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Data Article

Data on land use and land cover changes in Adama Wereda, Ethiopia, on ETM+, TM and OLI-TIRS landsat sensor using PCC and CDM techniques

A.S. Mohammed Abdul Athick [a], K. Shankar [b, *]

[a] *Department of Geomatics Engineering, School of Civil Engineering and Architecture, Adama Science & Technology University, Ethiopia*
[b] *Department of Applied Geology, School of Applied Natural Science, Adama Science & Technology University, Ethiopia*

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ABSTRACT

Land use and land cover changes are often referred for the anthropogenic modification of Earth's surface. The extents of land use and land cover (LULC) changes in Adama Wereda at three different periods (2002, 2010, and 2017) were generated using data from various Landsat sensors namely ETM+, TM and OLI TIRS. This work focused on a change detection analysis using post classification comparison (PCC) and change detection matrix (CDM). These images were geometrically corrected and image processing operations for instance: radiometric correction, using spectral radiance model was carried out, followed by land cover categorisation into water bodies, built up, bare land, sparse vegetation and dense vegetation employing Knowledge, pixel and indices based classification in ERDAS imagine software. The generated data of both change detection techniques from 2002 to 2017 revealed interesting aspect that build up, dense vegetation and sparse vegetation increased in area of approximately 160%, 30% and 78% respectively at the expense of barren land which decreased at 8.5%, but there is not much change in the water bodies. It was also noticed that both the algorithms gives similar values but with negligible deviation.

* Corresponding author.
E-mail addresses: mohammed.abdulathick@astu.edu.et (A.S.M. Abdul Athick), geoshankar1984@gmail.com (K. Shankar).

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Specification table

Subject Area	Urban and Environmental Studies
More specific subject Area	Land use and land cover change, urban sprawl
Type of data	Table, figure and text file
How data was acquired	Data were extracted from various Landsat sensors such as ETM+, TM and OLI TIRS with path/row numbers 168/54 and primary data were acquired by using GPS ground survey technique
Data format	Analyzed
Experimental factors	We make use of data from USGS for mapping urban sprawl and land surface changes
Experimental features	The data were radiometrically corrected using spectral radiance model. The surface features were classified employing knowledge, pixel and indices based classification using ERDAS imagine 2015 software.
Data source location	Landsat ETM+, TM and OLI TIRS, Adama Wereda (8°33′–8°54′N, 39°16′–39°27′E)
Data accessibility	Data are available in this article
Related research article	Tamam Emiru, Hasan Raja Naqvi, Mohammed Abdul Athick, Anthropogenic impact on land use land cover: influence on weather and vegetation in Bambasi Wereda, Ethiopia, Spatial Information Research, 26 (4) (2018), 427–436 [1].

Value of the data

- The data speculates the scenario on the land use and land cover changes across Adama Wereda for almost one sixth decade.
- The data provides information on the status of urban expansion towards the sub urban and ex urban areas around Adama Wereda.
- The data place a vital role in administering the spatiotemporal expansion and its impacts on the other surface features and environment.
- The generated data gives a detailed insight on which feature is expanding on the expense of an another feature over the given period.
- The data are important for agriculture, settlements, urban planning, researchers, scholars and academics.

1. Data

The data in this article depicts the status of LULC changes in Adama Wereda over three different periods 2002, 2010 and 2017. The administrative centre of Adama Wereda is Adama City. Fig. 1 – 3 illustrates five different LULC classes (built up, water bodies, dense vegetation, sparse vegetation and barren land) for the given period. In 2002 majority of the land cover was occupied by bare land around 80409.58 ha and the least was built up closer to 2034.34 ha. Whereas, in 2017, barren land reduced by 10575.58 ha and interestingly built up area expanded approximately 3208.56 ha. These are followed by Table 1. The data in table provides the information on area (ha) and percentage (%) occupied by five land use categories over time. Table 2 – 4 represents the producer accuracy of classifications. Fig. 4 shows the comparison of overall land use and land cover values in percentage. Figs. 5 and 6 illustrates the generated map by PCC for 2002 to 2010 and 2010 to 2017 respectively illustrating the changes from one feature to another. The data in Tables 5 and 6 demonstrates the change area in hectare generated by change detection matrix.

2. Experimental design, materials, and methods

Land use and land cover changes have major impact on wide range of environmental and landscape attributes [1]. ETM + (2002), TM (2010) and OLI – TIRS (2017) Landsat images of 30 m spatial resolution with path and row of 168/54 and GPS ground coordinates were the vital data employed in this article [2–6]. At first, all the data were radiometrically corrected to remove noise due to sensor and atmosphere using spectral radiance model. The spectral reflectance values from the spectral library were utilized to identify the features from images. The generated corrected images were enhanced and the surface features for instance built up, water bodies, dense vegetation, sparse vegetation and barren

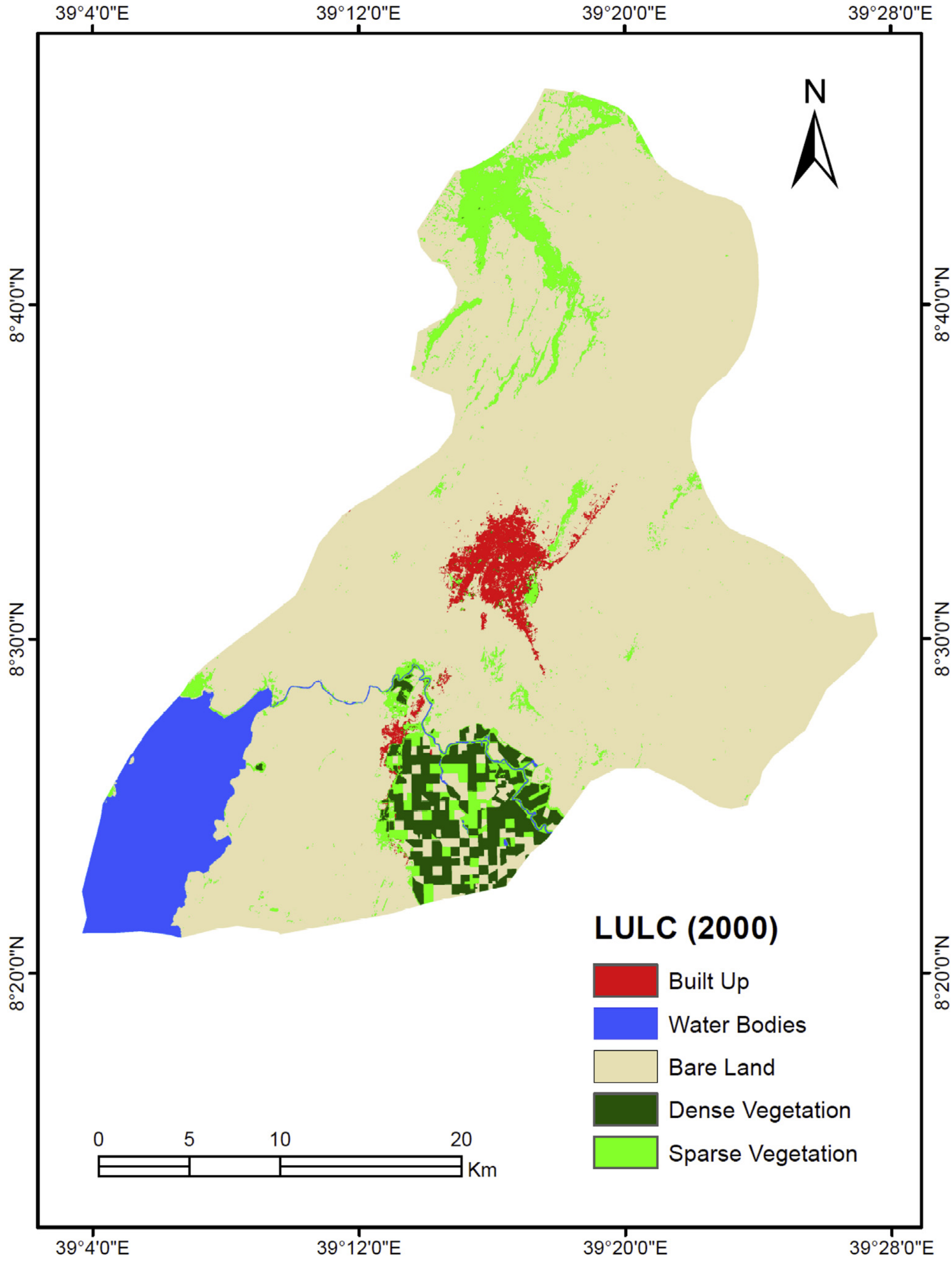

Fig. 1. LULC classes of Adama Wereda in 2002.

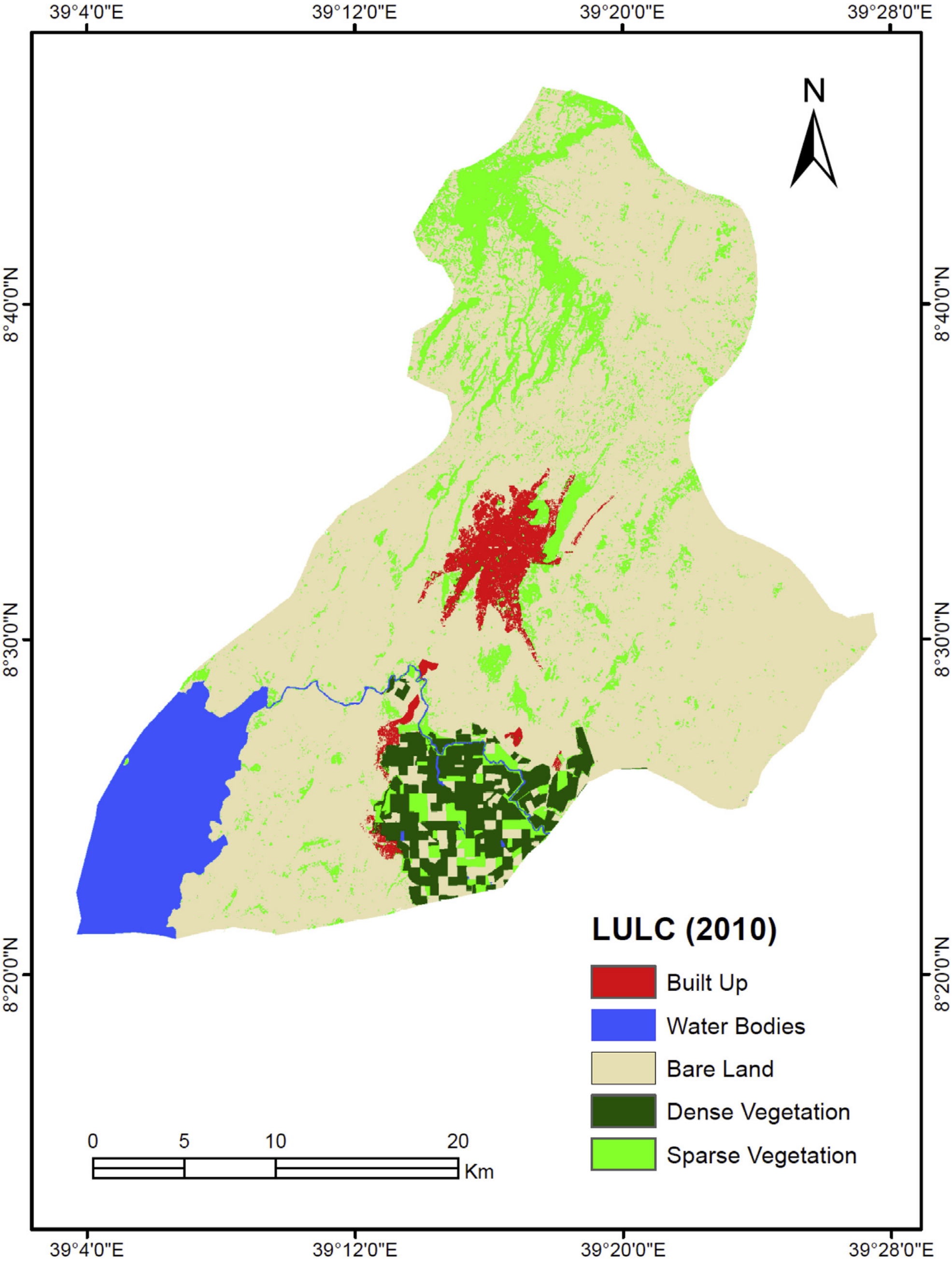

Fig. 2. LULC classes of Adama Wereda in 2010.

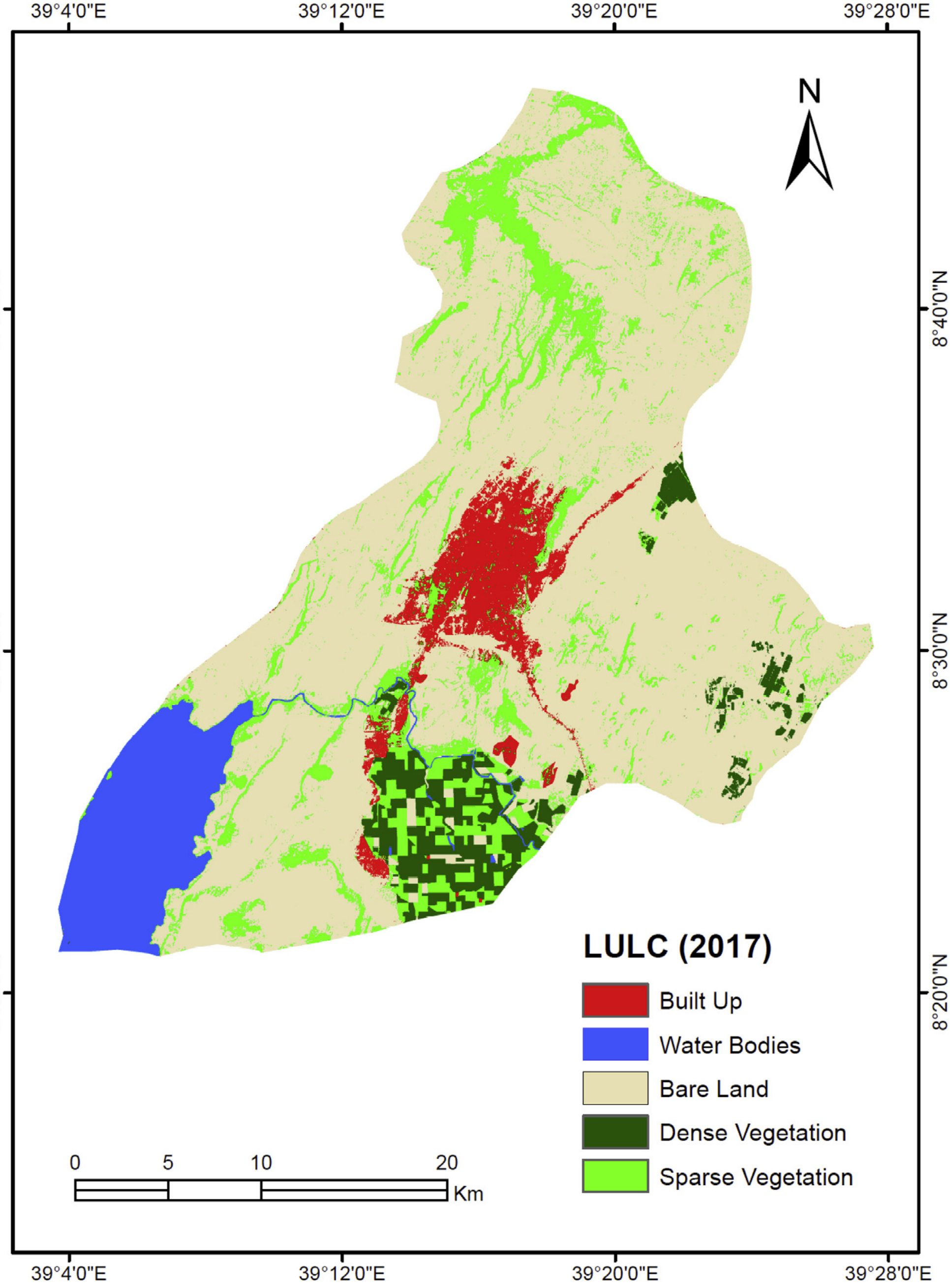

Fig. 3. LULC classes of Adama Wereda in 2017.

Table 1
LULC extents and changes (2002–2017).

LULC Class	2002		2010		2017		2002–2010		2010–2017		2002–2017	
	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%
Sparse vegetation	5968.13	5.97	10602.67	10.57	11980.2	11.97	−4634.57	−4.60	−1377.51	−1.41	−6012.07	−6.00
Dense vegetation	3592.75	3.59	4689.035	4.65	4866.57	4.86	−1096.29	−1.06	−177.54	−0.21	−1273.82	−1.27
Bare land	80409.58	80.37	73623.8	73.65	69834	69.80	6785.78	6.73	3789.8	3.84	10575.58	10.57
Water body	8040.58	8.04	8249.94	8.25	8121.71	8.12	−209.36	−0.22	128.23	0.13	−81.13	−0.08
Built up	2034.34	2.03	2879.91	2.88	5242.9	5.24	−845.57	−0.85	−2362.99	−2.36	−3208.56	−3.21
Total	100045.38	100	100045.38	100	100045.38	100						

Positive sign means increase while negative sign means decrease in area.

Table 2
Contingency Matrix of classified image, 2002.

Data	Bare land	Dense vegetation	Sparse vegetation	Water bodies	Built up	Row total	%
Bare Land	483237	2	0	1093	3457	487789	99.07
Dense Vegetation	0	29246	504	6	0	29756	98.29
Sparse Vegetation	2255	877	33259	375	16	36782	90.42
Water Bodies	0	0	0	195786	0	195786	100
Built Up	7939	16	35	78	40368	48426	83.34
Column Total	493431	30141	33798	197338	43831	798539	
Overall accuracy for 2002 classified image is 94.22%							

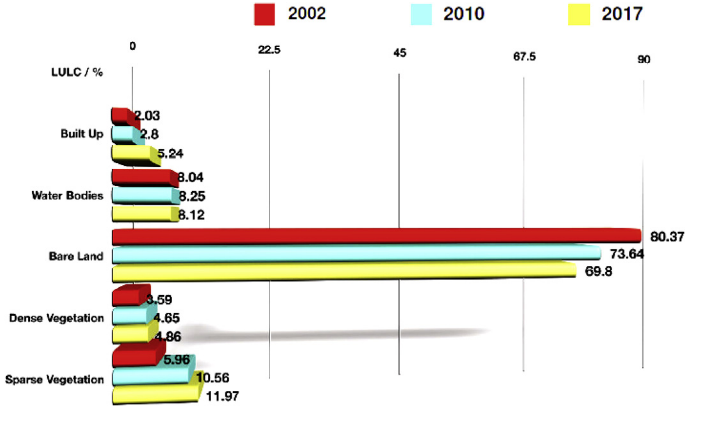

Fig. 4. Overall comparison of LULC changes (%) in Adama Wereda between 2002, 2010, 2017.

land as defined by US geological survey [7,8] employing pixel, knowledge and indices based maximum likelihood classification. Indigenous features namely water bodies and vegetation were extracted using mathematical indices, features in mixed pixels were categorized by knowledge based classification and various features such as road network, settlements, industries, utilities under the category of built up were isolated by pixel based classification. The classified images were evaluated through confusion matrix, if the accuracy of the classified image accounted less than 80% then the images must be reclassified [9]. Finally, only the images with accuracy greater than 80% were used to generate land use and land cover changes by employing PCC and CDM techniques. The land cover changes for 2017 were validated by ground truth using GPS coordinates of sample spatial features with minimum 20 spatially distributed ground control points. For the images of 2002 and 2010 the area change was correlated by

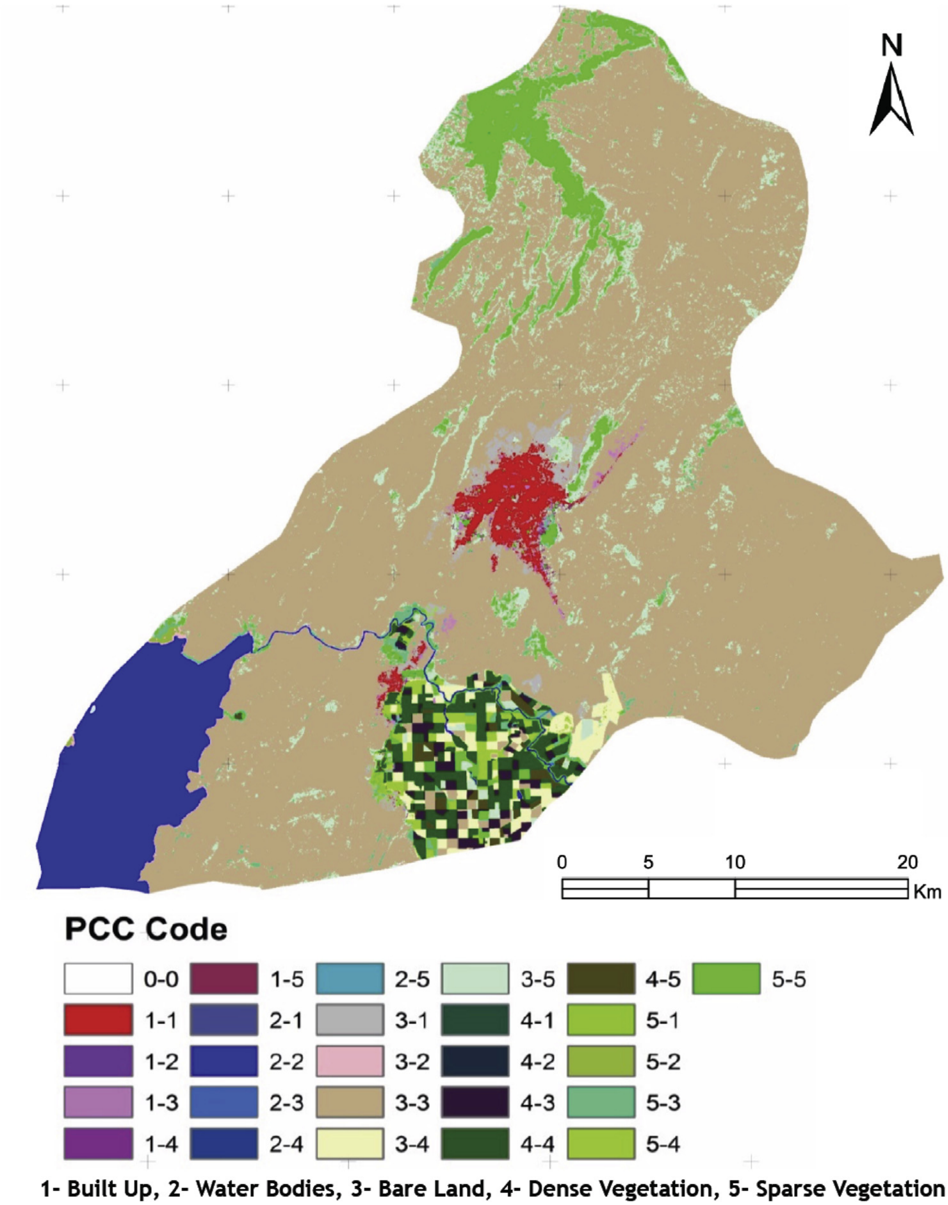

Fig. 5. LULC transformation with respective codes using PCC technique (2002–2010).

using spatial link with google earth. The generated data from PCC and CDM depicted that built up has drastically increased from 2.03% to 5.24% and Bare land decreased from 80.37% to 69.80%. Moreover there was fluctuation in the area of dense and sparse vegetation approximately by 1.3% and 6% respectively. As Adama being a high elevated land the type of green cover on the ground has an effect on triggering or preventing natural hazards. If there are bushes or tree species can prevent and stabilize the highlands [10]. There is no significant change observed in water bodies.

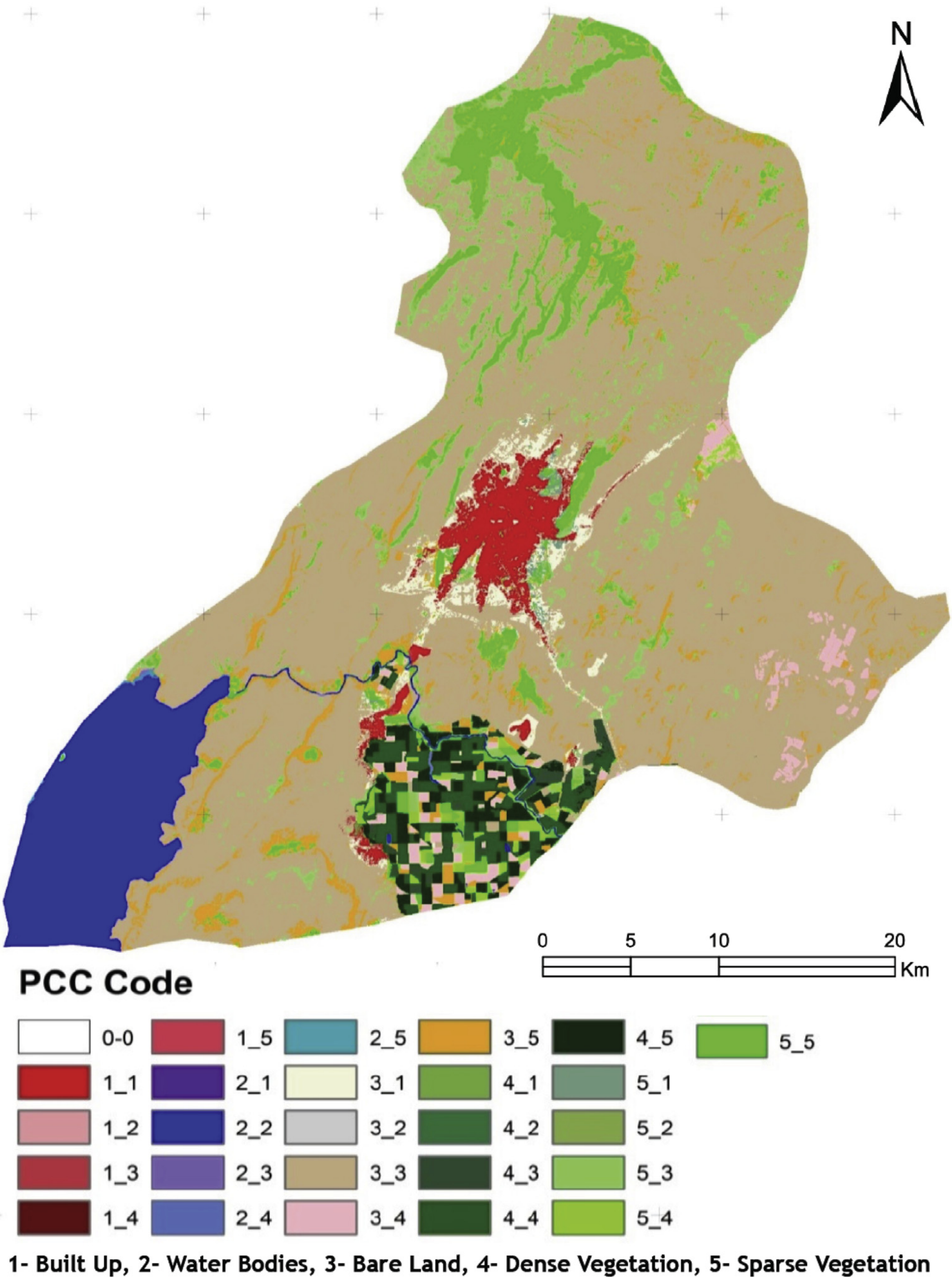

Fig. 6. LULC transformation with respective codes using PCC technique (2010–2017).

Table 3
Contingency Matrix of classified image, 2010.

Data	Sparse vegetation	Dense vegetation	Bare land	Water bodies	Built up	Row total	%
Sparse Vegetation	21206	115	946	299	585	23151	91.6
Dense Vegetation	76	1506	0	11	0	1593	94.54
Bare Land	731	0	18622	73	920	20346	91.53
Water Bodies	0	0	0	36755	0	36755	100
Built Up	482	0	177	119	16492	17270	95.5
Column Total	22495	1621	19745	37257	17997	99115	
Overall accuracy for 2010 classified image is 94.63%							

Table 4
Contingency Matrix of classified image, 2017.

Data	Built up	Bare land	Dense vegetation	Water bodies	Sparse vegetation	Row total	%
Built up	84390	260	428	958	829	86865	97.16
Bare Land	565	61086	240	10	352	62253	98.13
Dense Vegetation	87	2	51335	673	133	52230	98.29
Water Bodies	0	0	0	146025	0	146025	100
Sparse Vegetation	81	274	4990	27	61988	67360	92.02
Column Total	85123	61622	56993	147693	63302	414733	
Overall accuracy for 2017 classified image is 97.1%							

Table 5
Change detection Matrix in hectare (2002–2010).

LULC Class	Built up	Water bodies	Bare land	Dense vegetation	Sparse vegetation	Total
Built Up	1600.178	0.292	1186.065	1.103	92.272	2879.91
Water Bodies	0.068	7983.179	140.963	3.487	133.628	8249.94
Bare Land	296.55	30.6	71508.848	842.04	911.655	73589.693
Dense Vegetation	8.64	5.67	1537.492	2186.325	909.112	4647.239
Sparse Vegetation	128.903	20.836	5936.153	559.372	3911.445	10556.709
Total	2034.337	8040.577	80409.488	3592.755	5968.125	

Table 6
Change detection Matrix in hectare (2010–2017).

LULC Class	Built up	Water bodies	Bare land	Dense vegetation	Sparse vegetation	Total
Built Up	2676.983	4.005	2142.81	23.49	394.267	5241.555
Water Bodies	0.675	8046.922	32.828	5.872	28.508	8114.805
Bare Land	121.5	51.188	64772.527	633.622	4156.448	69735.285
Dense Vegetation	5.197	35.932	1823.872	2260.057	739.372	4864.43
Sparse Vegetation	75.555	109.665	4817.655	1724.198	5238.113	11965.186
Total	2879.91	8249.94	73623.78	4651.74	10565.37	

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Transparency document

Transparency document associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2019.103880.

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