Peer Reviewed International Research Journal of Geography
Maharashtra Bhugolshastra Sanshodhan Patrika
ISSN : 0971-6785 {Impact Factor 3.687 (IIFS)} Vol. 35, No.1, Jan-Jun. 2018. pp 61-76

URBAN SPRAWL OF URBAN AGGLOMERATION OF AANAND-VALLABH VIDYA NAGAR-KARAMSAD USING GEOSPATIAL TECHNOLOGY"

Prakash R. Konka Avinash V.Talmale Manjunath P. Mankari

Abstract:

An attempt has been made in this paper to study the Urban Sprawl of urban agglomeration of Anand –Vallabh Vidya Nagar- Karamsad using geospatial technology. Urban sprawl change detection has been studied using remote sensing imageries of 2008 and 2017. Three aspects viz. Urban, non-urban and water body changes have been studied.

Keywords: *Urban sprawl, Urban agglomeration, Land Cover Land Use*

Introduction:

The term 'Urban Centre' refers to towns or cities having marked secondary and tertiary functions along with a municipality or notified area committee. It has been defined by different scholars and institutions in different ways. On the basis of minimum population size, UNO defines an urban place as "a permanent settlement with not less than 20,000 inhabitants" (Brian, 1979). In India, as per Population Census of India, a settlement is urban when its 1.population is 5000, 2.more than 75 per cent of the population is engaged in non-primary activities, 3.population density is 400 per sq.km. and 4.notified area as municipality, cantonment.

In the census of India - 2011, following criteria are adopted for treatng a place as on urban centre.

(a) All places with a municipality, municipal corporation, cantonment board or notified town area committee, etc.

(b) All other places satisfy the following criteria:-

(i) a minimum population of 5,000

(ii) at least 75 per cent of male working population engaged in non-agricultural pursuits, and

(iii) a density of population of least 400 persons per sq.km.

The first category of urban units is known as Statutory Towns. These towns are notified under law by the concerned State/UT Government and have local bodies like municipal corporations, municipalities, municipal committees, etc., irrespective of their demographic characteristics as reckoned on 31st December 2009.

The second category of towns (as in item 2 above) is known as Census Town. These were identified on the basis of Census 2001 data.

In addition, the Directorate of Census Operation, in consultation with Registrar General's Office, were also permitted to classify marginal cases as urban by taking into consideration the local circumstances. Such marginal cases which could have qualified as urban units would include major project colonies, new areas of intensive industrial development, railway colonies and important tourist centres, etc.

The constituents of urban area are Statutory Towns, Census Towns and Outgrowths (village or part of village contiguous to a statutory town and possess the urban features in terms of infrastructure and amenities. Examples of outgrowths are Railway Colonies, University Campuses, Port Areas, etc.) Urban spread results in Urban Agglomeration (UA). It is a continuous urban spread constituting a town and its adjoining urban outgrowths or two or more physically contiguous towns together and any adjoining urban outgrowths of such towns.

It is worthwhile to mention that in India, criteria adopted by Census Department distinguish only towns and villages from each other. But, by usage, settlement with larger populations, such as those having a municipal committee or municipal corporation would be called cities.

Urban Geography, a separate branch has been emerged to study the urban settlements. It

attempts to analyse the geographical conditions which are significant in the building of urban centres. It shows how a particular site attracts the people to settle and develop thereafter, with the increase in its functional activities and civic organizations.

Increased ratio of urban population is called urbanization. Urbanization can be measured by two different ways i.e. increase in city population or increase in the total number urban places or cities. When urban population of any country increases compared to total population, during period of time, there is urbanization.

In any town or city there are urban limits. These boundaries are defined as per authority. Beyond this limits there is existence of rural area however, due to impact of urbanization and development on inside edge of urban boundaries and activities noticed just outer fringes. Urban sprawl eats agricultural fields, speculators are rewarded, non-committal plans are ignored, and open space disappeared.

Population growth rate is high in urban areas and there is a strong trend towards the net migration into towns as a result of both the 'pull' to existing and anticipated economic opportunities as well as availability of educational, recreational, health and other facilities in town and the 'push' from harsh environment and insufficient employment opportunities in rural areas. There is a cause and effect relationship between urbanization and development (Gugler, 1996). Sometimes it is a cause at others it is an effect.

Urban sprawl defined as the spreading of new development on isolated tracts, separated from other areas by vacant land (Shekhar, 2005). The result is increase in the built up area and related changes in the urban landuse patterns, causing loss of fruitful agricultural lands, forest cover, other forms of greenery, loss in surface water bodies, reduction in ground water aquifers and increasing levels of air and water pollution; causing ecological problems. The process of urbanization is contributed by population expansion and migration. Infrastructure initiatives result in the growth of villages into towns, towns into cities and cities into metros involving large scale migration from rural to urban area. Sprawl is considered to be an unplanned outgrowth of urban centres along the fringe of cities, along highways, along the road linking a city (Sudhira, et.al, 2003).

Conceptual Framework: Urban Sprawl

The urban sprawl means the urban settlements spread towards the rural fringe, i.e., growth of built-up area outside the city limits. In India major metropolitan cities are already saturated due to large scale migration of population. Many big urban centers are facing problems of congestion of city core and in some cases decay also due to saturation within the proper city or the urban limits. This results in pressure on the cities. Fringe areas and nearby villages were start merging and become part of the city due to the process of suburbanization. The rapid growth of population and congestion of the core areas strength of middle class people to settle along the fringe areas and urban sprawl starts, i.e., the outward spread of cities. Slowly the surrounding villages are absorbed and the sprawl further extends outward into a new fringe area, which is a continuous process of expansion of cities. The suburbanization in many Indian cities started with newly added industrial and commercial functions. The cities have developed haphazardly without proper planning, because planning was introduced only after the conditions started failing.

Urban sprawl is defined as the physical pattern of low density development of large urban areas under market conditions into the surrounding agricultural areas. Sprawl life in advance of the principal lines of urban growth and implies little planning control of land subdivision. Development is patchy, scattered and strung out, with a tendency to discontinuity because it leap-frogs over some areas, leaving agricultural enclaves. Its three major forms are low density, continuous development, ribbon development and leap frog sprawl.

Causes of Urban Sprawl:

The process of urbanisation is moderately contributed by population growth, migration and transportation initiatives resulting in the growth of villages into towns, towns into cities and cities into metros. However, in such a fact for economically feasible development, planning requires a kind of the growth dynamics. Nevertheless, in most cases there are lot of inadequacies to ascertain the nature of uncontrolled progression of urban sprawls. Sprawl is considered to be an unplanned outgrowth of urban centres along the periphery of the cities, along highways, along the road connecting a city, etc. Due to lack of prior planning these outgrowths are devoid of basic amenities like water, electricity, sanitation, etc. condition of certain transportation facilities like new roads and highways; fuel such sprawls that ultimately result in inefficient and extreme change in land use affecting the ecosystem. With respect to the role of technology in urbanisation, has illustrated a new linkage between transport infrastructure development cycles and spurts in urbanisation. Urban infrastructure development is doubtful to keep pace with urban population development.

The study of trends in urban growth as well as relationship between urbanization and changes in landuse in rapidly growing cities will be helpful for future planning, government agencies, industrialists, traders and also to common people. In view of this, it was decided to undertake the present research work entitled "Urban Sprawl of Urban Agglomeration of Aanand-Vallabh Vidya Nagar-Karamsad using Geospatial Technology"

Objectives:

The main aim of the present study is to analyze the urban sprawl and assess the impact of urbanization on landuse. To achieve this aim, the following specific objectives are kept in mind:

i) To study the urban growth and development trends.

ii) To study spatial distribution of urban land use by analyzing changes in land transformation due to urban sprawl using remote sensing and geographical information system tools.

Data Base and Methodology:

A] Literature Survey:

The available literature on the above topic of research will be scanned from various libraries research institutes, journals and internet.

B] Data Collection:

For the study secondary data will be used for the present research work. The data regarding population, landuse will be collected from the secondary sources such as district census handbooks, socio-economic reviews municipal corporation reports, land records, town planning department and other related departments.

Remote sensing data LANDSAT TM for the year 2008 and 2017 have been obtained and downloaded from website of United States Geological Survey (USGS), having spatial resolution of 30m

C] Laboratory Work:

The specific LCLU map of study region prepared with the help of Erdas imagine 14 and Arc GIS 10.3. The subset of Landsat TM and ETM images taken for further interpretation and classification process. Unsupervised classification has been performed and change detection has calculated in matrix.

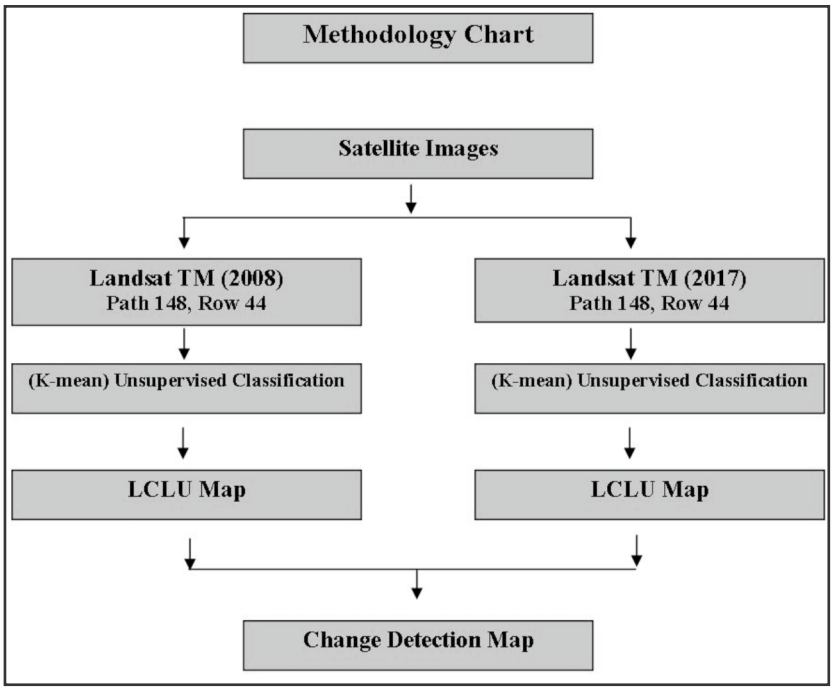


Fig. 01

Study Area:

Anand, Vallabh Vidya Nagar and Karamsad urban agglomeration is located in Anand District. Anand district is the part of Central Gujarat. The geographical area of the Anand district is 2951.10 sq.kms. which accounts for 1.50 percent of total geographical area of the state. The district is divided into 8 talukas and it has 365 inhabited villages and 12 towns.

Locations:

Anand: Anand is located in midst of the Charotar region known for its industrious development. The Anand Municipality was founded in 01/10/1889 Anand city is positioned on National Highway No. 8 and it is encompassed by 22°33'27.84" North Latitude and 72°57'19.87"E longitude , it has spread over 21.13 sq.km area. Anand is 76 km away from Ahmedabad, 38 km from Vadodara. According to Census of 2011 Anand has total population of 2,09,410 out of which 1,08,403 are male and 1,01,007 are female.

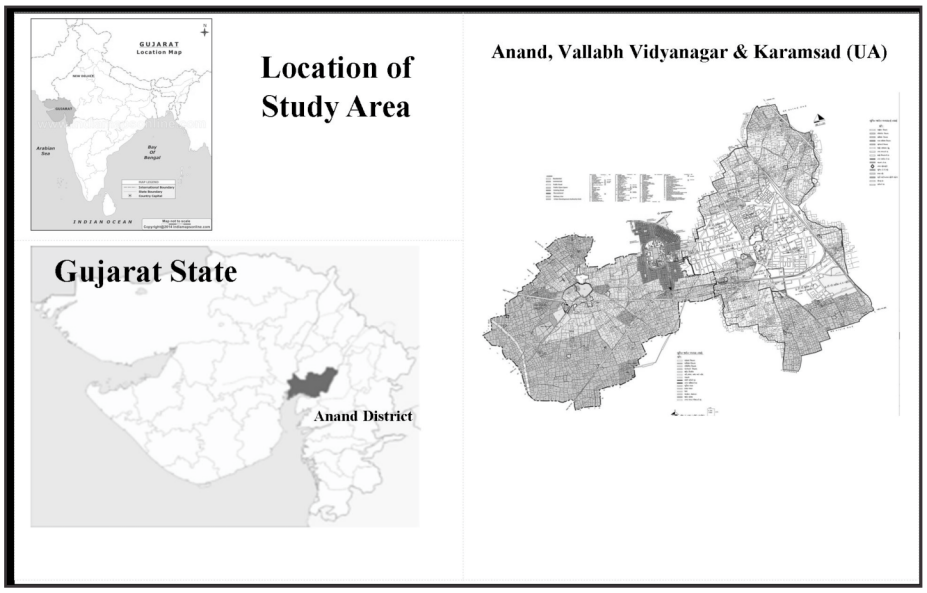


Fig.02

B) Vallabh Vidya Nagar:

This Educational Town is located between 22°33'1.18"N Latitude and 72°56'11.67"E longitude. This town covers 2.30sq. km area and has total population 23,783 including 12,111 Male and 11,672 Female.

C) Karamsad: This town is situated between 22°32'29.94" North Latitude and 72°54'17.29" East longitude and covers 16.100 sq. Km area. Karamsad town has 35,285 total population in Year 2011 comprising 18,219 male and 17,066 female.

Historical Development & Background of Anand:

Anand is a city in the state of Gujarat. Anand is known as the Milk Capital of India. It became famous for Amul dairy and its milk revolution. This city hosts the National Dairy Development Board of India and Anand Agricultural University. Vallabh Vidyanagar and Karamsad, are educational suburbs of Anand and located within Anand urban agglomeration. Anand is located between Ahmedabad and Vadodara, 101 km away from state capital Gandhinagar. The National Express highway from Ahemdabad to Vadodara also passes through Anand. Anand has seen rapid economic growth along the Anand Vallabh Vidyanagar and Karamsad road belt. It is on track of becoming a Municipal Corporation with the inclusion of various peripheral villages like Karamsad, Chikhodra, Lambhvel, Vallabh Vidyanagar, Bakrol, Mogri and 20 others.

Early History:

The available history of Anand goes about 1000 years back, said to have been established by a "GOSAI" named Anandgar in the 9th century and known as Anandpur and situated on the highway from Cambay to the central and northern India. After having been historically thrived under the successive administration of Guptas, Rajputs, Muslims, Marathas, and Britishers, the post-Independence period has seen Anand emerging as an important agro based self sustaining economy. During the British period, the city growth started taking new dimensions. It was during this period that mobility in Anand began to grow. Many people from nearby region started migrating towards the city

for getting better opportunities. Thus, Anand initially acted as political setup, it started to show development in other areas also. The city grew beyond the old settlements and resulted into new colonies of newly migrated class. Slowly and steadily after the post British period these settlements made a strong impact on the development and the growth of the city. Naturally, Anand became the centre of Charotar region.

On 1st September 1997, Government of Gujarat added six new districts in the state. Kheda district was divided into two districts namely Anand and Kheda, Anand district have eight talukas with 366 villages. The region of Anand district is known as a "Charotar". The area between Shedhi and Mahisagar River has fertile and productive land. This "golden leaf" area has highest production of tobacco in Gujarat.

Anand in the current development authority areas act as the core city, which had more than 55 years of town planning history, since its first plan enacted in year 1954. The development of town from being agricultural services town to urban centre with more than 1.9 lakh persons (Census of India, 2011) within the municipal limits. During the period 1961-62, the town planning committee started issuing the building permits within the municipal limits, and the last plan was prepared in year 1997.
In the Revised Development Plan (1995), the Anand Area Development Authority proposed the density of the developed area would be 125 persons per hectares and accordingly the final developed area was suggested to be 1460 hectares. For residential zone in existing use an area of 798 ha. was allotted and considering the density of 155 persons per hectares another 600 hectares of land is allotted, which makes the proposed residential zone 1398.66 hectares. Figure 1-8: Existing DP: AnandOn the NH 8 near the Samarkha Chowkdi, for this same purpose 35 hectares of land was proposed for industrial development.

Table 1: Progress in Anand Development Plan (1967 Onwards)

Plan	Act	Sanctioned Year	Notification No.
First Plan	Bombay Town Planning Act 1954	18-05-1967	Panchayat and Health Department No. GHB/991/DVP/1667/3056 Dated: 18-05-67
Revised Development Plan	Section 17, Bombay Town Planning Act 1954	22-11-1982	GHP/206 of 1982/DPV/1677/4545/82 L, Dated 16-10-1982
Declaration of Area Development Authority	Section 3(1) and 6 (1)	30-01-78	GHP/20/UDA/1177-746 (2)

For provision of social services in the town the tool of TP schemes was very well utilized and almost nine TP schemes from ten are finalized. Various educational institutes and open spaces for gardens are located in the TP schemes area. Along Anand and Vallabh Vidyanagar road, the development of commercial zone will cater to the proposed residential areas.

Table 2 : Stages of Growth, Anand City

STAGES	YEARS	CAUSES OF GROWTH	RESULT
FIRST	1900-1925	Better infrastructure availability in the form of ho spitals and railway station and Polson dairy development.	Concentric form of core
SECOND	1925-1950	Congestion of the City Core	Growth cross the limit of city core and emergence of the station area as a new economic center.
		Establishment of Amul dair y and Gujarat agriculture university 8 km away from the gamtal.	Establishment of satellite urban areas and sub-urban, economic centers.
THIRD	[illegible]	Industrialization	A tremendous growth rate of the town has led to a sprawl in southern and northern direction.
FOURTH	1975-2001	Establishment of Anand area development authority. AADA.	Planned urban development through TP scheme development, city has developed in all direction.

The Town Plan (TP) scheme in Anand was implemented in 1969. Since then 9 TP schemes have been prepared. TP Schemes 1 to 7 have been implemented, however, TP 6(8) and 7(9) are yet to be serviced by a central sewerage system. TP 8 and 9 are in the implementation stage.

Vallabh Vidya Nagar:

Late Sardar Vallabhbhai Patel inspired Bhaikaka and Bhikhabhai Saheb for rural resurgence of post-independent India through education. Charotar Vidya Mandal (CVM) and Charotar Gramodhar Sahakari Mandal were established in the year 1945. A prime objective of CVM is rural development through education, to bring about the social awakening, social upliftment and enrichment.

Vallabh Vidyanagar is located adjoining to west-side of Anand, a district head quarter. Hon. Bhaikaka, a visionary engineer, had taken land of Bakrol, Karamsad and Anand and prepared detailed plan for educational town. In the year 1945, Charotar Vidya Mandal (CVM) and Charotar Gramodyog Sahakari Mandali came into existence for development of educational institutions. In the year 1954, statutory Gram Panchayat status was obtained. As the area was planned to develop for education, the Sardar Patel University was established in the year 1955 Various Educational centers and colleges have been developed so far, catering to 30000 students. CVM has constructed many hostels and staff

quarters. The health facilities are looked after by Charotar Arogya Mandal and Government hospital. There are private hospitals and dispensaries in surrounding areas. To foster the economic development of area, an industrial development took place in the form of Vithal Udhyognagar GIDC, on the southern part of the town. The local body, Gram Panchayat, was upgraded to Nagar Palika in the year 1998. The town is marching rapidly towards urbanization and affords for development of New Vidyanagar for the development of education.

Karamsad:

The historical evidences suggest that during era of Kumarpal i.e., in 1155 AD, the Karamsad village was populated mainly by Koli tribes. The agricultural development within the villages was poor. It is believed that in 1211, Aja Patel, originally from Hilod (a town near Adalaj), came over and settled here which helped in increasing agricultural production and prosperity of the village.

The details from Aja Patel to Kupa Patel are not available. However, Kupa Patel was from the twelfth of fourteenth generation of Aja Patel. Kupa Patel was an ardent devotee of Lord Shiva. He renovated Lord Shiva's temple, which was in ruins. The temple was situated in the western side of the village. That was built by his son Lakha Patel. He had also helped in constructing a lake in the village.

Devidas, who was a few generations down from Lakha Patel had two sons, namely Jibhai and Bajibhai. His sons requested the Moghul Governor of Ahmedabad Province to let them retain Karamsad for the purpose of revenue collection. Out of them, Majibhai's four sons and their descendants got themselves distributed in six different Khadkis (street or lane in front of a group of two or more houses with a common gate) in Karamsad. Six different Khadkis were formed in Karamsad after the six descendents of Mahijibhai namely, Bhayni Khadki (Gokaldas), Bapni Khadki (Govendas), Hathibhaini Khadki (Sunderdas), Motabhaini Khadki (Jivabhai), Jini Khadki (Bhavijibhai) and Chhatthi Khadki (Laljibhai).Between years 1875 to 1893 one of our eminent leaders Shri Sardar Vallabhbhai Patel grew up in Karamsad. It was also home town of his elder brother Shri Vithalbhai Patel, who was also an important political leader. The Patel brothers lived with their two elder brothers and one younger brother and sister, and parents Jhaverbhai and Ladba Patel in a mud-brick house adjacent to his family's farm holdings. This house is preserved to date as a memorial to Patel.

Present Scenario:

Anand city's present profile of growth can be understood by studying its growth at certain stages. The Anand Municipality covers an area of about 39.69 sq. kms, having more than 61% of developed urban area by 2013. The next important class to consider would be its proximity with Nadiad municipality; in terms of its urban development. The surrounding 34 villages and 4 urban areas of an urban agglomeration in 2001 census represented a pattern of development where large vacant or agricultural land separated the Anand urban development with surrounding urban centers of Karamsad, Vallabh Vidyanagar, & Boriyavi.

At present 61.86% of total area has been developed land, while 38.14% is undeveloped land, having agriculture and vacant land. Anand city has been highly urbanized in the form of percentage urban development area, that city hasn't got ample of land to fulfil its future requirement in a longer time frame.

The existing land use reveals that major N.A. (non-agricultural) activities have taken place in the town planning scheme area due to the vicinity of the railway station and bus station area, immense commercial activities in the heart of the town and establishment of the Amul dairy in these areas.

It is also noticed that there has not been any noticeable industrialization within the Anand jurisdiction.

Urban Sprawl Change Detection Analysis:

The urban change analysis presented in this study was based on the statistics extracted from the two land use and land cover maps of the agglomeration of three urban areas Anand , Vallabh Vidya Nagar

and Karamsad. The changes in land cover during the study period (two dates) can be observed clearly from the pie diagrams shown in Figure 3 and 4

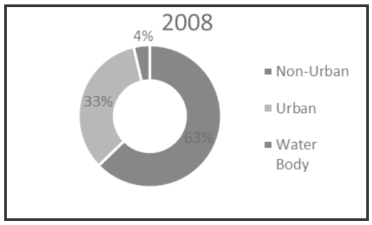


Fig.03

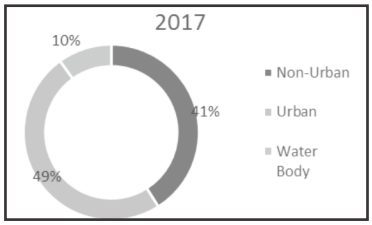


Fig.04

All the three areas of interest i.e. urban area, non- urban area and water body has changed drastically from 2008 to 2017. Urban Area has been increased from 33% to 49 %, water body has been increased from 4% to 10% while non-urban area has been drastically reduced from 63% to 41%, therefore effective positive change is 16% and 6% in urban and water body respectively and 22% decrease in non-urban area has many reasons. Anand is famous for producing of milk products, Vallabh Vidyanagar is known as educational city and Karamsad is known for the birth place of Vallabh Bhai Patel. Large number of institutions is coming in to existence and corresponding infrastructure development leads to the increase in urban area. Increase in institutional establishments and low cost housing are contributing to the loss of agriculture. There is an increase in water body also by 06% over the study period because of development on new canal. The results of change detection analysis are presented in the 4.1

Table 3: Land Use Changes Matrix of agglomeration of three urban areas Anand , Vallabh Vidya Nagar and Karamsad (2008-2017)

	Area in Sq.km		Changes in %Area
Class	2008	2017	2008-2017
Non-Urban	102.9	67.2	-34.68%
Urban	55.02	80.4	46.16%
Water Body	5.99	16..2	171.69%

Table 4: Land Use Changes Matrix of agglomeration of three urban areas Anand, Vallabh Vidya Nagar and Karamsad (2008-2017)

Sum of area (sq.km.)	**2017**			
2008	**Non-Urban**	**Urban**	**Water Body**	**Grand Total**
Non-Urban	53.97	36.29	12.62	102.87
Urban	11.25	41.34	2.43	55.02
Water Body	1.98	2.79	1.21	5.99
Grand Total	67.20	80.42	16.26	**163.88**

Change in Non-Urban, Urban & Water Body in Year 2008 to 2017

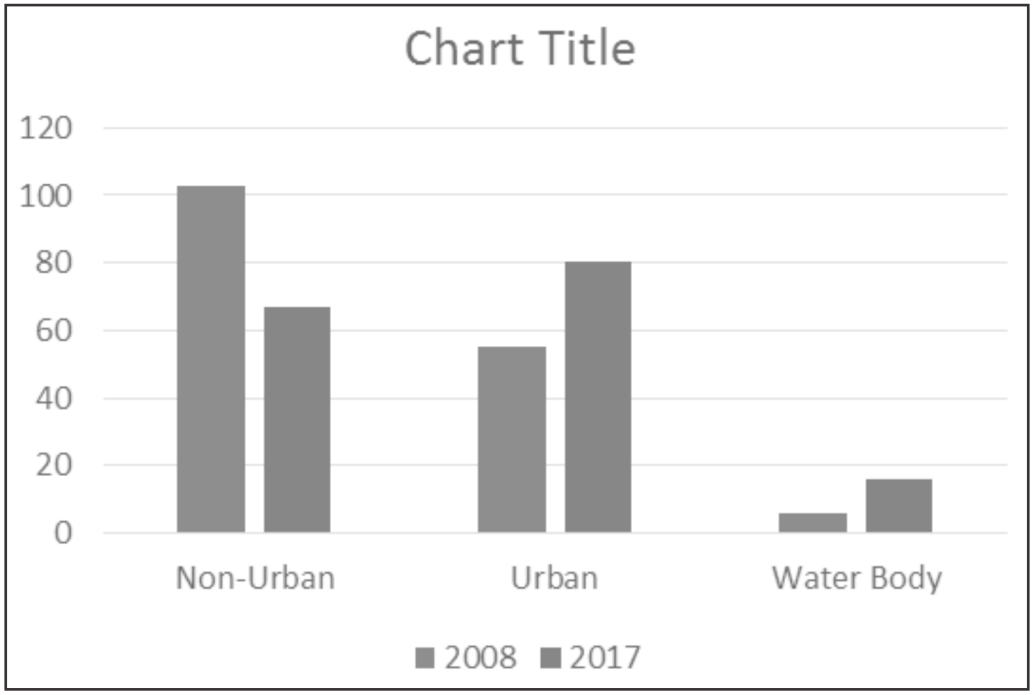
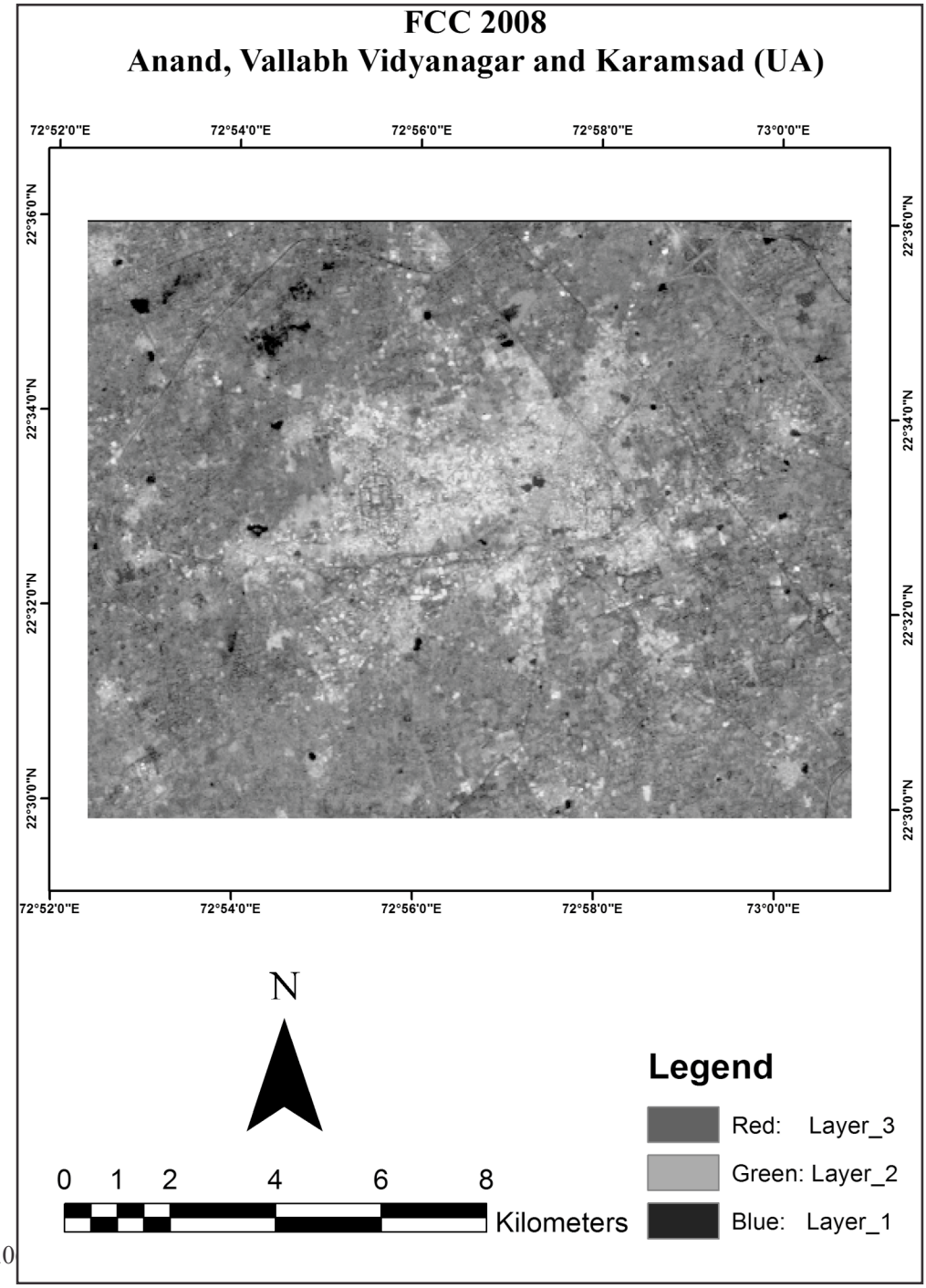


Fig. 05 - Change in LULC

The proportion of land-use changes especially the percentage urban area, which is a key metric to measure sprawl, were estimated across all the Anand, Vallabh Vidya Nagar and Karamsad municipal area. Growth of urban area in the outer region of the city in 2009, towards North (Gota and Gandhinagar) and East Changodar and Sanand. Growth of the built up area in the outer region of the city in 2011, towards West (Ogani) and south East (Vatva). So it shows the increase in the urban area of the city from all the directions. North side city is growing because of Gandhinagar city and all the government and IT industries are situated there. The development along West side is due to the large number of manufacturing industries along this corridor specially Sanand Tata nano plant, and South east is due to the location of existing industrial estate Vatwa and Odhav


FCC 2008
Anand, Vallabh Vidyanagar and Karamsad (UA)
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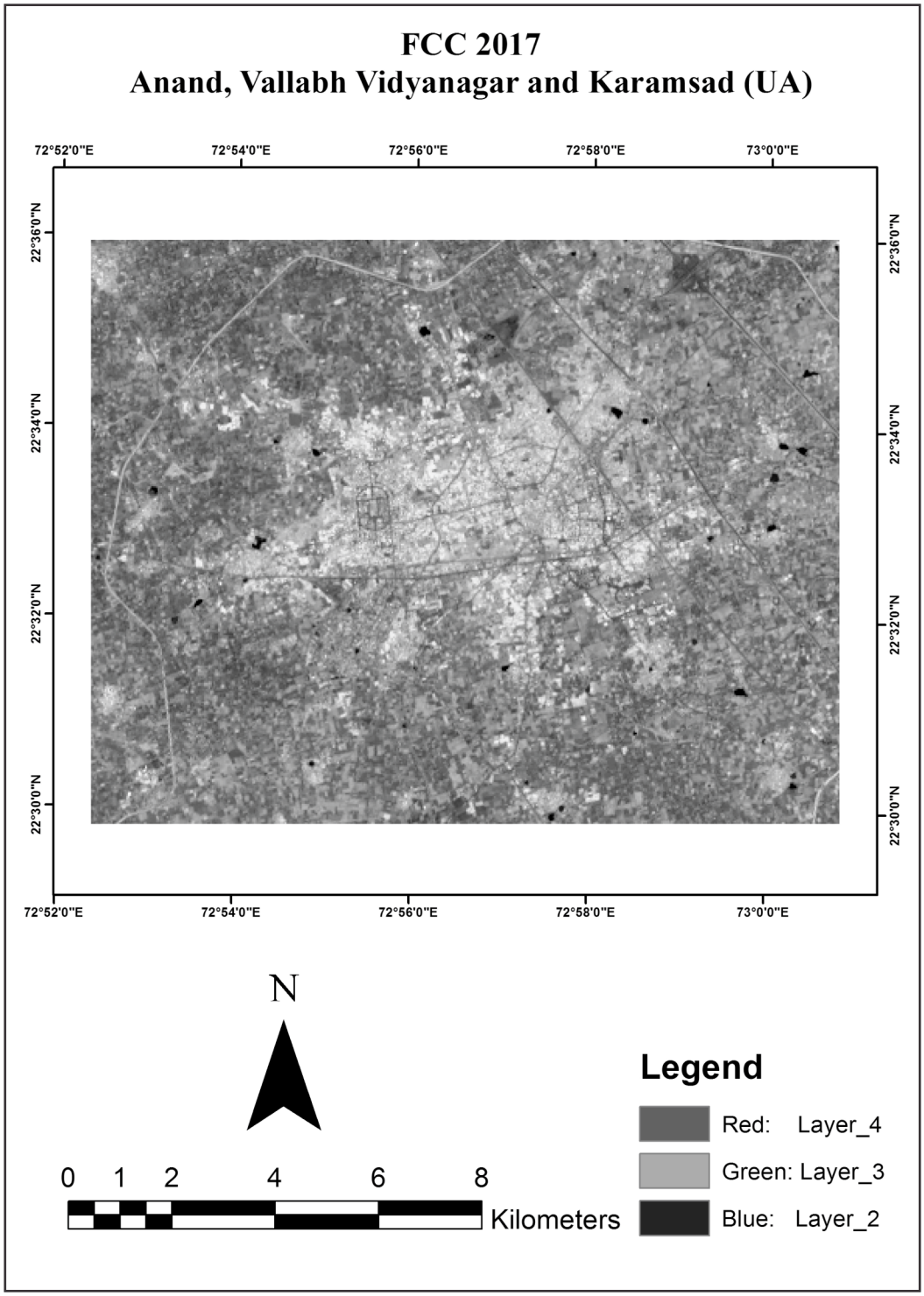
FCC 2017
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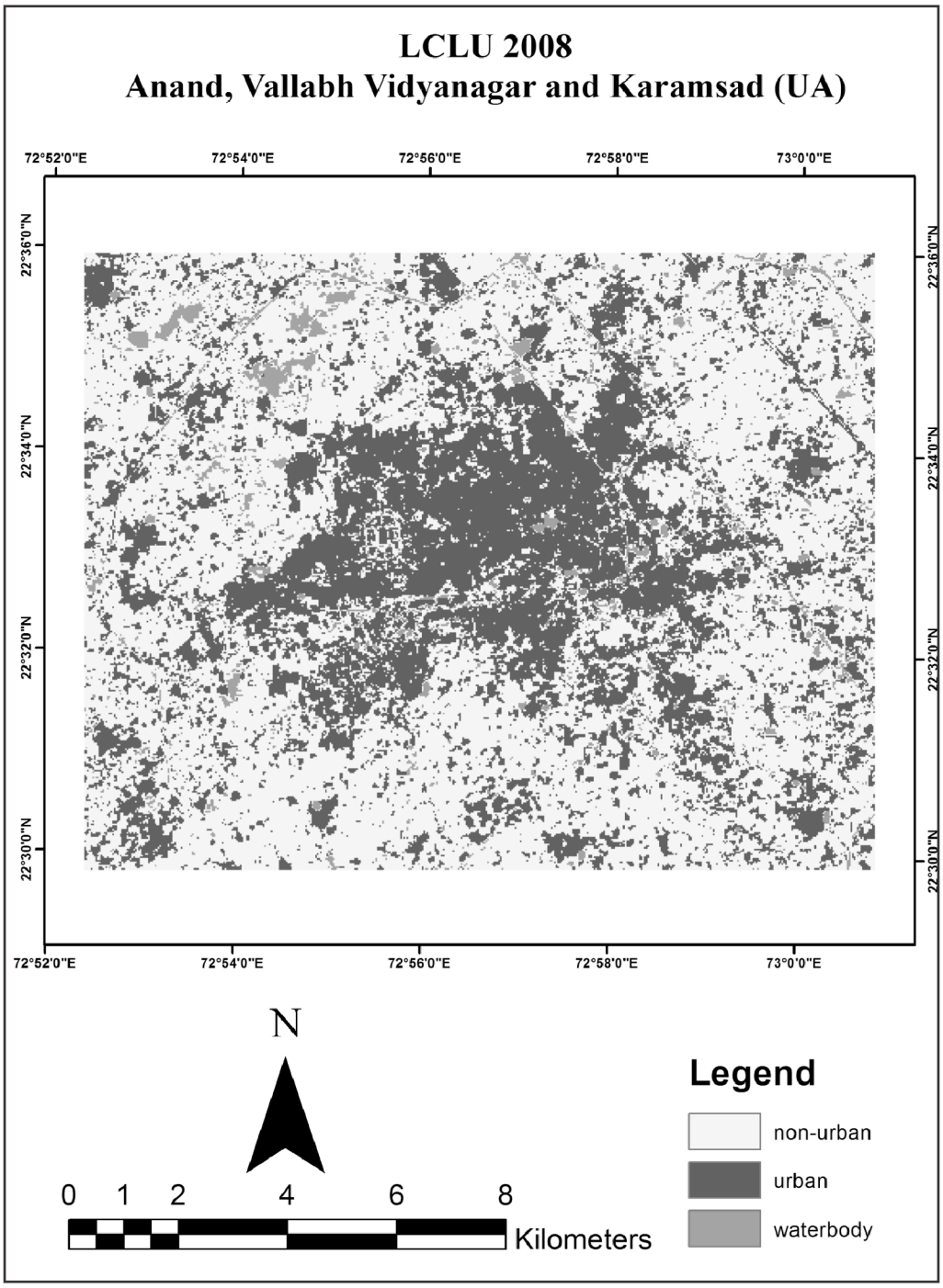
LCLU 2008
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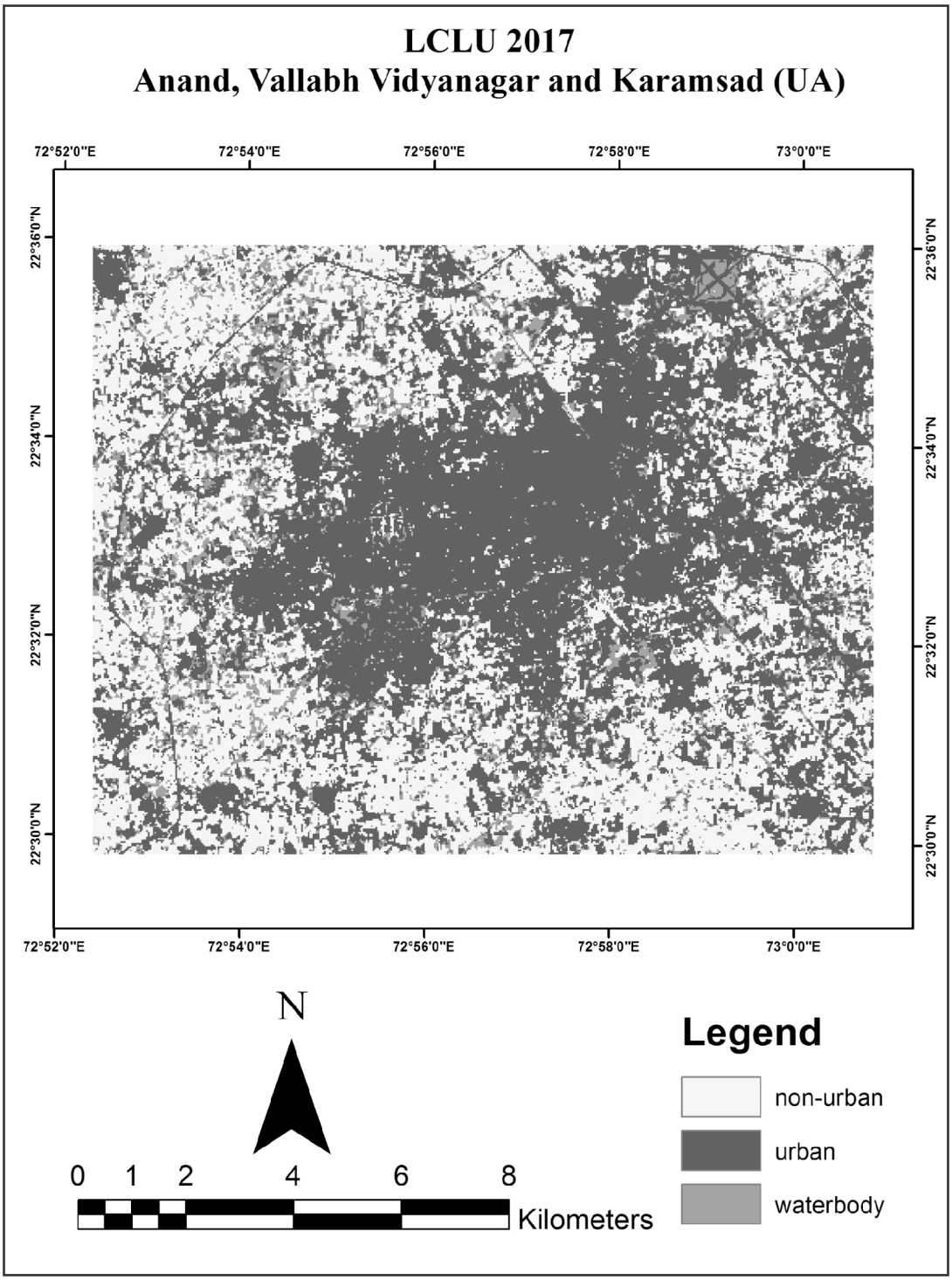
LCLU 2017
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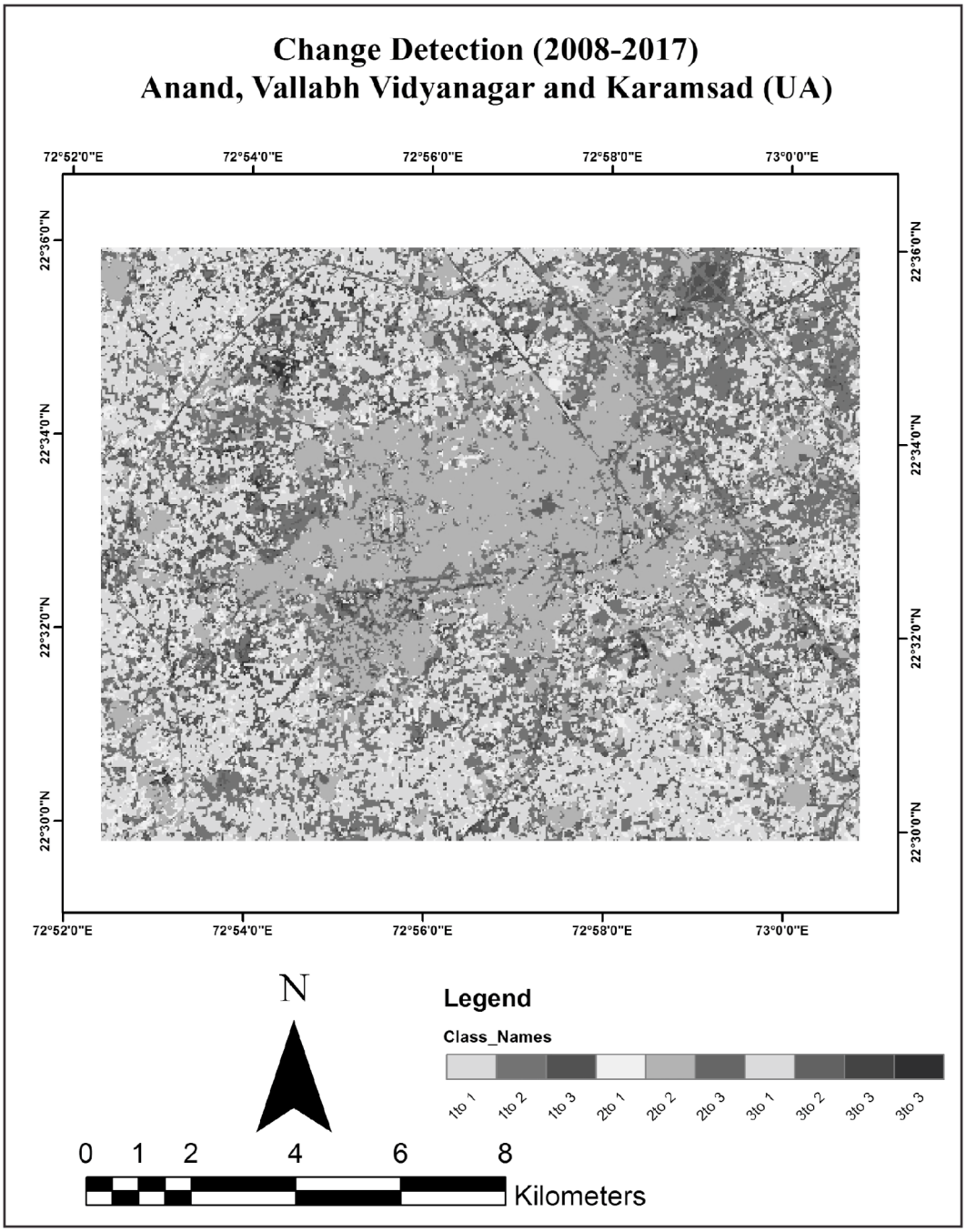
Change Detection (2008-2017)
Anand, Vallabh Vidyanagar and Karamsad (UA)
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3to 3
3to 3
0 1 2 4 6 8
Kilometers

Fig.10

Findings:

- All the three areas of interest i.e. urban area, non- urban area and water body have undergone changes drastically from 2008 to 2017.
- Urban Area has been increased from 33% to 49 %,
- Water body has been increased from 4% to 10% while
- Non-urban area has been drastically reduced from 63% to 41%,
- Effective positive change is 16% and 6% in urban and water body respectively and 22% decrease in non-urban area
- Large numbers of institutions are coming in to existence and corresponding infrastructure development leads to the increase in urban area.
- Increase in institutional establishments and low cost housing are contributing to the loss of agricultural land.
- There is an increase in water body also by 06% over the study period because of development on new canal.

Conclusion:

Urban sprawl found in Anand, Vallabh Vidya Nagar & Karmsad area. Sprawl is more in East and South direction and due to urban sprawl non-urban area is shrinking.

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