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Original Article

Land Cover Change detection of Medchal Mandal and Its Surroundings Using SAGA Software

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ABSTRACT

Land cover change detection is more important to understand the present scenario of the geographical condition of the region, for this analyses SAGA (System for Automated Geoscientific Analysis) software used for calculates the change detection between two different years such as 2008 to 2017. In this study, we collected Landsat 8 and Landsat 5 satellite images with 30m resolution. The change detection classified based on k means cluster analysis in saga software. The clusters are a wasteland, Cultural waste, Follow land, barren land, Water, uncultivated land, cultivated misc and tree, other follow land and the Net area sown. Each one have 87,34,70, 20,23,77,53,53 and 89 km² in 2008 and 79,51,47,31,41,68,50,60,and 89 km² in 2017. Change matrix method detected 16% of changes in the study area. Colour occupation is the main resources for classification of this study for that we used unsupervised classification. The changes mainly occur in and around of national highway (NH 44). The major land cover changes are in the center portion of the study area and towards the south-east and North West small changes.

KEYWORDS: *Land cover change matrix, Landsat images, Medchal Mandal and its surroundings, SAGA*

1. INTRODUCTION

The Medchal Mandal is located in the southwest region of Hyderabad, here number of industries have been developing since from decade for that it is called sub hub of Hyderabad. The latitude and longitudes fall on N 1960000 E 220000 and S 1936000 W 248000. The elevation of the study area is 602 m and annual rainfall is 835.7 mm, the geology of the area consists of igneous rocks such as pink granite and gray granite rocks and very few areas covered by the residual hills. The forest areas are Gundlapochampally reserve forest and Dundigal reserve forest and Dulapally reserve forest etc., water bodies are Shamirpet lake, Medchal lake, and Peddamma cheruvu etc.

Remote sensing is the science to study about earth surface features by acquiring satellite images without touching the land or surface (Fisher, P. F., and Unwin, D. J., eds. 2005, Blaschke T, 2010). Different geological agents plays important role in change of the earth's surface features, Vegetation, forest and grassland have been influenced by human activities, other natural disasters are landslides, forest fires, floods, and earthquakes etc., these are all distinct categories influenced by the changes of earth's surface (Carlson, T.N 1999, Gao J 2009, Naresh, D et. al., 2018). Determination of land cover changes depends on the time periods and spatial (Almutairi, A., Warner, T.A. 2010). While taking Landsat images in different time period which is necessary to maintain the following requirements. They are two satellite images exactly match when overlap, the acquired data should maintain same season, scale, geometry, and resolution. Satellite should be clean no errors, no blurring, and any other atmospheric effects. For analysis of land cover change detection, there are several techniques used such as supervised classification (Guerschman J.P. 2003, Naresh, D et. al., 2017), unsupervised classification, post classification, image differencing, change detection of components (Balakeristanan ML, Md Said MA 2012 Lu, D., and Mausel, P. 2004, Singh A (1989)).

The aim of this project is to calculate the land cover change matrix of Medchal Mandal and its surroundings in the period from 2008 to 2017 using remote sensing techniques, here we used SAGA (system for automated Geoscientific analysis) software for analysis of Landsat images to detection of land cover changes and we applied K-mean cluster, Unsupervised classification for change matrix (Two grids).

2. CHANGE MATRIX

Change matrix a good technique for comparing two different year of raster datasets (Smits, P.C 1999, Butt A. , et. al., 2015, Michael L. Treglia 2017), for generate of matrix we should follow the same class name and description values of the raster grid classes for each satellite image, after we prepared the grids from 2017 and 2008 change matrix. In the SAGA software, click the geo-processing menu and go to imagery tool, classification and select the confusion change matrix. After one dialog box opened here set the data in classification-1 2017 image and lookup table. Classification-2 2008 image and lookup table and then create a confusion change matrix. In the result, we can get two satellite images combination table data and thematic map (Table 1).

The total study area is 542 sq.km. Table 2 Shows 2008 to the 2017 year of change matrix of land cover classification in Medchal Mandal and its surroundings. The figure 1 shows the year of 2008 four land covers like Uncultivated land, cultivated misc and Trees, Other follow land and Water bodies have been changed in the year 2017 such as wasteland at a major portion, cultural waste and Water bodies moderate portion.

Table: 1. Land cover classification with change matrix of Medchal Mandal and its Surroundings ((**Area in m²**)

	2017									
2008	**Waste land**	**Cultural waste**	**Follow land**	**Barren land**	**Others**	**Water**	**Un cultivated land**	**Cultivated misc and trees**	**Other follow land**	**Net area sown**
Waste land	17999	4953	11068	8902	3847	22313	8657	5014	6761	6844
Cultural waste	7635	1402	3122	2930	2032	6691	2445	2386	2042	6551
Follow land	19625	3036	7193	5124	2901	18144	5132	3407	3945	9715
Barren land	3673	1859	3560	425	1544	5677	3447	2469	3073	1268
Others	3142	1804	3625	4720	1565	5425	3588	2699	3269	1101
Water	1215	648	1308	3893	8628	1873	1521	4713	1763	523
Uncultivated land	3669	2802	4811	19571	11584	6436	6737	19999	8030	1466
Cultivated misc and trees	5004	3485	6376	10380	3249	9236	6857	6287	6502	1761
Other follow land	8130	3310	6870	7068	2704	11962	6115	4157	5311	2906
Net area sown	5720	5038	8396	21020	7299	10921	10807	15403	11752	2155

Table 2: Medchal Mandal and its surroundings land cover changes

	2008 Sq. km	%	**2017 Sq.km**	%
Waste land	87	16	79	15
Cultural waste	34	6	51	9
Follow land	70	13	47	9
Barren land	28	5	31	6
Others	28	5	26	5
Water	23	4	41	8
Uncultivated land	77	14	68	13
cultivated misc and trees	53	10	50	9
Other follow land	53	10	60	11
Net area sown	89	16	89	16
Total	542		542	

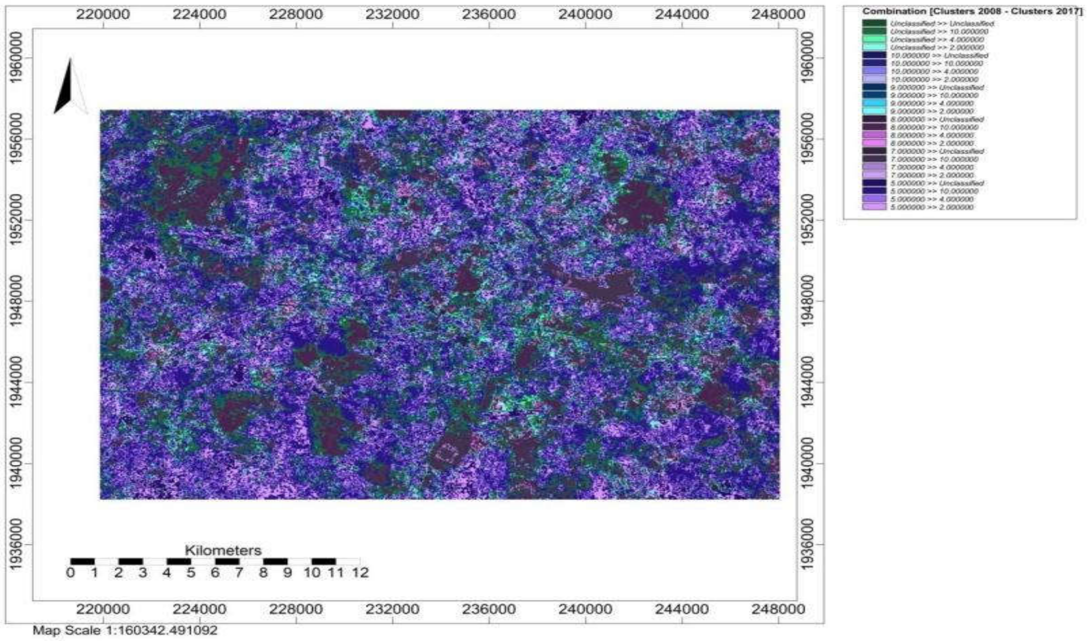

Figure: 1. Land cover change matrix cluster 2008 to 2017 **(Area in m^2)**

3. SOFTWARE ANALYSIS WORK ON SAGA

SAGA is good software to generate automatic detection of Medchal Mandal and its surrounding land cover changes. first, open the satellite data in SAGA software. SAGA has three menu commands such as geoprocessing menu, map menu (Conrad, O, et. al., 2015) and File menu. File menu generally using for uploading images, shapes and tin files etc., Geoprocessing menu is the main body of the software to analyze the data. Map menu to create a thematic map for taking printout (Svidzinska, D. 2014). Now we want to clip the image to our study area of interest. Use the clip gird interactive tool: the process is Geoprocessing >Grid> Grid system> Clip Grid Interactive. Both images produced the K-means cluster for classification of data with the reference of Friedman, H. P., & Rubin, J. 1967, Radke, R.J. (2005), after classification to explore the study area land cover changes with the appearance of histogram bar charts and tables.

We have followed the steps in SAGA for determination of change matrix they are.
1. Load Landsat imagery from 2 image dates
2. Clip both images to the area of interest
3. Conduct unsupervised classification on first image date
4. Reclassify supervised classification
5. Conduct supervised classification on other image date and reclassify
6. Compare classes/create change matrix.

In this study, we used Landsat 8 for 2017 and Landsat 5 for 2008 satellite images in the area of Medchal Mandal and its surroundings. We collected data from USGS Earth Explorer website (Friedman, H. P., & Rubin, J. (1967), each image contains three different bands 2, 3, 4 and both images have the same resolution of 30 meters. Unsupervised and K- means clusters classifying the land cover changes in different years by sequence to identify the significant changes in study area land cover changes.

Landsat 5 had a maximum transmission bandwidth of 85 Mbit/s. It was deployed at an altitude of 705.3 km (438.3 mi), and it took about 16 days to scan the entire Earth (Alphan H, Doygun H, Unlukaplan YI 2009, Czapla-Myers, J.S. 2013). The satellite was an identical copy of Landsat 4 and was originally intended as a backup. Therefore, Landsat 5 carried the same instruments, including the Thematic Mapper and Multi-Spectral Scanner Landsat 5 (Markham B. L., 1998) and Landsat 8 swath 185 km and the resolution is 15-30 meters, 16 bit of Geo Tiff image format (Storey et. al., 2014), both data collected from USGS Earth Explorer website.

4. RESULTS AND DISCUSSION

SAGA software gives a clear view of the land cover changes in Medchal and its surroundings between years from 2008 to 2017. Change matrix is the best method to analyze data of changes in satellite images (Gao J., and Liu Y. 2010, Mas JF 1999, Tucker M, Asik O (2002) in the study area 90 km^2 land changes occur, Uncultivated land, cultivated misc and trees, other follow land and are converted into a wasteland, cultural waste and Water bodies in different percentages (Treitz P, and Rogan J 2004). As per the results we found that the period from 2008 to 2017 different clusters decreases like wasteland 8 km^2, Follow land 23 km^2, Uncultivated land 9 km2, Cultivated misc and trees 3 km2. Increases in land changes are Cultural waste 17 km^2, Barren land 3 km^2, Water bodies 18 km2 and other follow land 7 km^2.

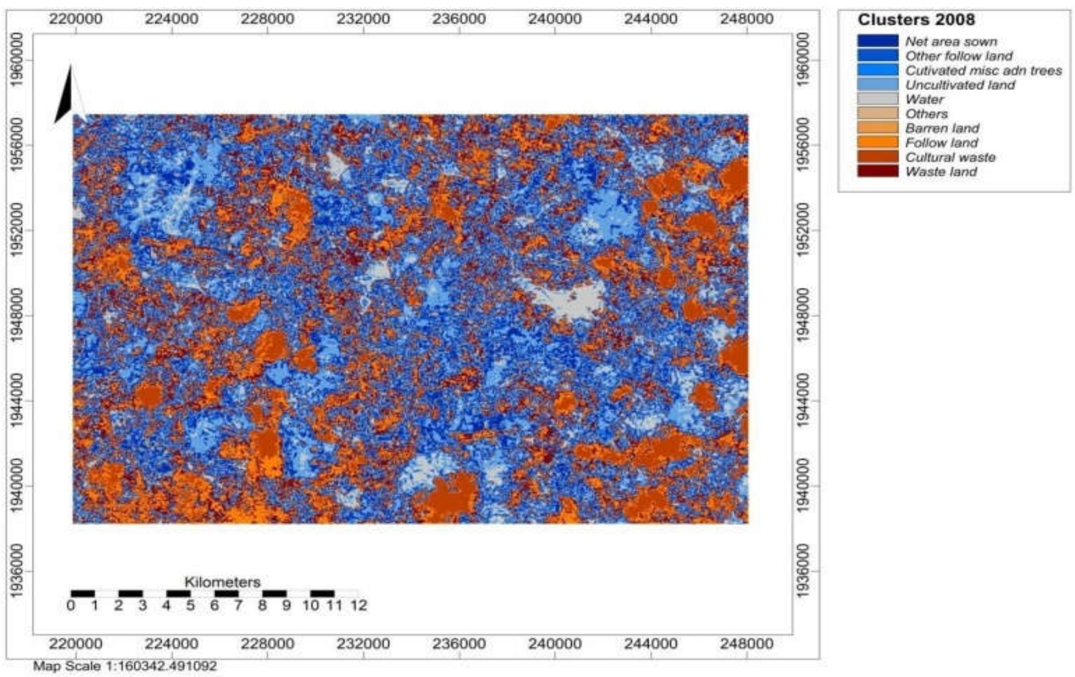

Figure 2: The study area of land cover classification with represent to 2008 cluster

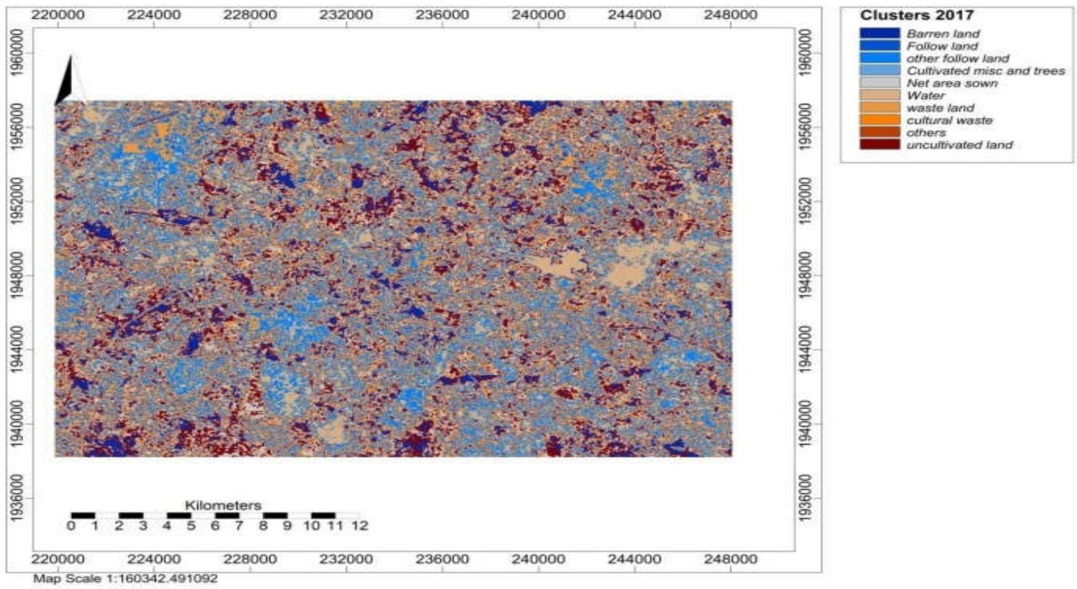

Figure 3: The study area of land cover classification with represent to 2017 cluster

Urban development increases in the center portion of the study area and towards the south-east and North West fewer changes only. The changes occur in and around of national highway (NH44) the villages are Gundlapochampally, Kistapur, Medchal, Dundigal, Pudur, Kandlakoia and Railpur. Rapid increase of Water bodies in the year of 2017 because in the year of 2016 Medchal Mandal received highest rainfall in September 196.75mm, for that we observed 18 km^2 increases of water bodies, and the Telangana state government introduce the surface water body protection programme it is called Mission Kakatiya. For that reason water bodies' are increased in Medchal Mandal. In the year of 2017 satellite shows that 17 km^2 of the cultural waste land increased because Industries, real estates, population and infrastructures increased. The developing areas are in Kistapur, Gundlapochampally and Dundigal regions.

5. CONCLUSION

Land use Land cover change matrix provides numerical information for understanding change detection of the study area, in this regards raster maps shows from 2008 to 2017 the amount of urban area, water bodies are increased while rural area cover types such as agriculture, cultural waste and follow land are decreased. We concluded that land cover change patterns in the study area and demonstrate the potential of Landsat data to provide an accurate, economical means to map and analyze changes in land cover over time that can be used as inputs to land management. While analysing the data from landsat satellite colour detection should carefully determine.

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REFERENCES

[1]. Fisher, P. F., and Unwin, D. J., eds. Representing GIS. Chichester, England: John Wiley & Sons (2005).

[2]. Blaschke T, Object-based image analysis for remote sensing. *ISPRS Journal of Photogrammetry and Remote sensing* 65(2010): 2-16.

[3]. Carlson, T.N.; Azofeifa, S.G.A. Satellite Remote Sensing of Land Use changes in and around San Jose´, Costa Rica. Remote Sensing of Environment, 70(1999): 247–256.

[4]. Gao J Digital Analysis of Remotely Sensed Imagery. McGraw-Hill Companies, Inc, New York, USA (2009).

[5]. Almutairi, A., Warner, T.A. Change Detection Accuracy And Image Properties: A Study Using Simulated Data. Remote Sensing 2(6), (2010):1508–1529 CrossRef, Google Scholar

[6]. Guerschman J.P.; Paruelo, J.M.; Bela, C.D.; Giallorenzi, M.C.; Pacin, F. Land cover classification in the Argentine Pampas using multi-temporal Landsat TM data. International Journal of Remote Sensing, 24, (2003) 3381–3402.

[7]. Balakeristanan ML, Md Said MA Land Use Land Cover Change Detection Using Remote Sensing Application for Land Sustainability. American Institute of Physics 1482(2012): 425-430.

[8]. Lu, D., and Mausel, P. Change Detection Techniques. Remote Sensing 25(20), (2004): 2365–2407 CrossRef, Google Scholar

[9]. Singh A. Review Article Digital change detection techniques using remotely-sensed data. International Journal of Remote Sensing 10: (1989): 989-1003.

[10]. Smits, P.C., Dellepiane, S.G. and Schowengerdt, R.A., Quality assessment of image classification algorithms for land-cover mapping: A review and a proposal for a cost-based approach. International journal of remote sensing, 20 (8), (1999): 1461−1486.

[11]. Butt A., Shabbir R., Ahmad S.S., Aziz N., Nawaz M., Shah M.T.A. Land cover classification and change detection analysis of Rawal watershed using remote sensing data *J. Biol. Environ. Sci.*, 6 (1) (2015): 236-248.

[12]. Michael L.Treglia An Introduction to GIS Using QGIS (v.2.12.2) (2017). https://mltconsecol.github.io/QGIS-Tutorial/QGIS- p.30 .

[13]. Conrad, O., Bechtel, B., Bock, M., Dietrich, H., Fischer, E., Gerlitz, L., Wehberg, J., Wichmann, V., and Böhner, J. (2015): System for Automated Geoscientific Analyses (SAGA) v. 2.1.4, Geosci. Model Dev., 8, 1991-2007, doi:10.5194/gmd-8-1991-2015.

[14]. Svidzinska, D. Methods of Geoecological Research: A Geoinformational Tutorial with the Open Source GIS SAGA. Kyiv, Logos, 402p. (in Ukrainian) (2014).

[15]. Friedman, H. P., & Rubin, J. On some invariant criteria for grouping data. Journal of the American Statistical Association, 62, (1967):1158-1178.

[16]. Radke, R.J. Image Change Detection Algorithms: A Systematic Survey. IEEE Trans. Image Process. 14(3), (2005): 294–307. CrossRef, MathSciNet, Google Scholar

[17]. Alphan H, Doygun H, Unlukaplan YI Classification comparison of land cover using multitemporal Landsat and ASTER imagery: the case of Kahramanmaraş, Turkey. Environ Monit Assess 151(2009): 327-336.

[18]. Czapla-Myers, J.S. Anderson N.J., Biggar, S.F. Early ground-based vicarious calibration results for Landsat 8 OLI Proceedings of SPIE, (2013): 8866

[19]. Markham B. L., Seiferth J. C., Smid J., Barker J. L., "Lifetime responsivity behavior of the Landsat-5 thematic mapper", Proc. SPIE, 3427, (1998): 420-431.

[20]. Naresh, D. Rajesh, V and Madhu, T. Integrated flood risk mapping and landuse/ landcover at local scale by using GIS in dhulapally region, IJEP 38(12): 1056-1063 (2018).

[21]. Naresh Kumar, D, Nune sandeep, S. Jyothi and Madhu, T. Significant changes on landuse/ land cover by using remote sensing and GIS analysis-review, IJESC, vol.7, Issue No.3, (2017),5433-5435

[22]. Storey, James, Michael Choate, and Kenton Lee. "Landsat 8 Operational Land Imager On-Orbit Geometric Calibration and Performance." *Remote Sensing* 6, no. 11 (2014): 11127-11152.

[23]. Gao J., and Liu Y. Determination of land degradation causes in Tongyu County, Northeast China via land cover change detection Int. J. Appl. Earth Obs. Geoinf., 12 (1), (2010): pp. 9-16

[24]. Mas J.F., Monitoring land-cover changes A comparison of change detection techniques. International Journal of Remote Sensing 20: (1999): 139-152.

[25]. Tucker M, Asik O Detecting Land Use Changes at the Urban Fringe from Remotely Sensed Images in Ankara, Turkey. Geocarto International 17: (2002): 47-52.

[26]. Treitz P, and Rogan J Remote sensing for mapping and monitoring land cover and land-use change. Progress in Planning 61: (2004): 269-279.