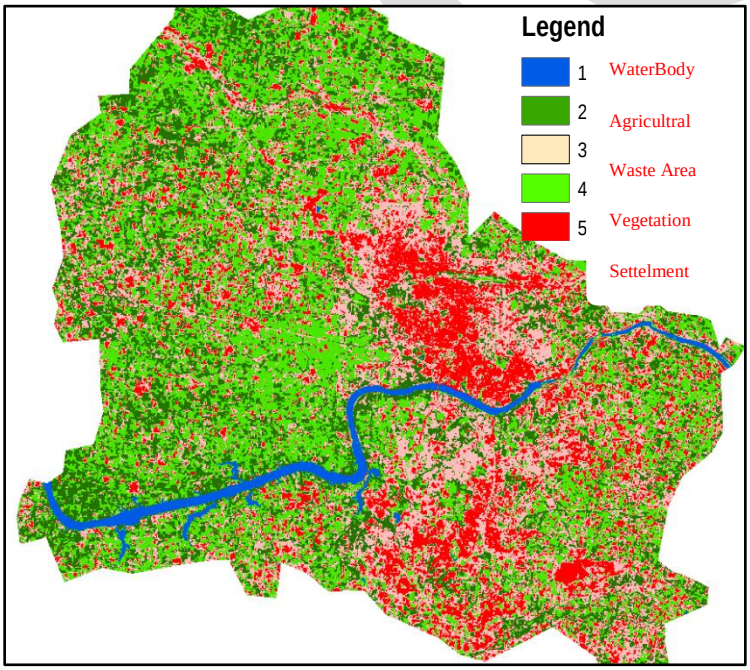

Fig. 1) 1973

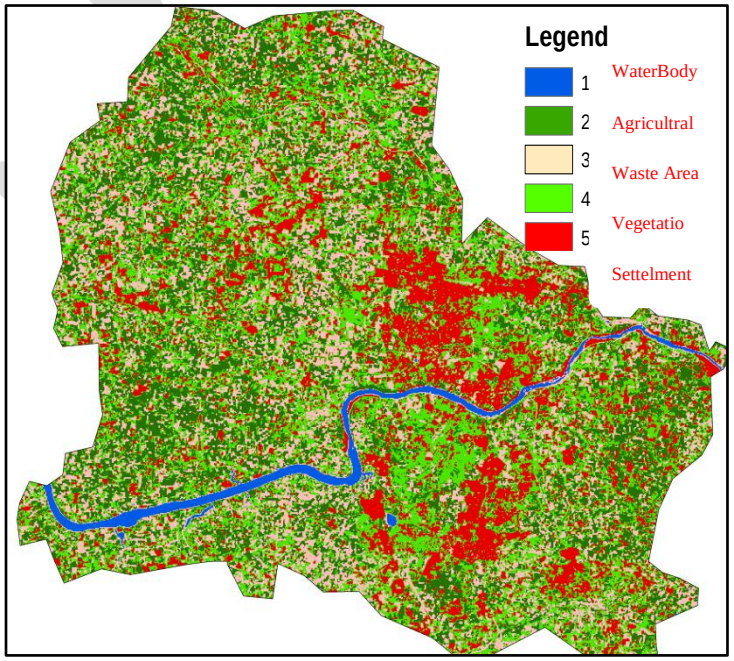

Fig. 2) 1992

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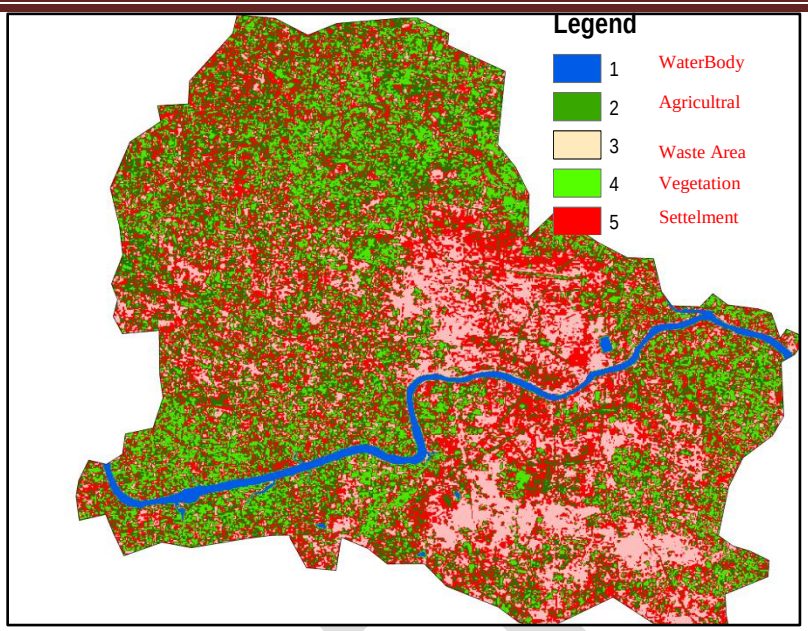
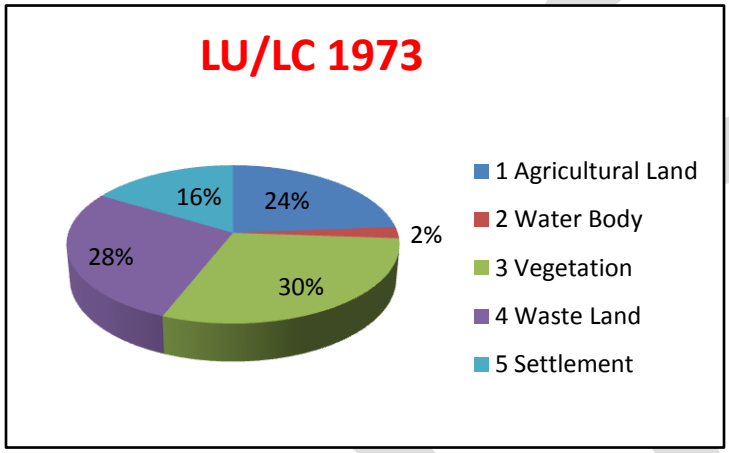
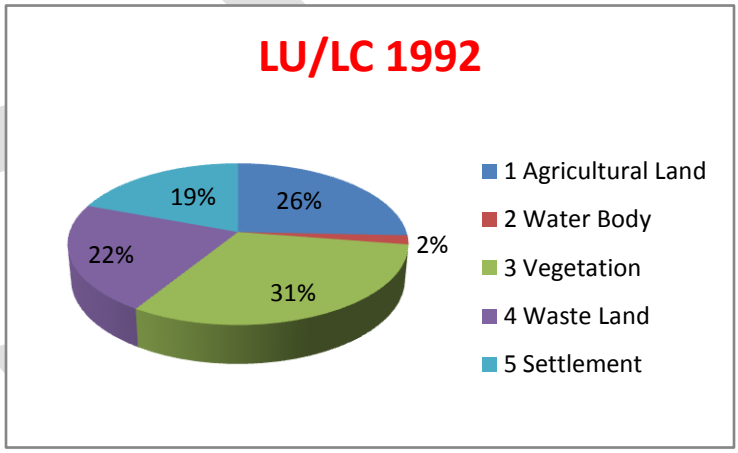


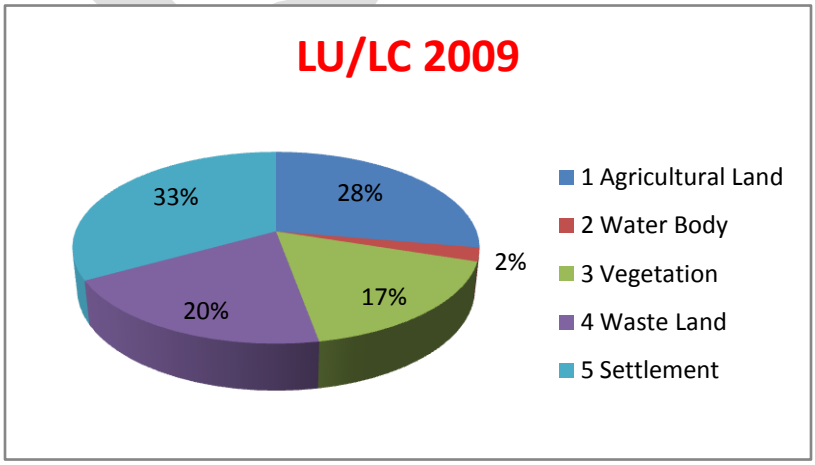
Fig.3) 2009



Graph 1. LU/LC 1973



Graph 2. LU/LC 1992



Graph 3. LU/LC 2009.

Conclusion:

The urban land cover and existing land use have been dynamic in nature over the periods in the Nanded tahsil. There are number of implications of urbanization on the land cover/land use changes as the landscapes physiological destruction, illegal land encroachment and shrinkage of forests cover etc.

Nanded is urbanized and rapidly growing cities of Maharashtra. The land cover / land use maps are generated, The urbanization growth of the city is observed. From our study it was observed that the urbanization in Nanded has increased. The increased urbanization may have several impacts on infrastructure, energy use and economy of the country.

References:-

[1] Change Detection Mapping: Using Remote Sensing and Gis Technology–A Case Study Of Achanakmar-Amarkantak Biosphere Reserve, Central India (Ijrsg: Issn No: 2319-3484)

[2] Land Use/Land Cover Changes Detection and Urban Sprawl Analysis (Ijasrtissn: 2249-9954).

[3] Tiwari Kuldeep, Khanduri Kamlesh, Land Use / Land cover change detection in Doon valley (Dehradun Tehsil), Uttarakhand: using GIS& Remote Sensing Technique. International journal of Geomatics and Geosciences volume 2, no 1, 2011. [11]. Tuhin Ghosh et.al. (2001).

[4] Arvind C. Pandy and M.S. nathawat 2006. Landuse Landcover mapping through Digital Image Processing of Satellite Data- A case study from Panchkula, Ambala and Yamuna nagar District, Haryana state, India.

[5] Demers Michael N., Fundamental of Geographic Information Systems, Second Edition.

[6] Land use and land cover change detection through remote sensing approach:
A case study of Kodaikanal taluka, Tamilnadu (ISSN 0976 – 4380).

[7] Land Use Land Cover Mapping, Change Detection and Conflict Analysis of Nagzira-Navegaon Corridor, Central India Using Geospatial Technology (ISSN 2277–9051).

[8] Investigations on Change Detection in Chandpur (M.S.) Watershed area by using RS & GIS (ISSN: 2321-3124).

[9] http://www.glcf.umd.edu

[10] Anil K. Jain, Fundamentals of Image Processing, Prentice-Hall, New Jersey, 2005.

[11] Anji Reddy M, Text book of Remote Sensing and Geographical Information System, 3rd ed., B.S. Publications, Hyderabad (India), 2010.

[12] Arnoff S, Geographical Information System: A Management Prospective, Ottawa, WLD publications, 1989.

[13] Ashbindu Singh, Review Article Digital change detection techniques using remotely-sensed data, International Journal of Remote Sensing, Volume: 10, Issue: 6, Publisher: Taylor & Francis,1989, pp. 989-1003

[14] Bastin L., Fisher, P.F. and Wood, J., Visualizing Uncertainty in Multi-Spectral Remotely Sensed Imagery. Computers & Geosciences, 28(3), 2002, pp. 337-350

[15] Benjamin B. Bederson and Ben Shneiderman, The Craft of Information Visualization: Readings and Reflections. Morgan Kaufmann, San Fransisko, 2003.

[16] Burrough P. A., Principles of Geographical Information System, Oxford University, 1986.

[17] C.P.Lo and Albert K.W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice-Hall, New Jersey, 2002.

[18] Charles D. Hansen and Chris Johnson, Visualization Handbook, Academic Press, New York, June 2004.

[19] Cleef, E.V., Hinterland and Umland, The Geographical Review, Vol.31, 1941. pp. 103-126.

[20] D. Lu, P. Mausel, E. Brondízio, E. Moran, Change Detection Techniques, International Journal of Remote Sensing, Volume 25, Number 12, 2004, pp. 2365-2401.