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Agricltural Land Use Change Detection in Pandharpur Tahsil, Solapur, Maharashtra Using Multi Temporal Satellite Data

KEYWORDS: RS, GIS, Land Use, Change Detection

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ABSTRACT *Change detection is the measure of the distinct data framework and thematic change information that can guide to more tangible insights into underlying process involving land cover and land use changes than the information obtained from continuous change. Change detection is useful in many applications such as land use changes, habitat fragmentation, rate of deforestation, coastal change, urban sprawl, and other cumulative changes through spatial and temporal analysis techniques such as GIS (Geographic Information System) and Remote Sensing along with digital image processing techniques. Pandharpur is a tahsil of Solapur district of Maharashtra extend between 17°30'00"N to 18°05'00"N Latitude & 75°05'00"E to 75°35'00"E Longitude, which cover 1303.6 Sq Km area. LANDSAT MSS-1973, TM-1991 & ETM + -2005 satellite data were used to study & classified using Maximum Likelihood classification method. The increasing population and economic activities were noted to be putting pressure on the available land resources. Supervised classification images of MSS, TM & ETM+ shows drastic change in Agricultural field which increased near about 25 % in last twenty decades. Availability of water through canal & dams, maximum use of fertilizers, development in economic condition of farmer etc. are the main causes of increase rate of Agricultural field.*

Introduction
Land is the most important natural resource on which all activities are based. Land-cover refers to the physical characteristics of earth's surface, captured in the distribution of vegetation, water, soil and other physical features of the land, including those created solely by human activities e.g., settlements. Land-use refers to the way in which land has been used by humans and their habitat, usually with accent on the functional role of land for economic activities.

Change detection is the process of identifying differences in the state of an object or phenomenon by observing it at different times (Singh 1989). 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.

The aim of this study was to incorporate the temporal dependence of multi- temporal image data to identify the changing pattern of Land cover and consequently enhance the interpretation capabilities. Moreover integration of multi-sensor and multi- temporal satellite data effectively improves the temporal attribute and the reliability of multi- data.

Objectives
In view of the facts the present study aims to highlight the following objectives:

- To study Geographic situation of study area.
- To prepare Agricultural land use map and to show the change from 1973 to 2005 within the study region
- To analyze the temporal change of Agricultural Land Use in study region.

Study Area
Pandharpur is a tahsil of Solapur district of Maharashtra. Geographical Extensions is 17°30'00"N to 18°05'00"N latitude & 75°05'00"E to 75°35'00"E Longitude, which cover 1303.6 Sq Km area. The total population of Pandharpur is 402707 (2001 Census), out of this, 9605 are Scheduled Tribes (STs) and 62209 are Scheduled Caste (SC) & the sex ratio is 917.

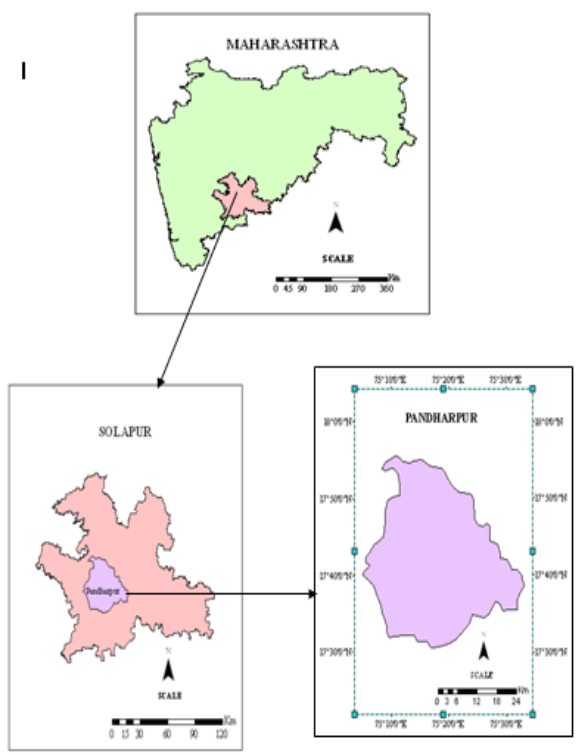

Fig. No. 1.1: Location Map of Study Area

Fig.1 Location Map

Data Processing
A. Georeferencing of Toposheet
The NE 43-11 and 43-7 toposheets are georeferenced in ArcGIS 9.3 with projection type Geographic (LAT/LON), spheroid name Everest definition 1975 and datum name Everest definition 1975. The toposheets are resampled and then reprojected with nearest neighbor resampling technique.

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B. Collection of Satellite Data

The following data was used to create Land use/ land cover map

Satellite	Sensor/ Sub-scene	Path/ Orbit	Row/ Sector	Acquisition date
LANDSAT	MSS	156	048	01-06-1973
LANDSAT	TM	146	048	01-25-1991
LANDSAT	ETM+ (30 mt)	146	048	22/10/2005

Table No. 1 Details of LANDSAT MSS, TM & ETM + data

C. Collection of Elevation Data:

Dataset	Producer	Acquisition date	Type	Location
SRTM degree tiles	USGS/GLCF	2000	GeoTIFF	India

Table No. 2 Details of Elevation Data

Methodology

The research involved two main steps. In the first step, classification of satellite data for Agricultural Land use types has been done. The second step concentrated on the change detection analysis in the Agricultural Land use types. Analysis of satellite data includes registration, classification and change detection using post classification comparison Satellite data.

Agricultural Land Use Mapping And Change Analysis

Supervised classification is used for Agricultural Land use mapping and change detection analysis of MSS, TM, and ETM+ for the years 1973, 1991 and 2005 respectively. According to that five classes of the land are Agriculture, Fallow land, Barren land, Grass land & Water body.

Flowchart of Methodology

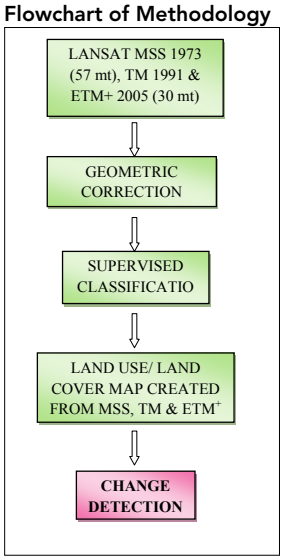
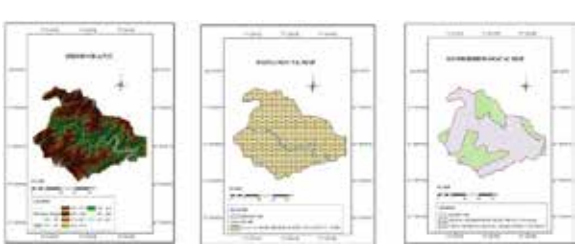


Chart No. 1 Flowchart of Methodology

GEOGRAPHICAL CHARACTERISTICS OF STUDY REGION



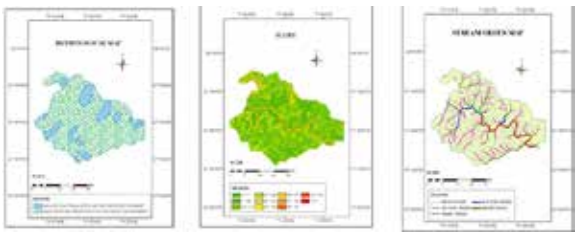


Fig. 2 Geographical Characteristics of Pandharpur Tahsil

Agricultural Land Use Mapping and Change Analysis

Land sat ETM+ Satellite images of 30 mt. and of Pandharpur have been used for this purpose. The two images of ETM+ mosaic by using ERDAS Imagine 9.1. Remotely sensed data usually contains both systematic and unsystematic geometric and radiometric errors, which are being removed through rectification. Images were registered geometrically using topographic maps on 1:250000 scale. The common uniformly distributed Ground Control Points (GCPs) were marked with root mean square error less than 0.002-0.008 and the ETM images was resample by nearest neighbor method. As the images cover adjacent areas, a subset image has been taken out for the further analysis. For land use and land cover mapping supervised image classification technique is used. In which the analyst defines small areas called training sites, on the image, which are representative of each desired land cover category. After the signatures for each land cover category have been defined, the software then uses those signatures to classify the remaining pixels. The interpreted land use/land cover map was taken for ground truth verification by using GPS (Global Positioning System) and suitably corrected wherever it was needed based on the ground information the vector layer was rectified to the final land use/land cover polygon map.

Class Name	Area in (Hector)	Area in (percentage)
Agriculture	23527.3	17.6578
Water body	5930.4	4..4509
Fallow land	29194.5	21.9112
Barren land	37447	28.1049
Grass land	37140.6	27.875
Total	133239.8	100

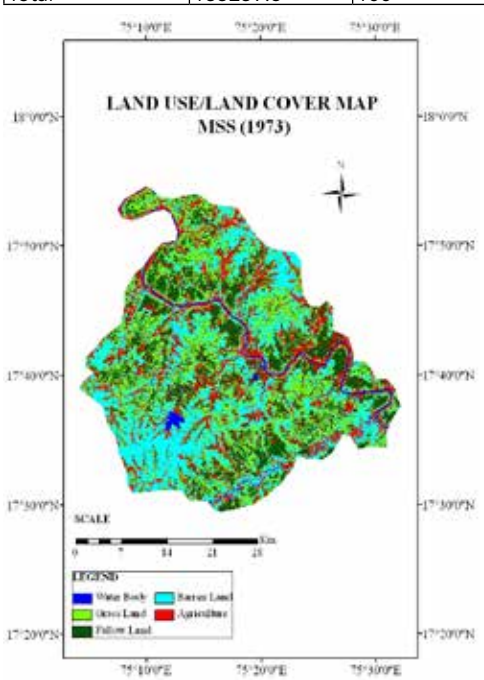


Table No. 3 Agricultural Land Use Area MSS (1973)

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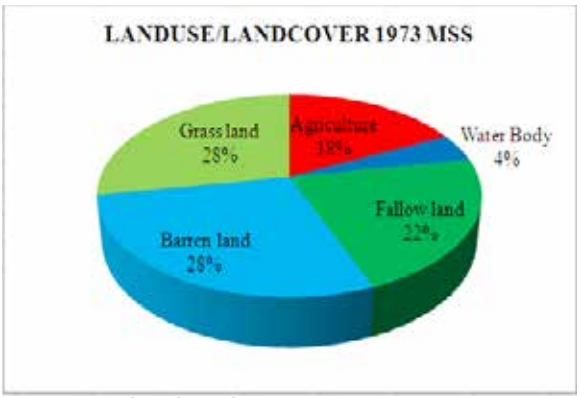

Fig. 3 Agricultural Land Use map MSS (1973)

Chart No. 2 Area Statistic Of Agricultural Land Use (MSS 1973)

Class Name	Area in (Hector)	Area in (percentage)
Agriculture	49296.1	37.0659
Water body	5157.27	3.8777
Fallow land	34086.2	25.6295
Barren land	20071.2	15.09
Grass land	24384.7	18.3349
Total	132995.5	100

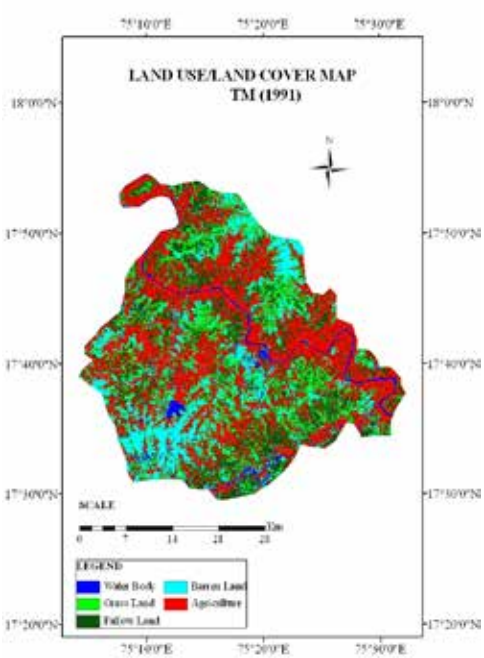

Table No. 4 Land Use/Land Cover Area (1991)

Fig. 4 Agricultural Land Use map TM (1991)

Chart No. 3 Area Statistic Of Agricultural Land Use (TM-1991)

Class Name	Area in (Hector)	Area in (percentage)
Agriculture	68572.3	51.6012
Water body	2457.02	2.8448
Fallow land	24233.9	18.2362
Barren land	23254.8	16.4994
Grass land	14370.8	10.8141
Total	132888.8	100

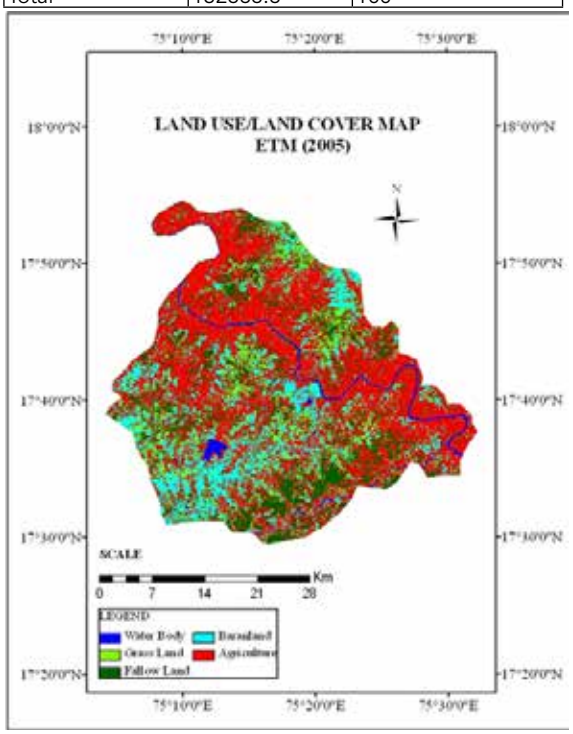

Table No. 5 Agricultural Land Use Area ETM (2005)

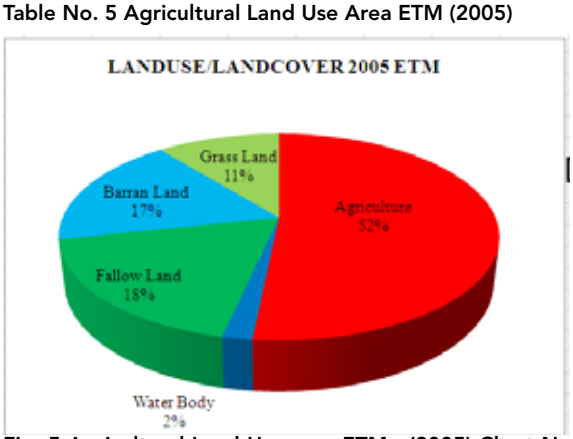

Fig. 5 Agricultural Land Use map ETM+ (2005) Chart No. 4 Area Statistic Of Agricultural Land use (ETM-2005)

RESULT & CONCLUSION

Change detection techniques using temporal remote sensing data provide detailed information for detecting and assessing land cover and land use dynamics. Different change detection techniques were applied to monitor the changes.

- Physiographic map shows that the North & South part cover by Highest elevation ranges from 474 to 526 meter & middle part cover by lowest elevation ranges in between 435 to 448 meter because of Bhima river basin.
- Geologcal map shows that largest area cover by 9 'AA' &

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1 'Pahochoe basaltic lava flow >190 mt which is suitable for watershed management.

- In Geomorphology maximum area cover by middle level plateau & some North & Western part cover by denudational origin of Deccan trap in which first class is suitable for agriculture.
- In Geohydrology Maximum area is suitable for Ground water development but there is a need if maximum rainfall which is not possible in Solapur region.
- Slope of Pandharpur region is in between 0 to 50 degree in which area cover by 0 to 5 degree is suitable for watershed management which can be helpful to increase Agricultural Field.
- Drainage map shows that, this is fifth order watershed having dendrtic drainage pattern which can be provide water to all over Pandharpur Tahsil if there is a availability of required rainfall
- When we compare Land Use/ Land Cover map of MSS (1973), TM (1991) & ETM + (2005) we know that this region having maximum development in Agricultural field which increased near about 25%, Grass Land, Barren Land is decreased by 15% which is the indication of maximum development in Agricultural area. Availability of water, use of fertilizers, development in economic condition of farmer etc. are the reason behind the increase rate in Agricultural field.
- The increase in agricultural land is a welcoming trend. But empirical observation reveals that due to increase in cost of cultivation, problems due to shortage of labor supply of low quality adulterated fertilizers and price fluctuation in the market the farmers prefer to sell their land to property promoters. Hence there is a risk of decline in the extent of land under agriculture in the near future.
- Although the area of land under Agriculture has increased, the general trend in land use and land cover change in the area has not benefited soil fertility. For this reason, multipurpose crops should be introduced that can satisfy the need for food, livestock fodder, soil fertility improvement, and soil and water conservation.

Agricultural Land use mapping and detection of changes shown here may not provide the ultimate explanation for all problems related to land use/land cover changes and cannot be an end in itself rather, it serves as a base to understand the patterns and possible causes and consequences of land use/ land cover changes in the area.

REFERENCE

1. Daniel Ayalew Mengistu1 and Ayobami T. Salami, December, 2007, Application of remote sensing and GIS inland use/land cover mapping and change detection in a part of southwestern Nigeria, African Journal of Environmental Science and Technology Vol. 1 (5), pp. 099-109, | 2. Bedru Sherefa Muzein, November 2006, Remote Sensing & GIS for Land Cover/ Land Use Change Detection and Analysis in the Semi-Natural Ecosystems and Agriculture Landscapes of the Central Ethiopian Rift Valley, Dresden, Germany | 3. Yasodharan Suresh, D. Balachandar, K. Rutharvel Murthy, R. Muruganandam and K. Kumaraswamy, 2011, Land Cover/ Land Use Change Detection through using Remote sensing & GIS technology – A case study of St.Thomas Mount Block, Kanchipuram District, Tamilnadu International Journal of Current Research Vol. 3, Issue, 11, pp.501-504, November, | 4. Volker Walter, 2004, Object-based classification of remote sensing data for change detection, ISPRS Journal of Photogrammetry & Remote Sensing 58 225– 238 | 5. R.Manonmani, G.Mary Divya Suganya, 2010, Remote Sensing and GIS Application In Change Detection Study In Urban Zone Using Multi Temporal Satellite, International Journal of Geomatics & Geosciences,Volume 1, No 1