OPEN ACCESS
Quick Response Code:
Website: https://wgges.us

Manuscript ID:
IJWGAFES-2025-021202

DOI: 10.5281/zenodo.18113706

DOI Link:
https://doi.org/10.5281/zenodo.18113706

Volume: 2
Issue: 12
December
Year: 2025
E-ISSN: 3066-1552

Submitted: *06 Nov.2025*
Revised: *11 Nov.2025*
Accepted: *04 Dec 2025*
Published: *31 Dec. 2025*

[1,2]Department of Geography, Vasantrao Naik Government College, Nagpur, Maharashtra, Rashtrasant Tukdoji Maharaj Nagpur University Nagpur
Email: pradiprshahare@gmail.com

Address for correspondence:
Pradip Shahare
Department of Geography, Vasantrao Naik Government College, Nagpur, Maharashtra, Rashtrasant Tukdoji Maharaj Nagpur University Nagpur
Email: pradiprshahare@gmail.com

How to cite this article:
Shahare, P., & Damodare, S. (2025). Change Detection for LULC Classification Using Satellite Imagery. International Journal of World Geology, Geography, Agriculture, Forestry and Environment Sciences, 2(12), 6–11. https://doi.org/10.5281/zenodo.18113706

Change Detection for LULC Classification Using Satellite Imagery

Pradip Shahare[1], Dr. Shushma Damodare[2]

Abstract

Change Detection for LULC Classification Using Satellite Imagery. To maintain the present natural resources and to understand the causes and consequences of over exploitation of soil and water resources the land use, a land cover mapping and monitoring was done in the study area i.e. Sakoli Taluka. In this study, satellite images for 2015 and 2025 were used for LULC (Land Use/ Land Cover) Supervised / Visually classification. For the classification purposes, Five LULC classes are derived. 1. Agriculture Land, 2.Forest Land and 3.Transportation 4.Urban built-up, 5.Water body For Accuracy Assessment Classification error matrix analysis was done. Change Detection between both the images for all the land use and land cover classes were computed. One decade Study for Change detection for Sakoli taluka district bhandara using scale 1: 10000 on Landsat 8 imagery between 2015 to 2025. Change Detection for LULC Classification for five classes Agriculture Land Decrease 2025 in 0.95% as compare 2015, Forest Land Decrease 2025 in 1.93% as compare 2015 and Urban built-up Land Increases 0.43% as compare 2015 and Water body Increases 0.66% as compare 2015.

Keywords: *Visually Image Interpretation, Support Vector Machine, Supervised, Unsupervised, Percentage of Deviation.*

Introduction

Change Detection for LULC Classification Using Satellite Imagery, Visually imagery interpretation technique use in Tone, Texture, pattern, Association for five LULC classes are derived. 1. Agriculture Land, 2.Forest Land and 3.Transportation 4.Urban built-up, 5. Water body. Using Satellite imagery spectral bandwidth information 1.True color - Red, Green, Blue, 2.False Color – NIR, Red, Green, 3.NDVI – (NIR-Red/NIR + Red), 4. Urban false color (B12, B11, B4), 5. NDWI – (Green - NIR/Green + NIR), 6. NDSI – (Green – SWIR /Green + SWIR). Over the past years, data from the Earth sensing satellites have become vital in mapping the Earth's features and infrastructures, managing natural resources and studying environmental change (Zubair, 2006).

Rao & Narendra (2006) and Boakye et al (2008) have done the mapping of land use and land cover changes using unsupervised classification methodology. They used ERDAS imagine software for classification and final maps preparation. There are many studies found in which many researcher or scientists have used ERDAS imagine software for the classification purpose. Asadi et al (2010), created spatial digital database consisting of Land Use/ Land Cover (LULC) using Indian Remote Sensing (IRS-ID), PAN (Panchromatic) and LISS-III (Linear Imaging Self Scanning Sensor) merged satellite data of Municipal Corporation of Hyderabad, India. Data input and conversion was done in ERDAS image processing software. Database creations and analysis were done in Arc/Info and ArcView GIS software. Yu et al (2007) used Landat MSS Image (1976), Landsat TM Image (1990) and IRS-ID LISS III (2005) images for Land Use/ cover mapping by visual interpretation and further analysis was carried out in ERDAS IMAGINE in Birahi Ganga Sub-Watershed of the Garhwal Himalaya, India.

Unlike unsupervised classification many scientists like Rao & Narendra (2006), Remi et al (2007), Chaudhary et al (2008) and Kim et al (2008) have applied supervised classification in their studies. They reported that land use land cover classification with maximum classification accuracies were acquired by using Maximum Likelihood Classification (MLC) decision rule.

Some studies on sustainable watershed management have been done in areas where resources are optimally utilized for the benefit of the people and development of a region, as a whole. To achieve optimal utilization of resources, studies were undertaken to decide alternative land use options in a watershed by visual interpretation techniques using GIS. A similar study was undertaken in National Capital Region (NCR) Delhi, where urban LULC change detection was done by Mohan (2005), under planning for rural and urban communities.

A project done by NRSA, Hyderabad (2007) on Geoinformatics based Land Use and Landcover change in Khamman District of Andhra Pradesh, India, by Social Forestry Institute of ITC Limited, PSPDC Unit, and Bhadrachalam.

The study was carried out using IRS ID and IA satellite data of LISS III, LISS IV and LISS I sensors using visual interpretation technique. Some scientists like Thornton (2002) and Herold et al (2006) also used visual interpretation technique to prepare a detailed land use land cover map.

State Forest Report Maharashtra (2005) shows that total geographical area of Maharashtra is 30,771,000 hectares, in which land unavailable for cultivation is 19.27%, land under cultural waste is 2.94%, fallow lands other than current fallows is 3.81% and land under current fallows is 3.87%.

Materials and Methods

1. Study Area and topography relief

Sakoli is a taluka and town located in the Bhandara district of eastern Maharashtra, India. Geographically, it lies approximately between latitude 21.1°N to 21.3°N and longitude 79.9°E to 80.1°E. It is part of the Vidarbha region and is well connected via National Highway NH-6 (now NH-53), forming a link between Nagpur and Raipur.

The terrain of Sakoli is characterized by a gentle to moderately undulating topography. Elevation generally ranges between 230 to 300 meters above sea level. The area includes low hill ranges, residual uplands, and intervening valleys, with some parts forming extensions of the Satpura hill ranges. The eastern and southern parts exhibit higher relief due to rocky outcrops and forested hills.

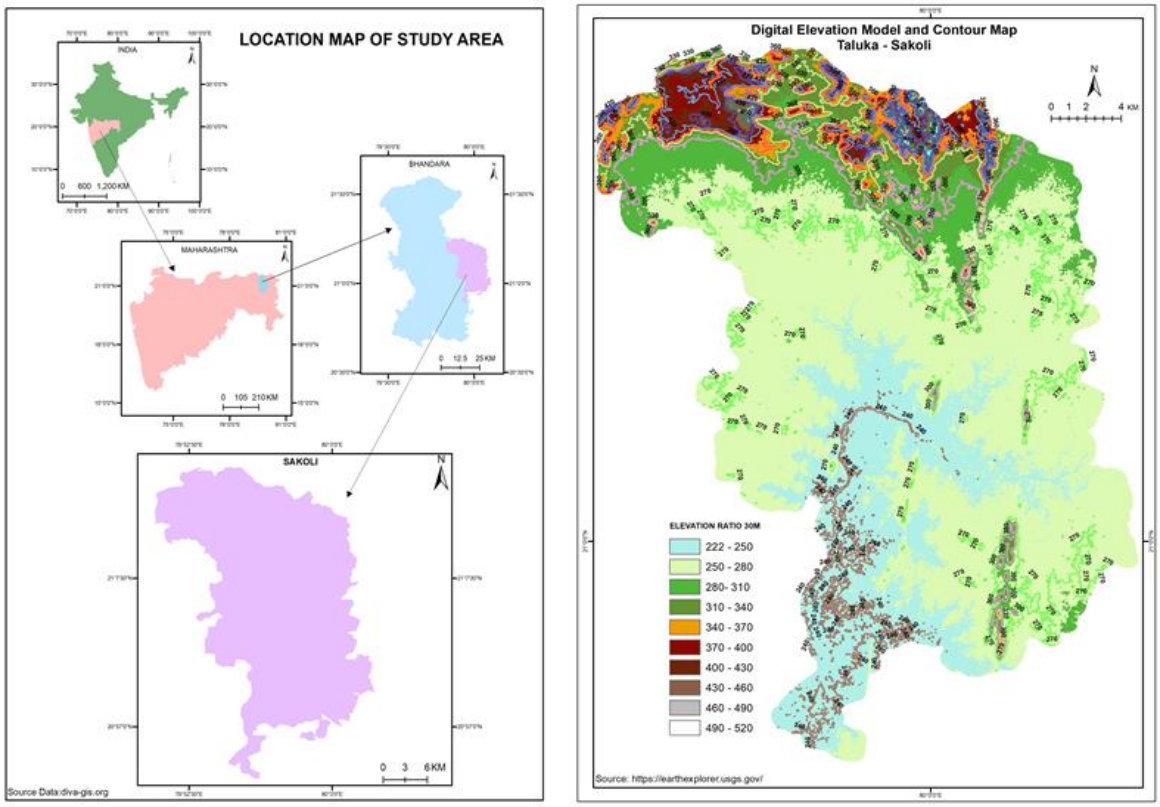

Fig.1

2. Soil and Drainage

The study area is predominantly black cotton soil (Regur), and lateritic soils are found. Alluvial deposits are seen along river valleys, supporting agriculture. Soil fertility is moderate to high in valley regions, but low in upland rocky areas. The area is drained by minor tributaries of the Wainganga River, such as the Bawanthadi and Kanhan. Numerous seasonal streams, tanks, and irrigation reservoirs are present, with Chulbandh Dam being a major water source for irrigation and domestic use. The general slope of the area is from northwest to southeast.

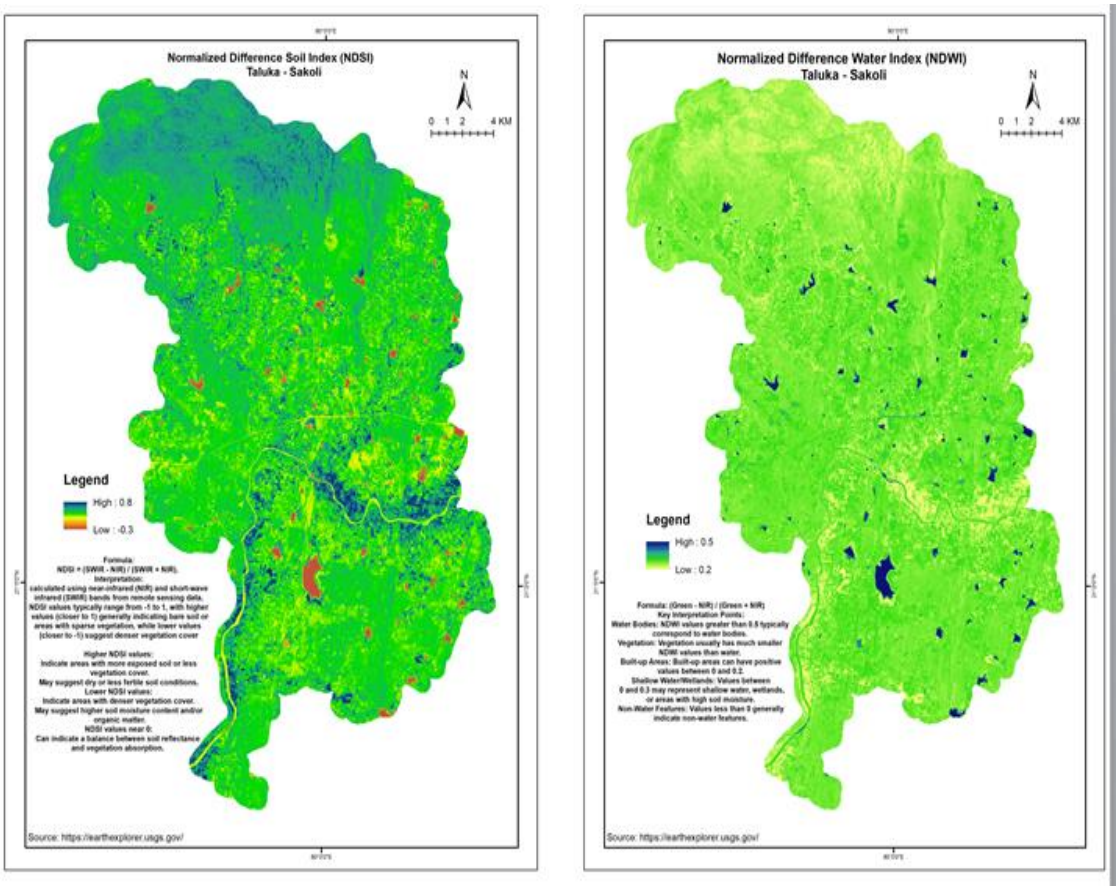

Fig.2

3. Remote Sensing Data

Landsat 8 images provide high-quality, free Earth observation data from its OLI and TIRS sensors, featuring 11 spectral bands, resolutions of 15m (panchromatic) and 30m (multispectral), a 100m thermal band, and a 16-day revisit cycle, crucial for monitoring land use, water resources, urban changes, and vegetation health globally.

Sensors: Operational Land Imager (OLI) & Thermal Infrared Sensor (TIRS).

Spectral Bands: 11 total (9 OLI, 2 TIRS) covering visible, NIR, SWIR, coastal, and thermal infrared.

Spatial Resolution:

15 meters (Panchromatic - Band 8).

30 meters (Multispectral - Bands 1-7, 9).

100 meters (Thermal - Bands 10, 11).

Swath Width: ~185 km (115 miles).

Revisit Time: Every 16 days, doubling coverage with Landsat 7 for 8-day revisit.

Altitude: ~705 km in a sun-synchronous orbit.

Bands 1-4 and 8: Visible light bands, including Blue, Green, Red, and Panchromatic.

Band 1 (Coastal Aerosol): Used for shallow water imaging and aerosol detection.

Band 2 (Blue): Captures blue light, useful for visualizing certain atmospheric effects.

Band 3 (Green): Captures green light, often used in true-color imagery.

Band 4 (Red): Captures red light, commonly used in false-color imagery.

Band 5 (Near-Infrared): Detects vegetation health and can be used to create vegetation indices.

Band 6 (SWIR 1): Captures shortwave infrared radiation, useful for analyzing soil and vegetation properties.

Band 7 (SWIR 2): Captures shortwave infrared radiation, useful for identifying water bodies and mineral deposits.

Band 8 (Panchromatic): Higher spatial resolution band, capturing more detail in a grayscale image.

Band 9 (Cirrus): Captures cirrus clouds, helpful for cloud detection and removal.

Bands 10 and 11 (TIRS): Thermal infrared bands, used for surface temperature analysis.

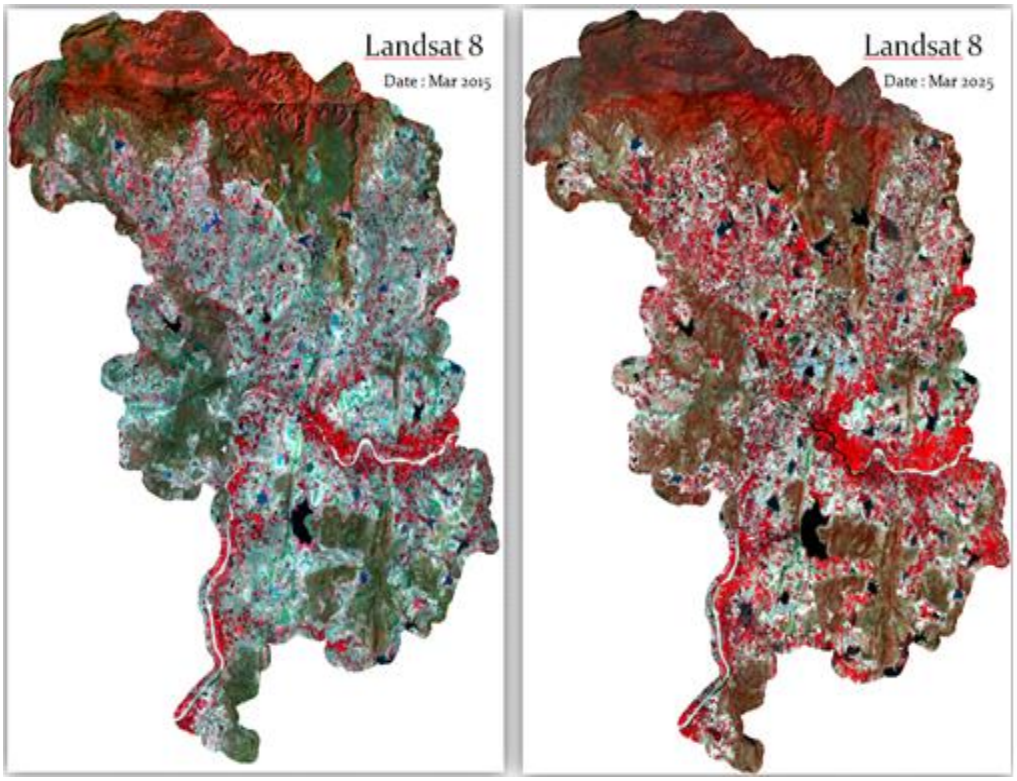

Fig.3

4. Land Use and Land Cover

Land Use and Land Cover (LULC) change detection is an essential component in understanding the dynamics of human-environment interactions and their impact on regional ecosystems. Sakoli Taluka, located in the Bhandara district of Maharashtra, India, has witnessed significant socio-economic development over the past few decades, resulting in notable transformations in its land use patterns. Agricultural expansion, urbanization, deforestation, and water resource development have contributed to shifts in the region's LULC.

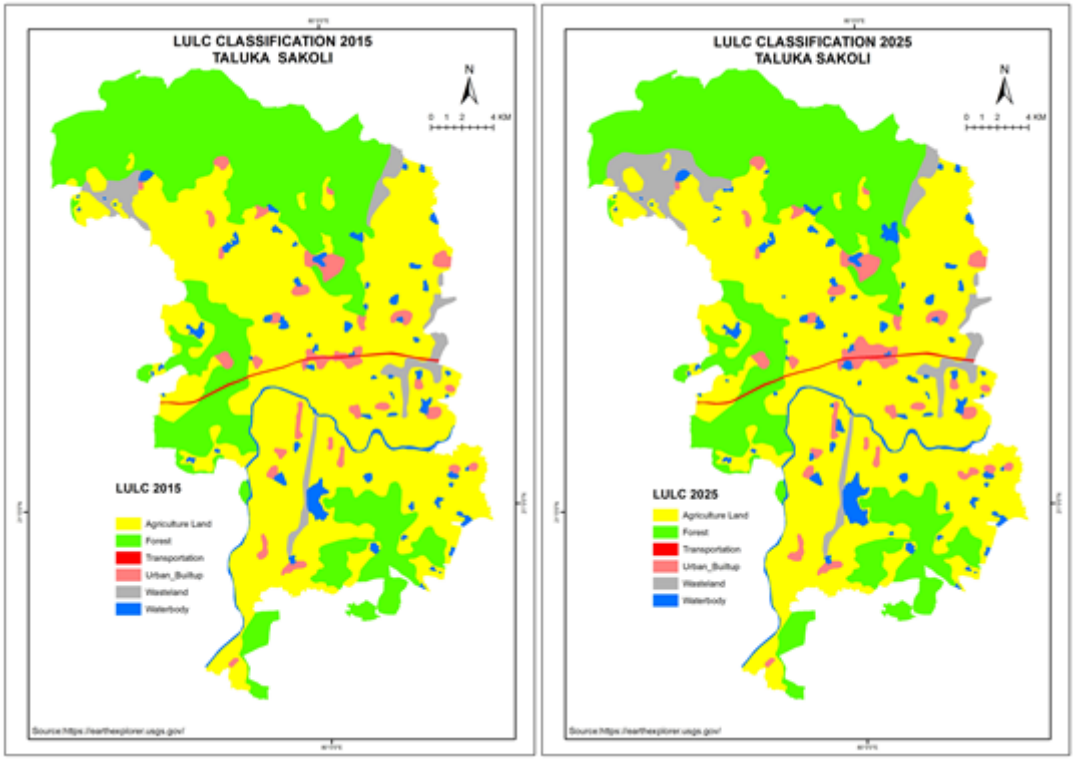

Fig.4

Table:1

LULC Class	2015 (in Hectare)	2025 (in Hectare)	(2025-2015) Difference in Hectare	(2025-2015) Percentage of Deviation
Agriculture Land	31345.10	30779.27	-565.83	-0.95
Forest	22230.41	21079.51	-1150.90	-1.93
Transportation	198.43	198.43		
Urban built-up	1859.15	2114.65	255.50	0.43
Wasteland	3703.42	3010.18	-693.24	-1.16
Water body	1792.57	2188.55	395.98	0.66
Total	**59370.58**	**59370.58**		

Result

1. Land Use and Land Cover Mapping and Change Detection

Change Detection for LULC Classification sakoli taluka district bhandara state Maharashtra using for five classes Agriculture Land Decrease 2025 in 0.95% as compare 2015, Forest Land Decrease 2025 in 1.93% as compare 2015 and Urban built-up Land Increases 0.43% as compare 2015 and Water body Increases 0.66% as compare 2015.

Table: 2

LULC Class	2015 (in Hectare)	2025 (in Hectare)	(2025-2015) Difference in Hectare	(2025-2015) Percentage of Deviation
Agriculture Land	31345.10	30779.27	-565.83	-0.95
Forest	22230.41	21079.51	-1150.90	-1.93
Transportation	198.43	198.43		
Urban built-up	1859.15	2114.65	255.50	0.43
Wasteland	3703.42	3010.18	-693.24	-1.16
Water body	1792.57	2188.55	395.98	0.66
Total	**59370.58**	**59370.58**		

Conclusion

Change Detection for LULC Classification sakoli taluka district bhandara state Maharashtra using study for one decade between 2015 to 2025 decrease for agriculture land , forest land, Wasteland as per 2015 classify.

The outcome is a change map that delineates areas where changes have occurred and provides quantitative metrics area in hectare for different types of changes 1.Agriculture land 2015 (31345.10) 2025 (30779.27),2.Forest Land 2015 (22230.41) 2025 (21079.51), 3. Urban built-up Land 2015 (1859.15) 2025 (2114.65) and 4. Water-body 2015 (1792.57) 2025 (2188.55).

Acknowledgment

The authors would like to express their sincere gratitude to Department of Geography Vasantrao Naik Government Institute Nagpur, Rashtrashant Tukdoji Maharaj Nagpur University for providing the necessary facilities and support to carry out this research.

We also thank Prof. Dr. Shushma L. Damodare of Geography Vasantrao Naik Government Institute Nagpur, Rashtrashant Tukdoji Maharaj Nagpur University for their valuable guidance and insightful suggestions during the course of this study.

Financial support and sponsorship

Nil.

Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

References

1. Asadi, S.S., Rao Hanumantha, C.H., Prasad Lakshmi, T., and Reddy Anji, M. (2010) Evaluation of physical charact eristics using geomatics: A Case Study. Indian Journal of Science and Technology, 3(4), pp. 450-454.
2. Maharashtra State Gazetteer (Jalgaon,)(1956-57), Cultural Affairs and Tourism Department, Mumbai
3. Jonathan, M., Meirelles, M.S.P., Berroir, J.P., and Herlin, I. (2007) Regional Scale Land Use/ Land Cover Classification Using Temporal Series of Modis Data. MS/MT. Revista Brasileira de Cartografia, 59, pp. 1-7.
4. Kaul, H.A., and Ingle, S.T. (2011) Severity Classification of Waterlogged Areas of in Irrigation Projects of Jalgaon District, Maharashtra. Journal of Applied Technology in Environmental Sanitation, 1(3), pp. 221-232.
5. Kim, M., Xu, B., and Madden, M. (2008) Object based vegetation type mapping from an Orthorectified Multispe ctral IKONOS Image using Ancillary Information. Commission: VI, WG VI/4.
6. Lillesand, T.M., and Kiefer, R.W. (2000) Remote Sensing and Image Interpretation. 4th ed. New York, Wiley and Sons.
7. Maharashtra State Gazetteer (2001) Maharashtra State Gazetteer. Government of Maharashtra, Cultural Affairs and Tourism Department, Mumbai.
8. Mohan, M. (2005) TS24.5 Urban Land Cover/ Land Use Change Detection in National Capital Regional (NCR) Delhi: A Study of Faridabad District. In: Pharaohs to Geoinformatics, FIG Working Week 2005 and GSDI-8, April 16-21, 2005, Cairo, Egypt. TS 24- Planning for Rural and Urban Communities.

9. Remi, A., Huang, S., Jiren, L., Herve, Y., and Yvew Louis, D. (2007) Large Scale Land Cover Map Generation based on low and medium resolution, Envisat ASAR Data, Application of Poyang Lake area (JIANG XI, P.R. China). Proc. Envisat Symposium 2007, April 23-27, 2007, Montreux, Switzerland (ESA SP -636, July 2007).
10. Adeniyi, P. O., & Omojola, A. (1999). Landuse/landcover change evaluation in Sokoto-Rima basin of NW Nigeria based on archival remote sensing and GIS techniques. Geoinformation Technology Applications of Remote Sensing Applications for Resource and Environmental Management in Africa. Ed. by Adeniyi, PO: African Association of Remote Sensing of the Environment.
11. Begum, N., Narayana, J., & SL, A. K. (2010). Land Use/Land Cover Changes in the Catchment of Water Bodies in and Around Davangere City, Karnataka. International Journal of Ecology and Environmental Sciences, 36(4), 277-280.
12. Bisht, B. S., & Kothyari, B. P. (2001). Land-cover change analysis of Garur Ganga watershed using GIS/remote sensing technique. Journal of the Indian Society of Remote Sensing, 29(3), 137-141.
13. Brown, K., McIlveen, H., & Strugnell, C. (2000). Nutritional awareness and food preferences of young consumers. Nutrition & Food Science, 30(5), 230-235.
14. Bushra. Praveen.(2017). Monitoring and Assesment of Landslide from Agastamuni to Sonprayag. International Journal of Recent Research in Social Sciences and Humanities (IJRRSSH), 4(2), pp. 92-118.
15. Charney, J., Stone, P. H., & Quirk, W. J. (1975). Drought in the Sahara: a biogeophysical feedback mechanism. science, 187(4175), 434-435.
16. Dhinwa, P. S., Pathan, S. K., Sastry, S. V. C., Rao, M., Majumder, K. L., Chotani, M. L., ... & Sinha, R. L. P. (1992). Land use change analysis of Bharatpur district using GIS. Journal of the Indian society of Remote Sensing, 20(4), 237-250.
17. Ding, J., Jiang, J., Fu, L., Liu, Q., Peng, Q. & Kang, M. 2015. Impacts of Land Use on Surface Water Quality in a
18. Subtropical River Basin: A Case Study of the Dongjiang River Basin, Southeastern China. Journal Of Water, 7, 4427-4445.