

SPATIO-TEMPORAL LANDUSE CHANGE: A CASE STUDY OF UDAIPUR CITY

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Abstract: *The present research work attempts to examine the growth and development, trends and pattern of landuse of Udaipur city. The entire study is based on secondarysources of data. The growth and development of Udaipur city have been discussed in terms of expansion of the city limits from walled city to the present municipal boundary over the two periods of times i.e. pre-independence and post-independence period. However, the trends land use of the city has been examined for four periods of times from 1971 to 2011 and pattern of land use of the city has been analyzed for 2011. The study reveals that there is significant rise in land use in the categories of residential, commercial, industrial, institutional, entertainment, public and semi-public, circulation, the government reserved, agriculture, forest, water bodies, other open areas.*

Key words: Growth, Development, Land use, Spatio-Temporal, Growth

Introduction

Land is the most significant of all the natural resources and the human-use of land resources gives rise to land use. Land use varies with the man's activity on land or purpose for which the land is being used, whether it is for food production, provision of shelter, recreation and processing of materials and so on, as well as the biophysical characteristics of the land itself. The land use is being shaped under the influence of two broad set of forces viz. human needs and environmental processes (Halder, 2013). Land is an important natural resource that embraces the elements like the overlying temperature, moisture, topography, soil matrix and physical structure. It is certainly a manifestation of the past and present human activities. But land has the characteristics of its fixity in supply and scarcity. Therefore, land use pattern is directly concerned with the problem arising in the process of deciding upon and carrying out into action the optimum use. In a dynamic world, certain modification can occur in the existing pattern of land utilization (Lekhi R.K. & Jogindre Singh, 2011). Land use is the surface utilization of all developed and vacant land on a specific point at given time and space (Mandal, 1982). Land use and land cover information are important for several planning and management activities concerned with the surface of the earth (Lillesand, 1993) because it constitutes key environmental information for many scientific, resource management and policy purposes, as well as for a range of human activities (Boayke et., 2008).

Objectives

There are two objectives have been selected for study:

- To analyzethe growth and development of Udaipur city.
- To examine the trends and patterns of landuse of Udaipur city.

Study Area

Udaipur city is located at 24°35" north latitude and 73°44' east longitude. The UMC (Udaipur Municipal Corporation) is only Municipal Corporation in Udaipur district and covered an area of 64 sq. km. At present, the city is divided into 55 wards (Fig.1). Udaipur city is the sixth largest urban center in Rajasthan. The north-south extension is 18.5 km and the east-west extension is 27.5 km and its location along the major transport arteries of the country NH- 8 connecting Delhi-Mumbai, NH-76 towards Chittaurgarh district, SH-9 and

Pre-Independence

The foundation of the city was originally laid down by Maharana Udai Singh on a hillock known today as 'Moti Magri' by building a place which is in ruins state today. On the advice of holy man, a palace named 'Nochoki Palace' was built presently is known as 'Rai Angan' (Surana, 1981: 12). Udaipur was established officially after about 1651 A.D. when the city befitting its status was elaborated with 6.3 kilometres long rampart with four gates in four directions, viz., a moat in the north and east, Ekling Garh in the north, Machala Magra forest provide security to the city including the Pichola dam known as Barapal and Jag Niwas and Jag Mandir palaces constructed within Lake Pichola have extension northwards to include the Rang Sagar.

The Phase of 1620-1818 was the time of development or growth outside the walled city. The Lake Fatehsagar was expanded by the Maharana Udai Singh to the periphery of the city. Sajjan Garh Fort, Jag Mandir, Jagdish Temple and Neemach Mata were built. Brahmpuri area was developed as a residential area during this period. The walled city was linked with additional gates like Hathipole and Surajpole. There were eleven gates in Udaipur city, but at present, there are only nine gates in existence i.e. Braham Pole, Amba Pol, Chand Pol, Hathi Pol, Suraj Pol, Udai Pol, Kishan Pol, Jamro Pol and Delhi Gate. The important development outside the city took place during the Phase of 1818- 1947. The traditional 'Haveli' type houses gradually changed into the 'Bungalow' type, which started growing outside the walled city towards north direction along with the residence of British officers. Several structure of religious and secular nature came into existence, including the construction of 'Goverdhan Sagar' and a palace adjacent to it at a distance of 3.2 km. towards the south with a feeding towards thenorth, and Pichola was extended towards Swaroop Sagar by putting a dam outside Hathipole. Public utility services increased due to the impact of Britishers and consequently Hospitals, schools, courts and gardens were built. The P.W.D. undertook the construction of several modern roads, not only within the city itself but also outside the city, connecting it with Kherwara (90 km south), Neemuch (215 km east), Desuri (140 km north) and Chittaurgarh (112 km north-east). The city was linked by metergauge railway line with Chittaurgarh in 1893.

In the period of Maharana Bhupal Singh (1921-1948 AD), the city was developed fast and urban expansion appeared in the form of new colonies, schools, colleges, roads, rail, dharamshalas, hotels and recreational areas etc. The railway was also extended from Mavali-Marwar section of the Western Railway which gave a direct access to Marwar and Jodhpur (Surana. 1981: 28-29). Fatehpura, Sardarpura and Bhupalpura were the planned residential development outside the city's wall. Private educational organisations, like the Vidya Bhawan, Vidya Pith, Mahila Mandal, Madan Mohan Malviya Ayurvedic College and Fateh High School added new cultures as well as physical dimensions to the city. Public institutions, like cinema houses and field clubs of social significance providing modern entertainment were established outside the Surajpole gate and near Fatehpura. The Fateh memorial just outside the Surajpole, the Udaipur hotel outside Delhi gate and AnandBhawan adjacent to the state guest house of Laxmi Vilas providing different types of accommodation for the visitors and pilgrimage were established during this period and contributed towards further urban developments. The city administration came to be organised under a municipal board established in 1922 and reorganised in 1946, when the boundary of Municipal city was also demarcated for the first time.

Post-Independence

The development and growth of Udaipur city after the post-independence has been unique in many ways. Independence of the country on 15th August 1947, there is amerging of the Indian States including the ancient and erstwhile state of Udaipur with the Indian Union on 18th April, 1948 and reconstituted the state of Rajasthan on 30th March 1949, which has by and large salutary effects on the city. Like other cities of Rajasthan, the city of Udaipur also experienced urban expansion resulting not only frequent outward redrawing of the

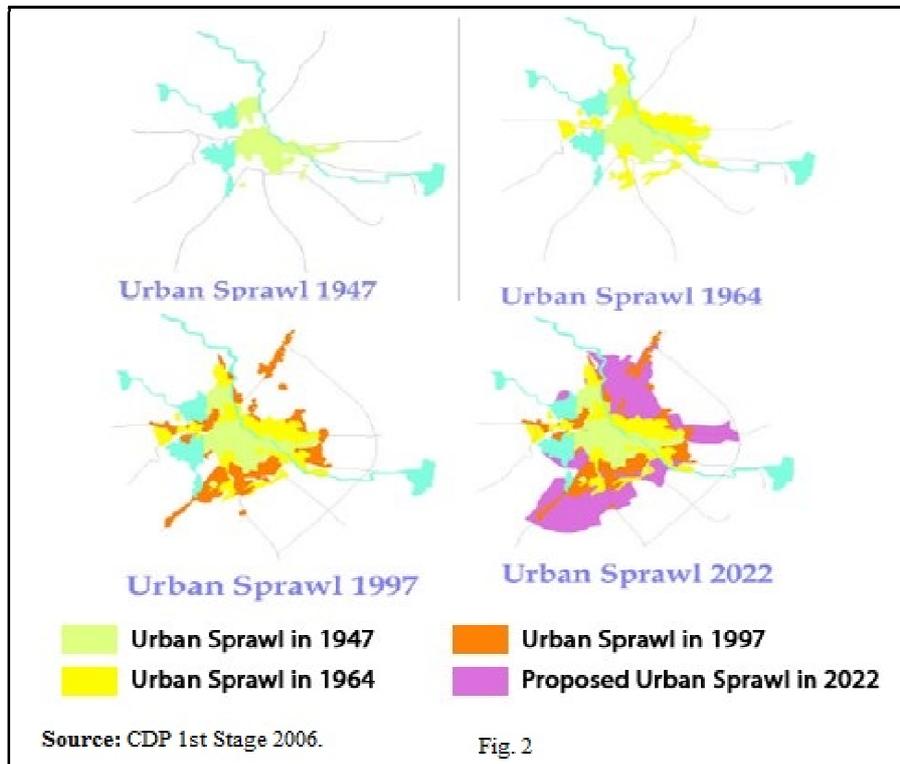
municipal boundary, five times since 1946 when it was first defined, but also, a rapid growth in the city's built up area and economic, social, cultural and administrative activities which were never known earlier.

Several new residential areas came into existence mostly outside the walled city not only in response to the responsibility of rehabilitating the displaced persons from West Pakistan but also, the desire on the part of the local people to establish themselves under more congenial conditions. Thus, for the first time, modern residential colonies came into establishments through institutional planning, such as Pratap Nagar, Bhupalpura, Hazareshwar colony, Bilochistan colony (Shaktinagar), Sikh colony, Panchwati and Madhuban colony, Dhebar colony, Kamal nagar, Ashok nagar, Amba Mata colony, Kalbelia Colony, Kishanpole, Khanpura, Shabari colony, Jawaharnagar, Shivajinagar, Mahaveer colony, Dhan Mandi extension of Nada Kheda and Meena Pada, Agrasen Nagar, Hiran Magri Sectors 3,4,5, and 6 in the south of the municipal city, Hiran Magri Sector 11 and 13 in the south of the Udaipur city, Railways Station, New Fatehpura in the north, Neemuch Mata Scheme, Ravindra Nagar, Ahimsapura, Moti Magri Scheme, and new colonies developed towards university known as Gandhi Nagar near Shobhagpura village, etc. (Karim, 1970: 26). Similarly, several new shopping centres and commercial zones such as Bapu Bazar, Nehru Bazar and Panchsheel Marg (between Delhi gate and Surajpole), Chetak Circle or Chaugan Scheme (north of Hathipole), Surajpole to old city station road (between Surajpole circle and Rajasthan college of agriculture), Ashwini Marg (between Delhi gate and Hathipole), city station road (between Delhi gate Surajpole and Udayapole) and a cluster of shops on the Naya Marg (north of Delhi gate) came into existence between 1958 and 1977. Several banks also established in the town hall or linking road, a part of national highway known as Panchsheel Marg near south of Delhi gate, in the response to expanding territory activities such as commerce and manufacturing.

The city assumed more educational activities, resulting in the establishment of several educational sectors, such as the Vidya Bhawan Rural Institute, Seva Mandir, VidyaBhawan STC Training Institute, Railway Zonal Training School, State Institute of Science Education, Meera girls college and RNT Medical College in the northern parts of municipal city, the school of social work in the west near Swaroop Sagar lake (now is situated Pratap nagar), Shramjeevi College, Rajasthan College of Agriculture, Law College (now in the university), Department of Geology, BN College in the east between Surajpole and old city station, Polytechnic, the new university complex having the office of the registrar and the Central University Library, College of Technology and Agricultural Engineering, Home Science and Faculty of Social Sciences and Humanities of the School Of Basic Science And Humanities, now known as College of Social Sciences and Humanities, Central School, the Tribal Research Institute and Alok Public School sector 11, Nimbark Teachers Training College, College of Dairy Technology, SIERT, etc. all these educational development institutes developed outside of walled city (Mehta, 1989: 31).

Development of a series of landscaping programmes beautify the city as fast growing tourist centre was under taken in the form of parks, gardens and fountains, such as the municipal rock garden (also known as guru Govind Singh park) on the Fateh Sagar drive, Nehru Municipal Bal Udhyan in the east, Delhi gate, Maharana Pratap Smarak on the Moti Magri hill, Nehru park inside the lake Fateh Sagar; Bhamashah Park between Fateh Sagar and Moti Magri, Sukhadia circle, opposite the railway training school, Aravalli Vatika, in between Swaroop Sagar and Fatehsagar, Sanjay Park near Rani road, Bhartiya Lok Kala Mandal and its museum, Machhala Magra and Doodh Talai area also developed. The UIT Udaipur was formed under the Rajasthan Urban Improvement Act, 1959. Moreover, in the phase of 1975-2000, the municipal limit was increased (64.30 sq. km.). The city was linked with NH-76 which enhanced the trade and tourism in Udaipur. Transport Nagar, Airport, Industrial Sector developed in the city.

The Major development in the city took place after 2000. The vertical expansion of city like, multiplexes, apartments, malls, etc. came into existence after 2000, for example, Celebration Mall, RK Mall, V-Mart, Big Bazar, Reliance Fresh, Vishal Megamart, Lake City Mall are also attracting the tourists in another dimension. Dabok airport has been renovated and renamed as 'Maharana Pratap Singh Airport'. Udaipur city is inviting attention towards education sector due to the upcoming development of various medical, engineering and management institutes. The development of Gitanjali University, Pacific University, Indian Institute of Management (IIM), Advent College and Singhania University are attracting the population for educational purposes.



Udaipur Municipal Limits

Udaipur Municipal Limits covers an area of about 64.28 square kilometers at present and it has increased from 47.11 square kilometers in 1946 to the present. As per the latest division, the city is divided into fifty-five wards. The wards have their unique identity based on socio-economic composition and relative location with reference to physical features and more importantly in relation to vicinity to major lakes like, Fateh Sagar, Swaroop Sagar and Pichola. Table 1 exhibits the pattern of expansion of municipal limits of the city. No change has been witnessed in the municipal limits of Udaipur city since after 1981. Nonetheless, the boundary of five new wards has been carved out in 2009 from the existing fifty wards.

Table 1: Udaipur City- Increase in the Municipal Area

Year of Boundary Demarcation	Total Municipal Area (in Hectare)	Percent Change
1946	1717	-
1948	1775	3.38
1956	1852	4.34
1959	2511	35.58
1960	3597	43.25
1969	5985	66.39
1981	6428	7.4

Source: Udaipur Municipal Corporation.

Landuse of Udaipur City 1971-2011

Table 2 explains the landuse change of Udaipur city. The percentage of developed area in the city is decreased 53.72 percent in 2011 from 89.77 percent in 1971 out of total area of Udaipur City. But, the total area of Udaipur city has been increased from 4300 acres in 1971 to 26925 acre in 2011. Land utilization for residential purpose markedly added 6467 acres in the city area from 1585 acre in 1971 to 8052 acre in 2011. Thus, the city area for residential purpose constituted 36.86 percent in 1971 and 29.91 percent in 2011. The sector of public and semi-public utilization of land showed significant expansion during this period, as an area of 1056 acre was added for utilization for this purpose from 10101 acre in 1971 to 2066 acre in 2011, but its area is 15.82 percent less from 1971.

Further, an examination of Table 2 depicts that there is no significant expansion of land utilization for commercial purposes in terms of percent and only 544-acre land has increased from 115 acre in 1971 to 659 acre in 2011. In fact, commercial activities prospered well in the city and this is noticeable from the growth of several localized shopping centres in various parts of the city and residential areas. A modest beginning for industrial development of the city began during 1971 and afterward. The land area under industrial purpose now rose to 1553 acre in 2011 from 170 acre in 1971, and recording a substantial rise of 1383 acre (5.77 percent out of the total area). The category of entertainment witnessed only 170 acre of land during this time from 365 acres 1971 to 535 acre 2011.

Table 2: Udaipur City- Land Use 1971 to 2011

#	Land Use	1971		1988		1997		2011	
		Area in Acre	% of total Area	Area in Acre	% of total Area	Area in Acre	% of total Area	Area in Acre	% of total Area
1	Residential	1585	36.86	2565	30.19	4988	22.07	8052	29.91
2	Commercial	115	2.67	295	3.47	548	2.42	659	2.45
3	Industrial	170	3.95	910	10.71	1152	5.10	1553	5.77
4	Institutional	75	1.74	92	1.08	96	0.42	212	0.79
5	Entertainment	365	8.49	302	3.56	358	1.58	535	1.99
6	Public and Semi-Public	1010	23.49	1615	19.01	1632	7.22	2066	7.67
7	Circulation	540	12.56	995	11.71	1105	4.89	1387	5.15
	Developed Area	3860	89.77	6774	79.74	9879	43.71	14463	53.72
8	Government Reserved	130	3.02	800	9.42	865	3.83	929	3.45
9	Agriculture, Forest	75	1.74	255	3.00	285	1.26	1579	5.86
10	Water Bodies	85	1.98	135	1.59	1900	8.41	2394	8.89
11	Other Open Areas	150	3.49	531	6.25	9672	42.79	7560	28.08
	Total	4300	100.00	8495	100.00	22601	100.00	26925	100.00

Source: Udaipur Master Plan-Draft (2011-2031)

Land utilization for circulation purpose recorded marked increase of 847 acres of land area over the time between 1971 and 2011. This constituted 5.15 percent and 9.59 percent of total municipal and developed area respectively. The land area utilization for agricultural and forest purposes recorded an increase of 1504 acre during this period. There is also the significant rise of land use in the categories of government reserved land (929 acres), water bodies (2394 acres) and open area (7560 acres) in Udaipur city.

Land Utilization of the City 2011

Secondary and tertiary economic activities are increasing in the north-eastern parts of Udaipur city. The maximum minerals activities and small scale industries are located in the north and north-eastern directions (i.e. Amberi, Sukher, Shobhagpura, Raghunathpura and Bhuwana). The growth of the Udaipur city in the eastern direction is due to the

availability of plain areas. Therefore, all new developmental activities are coming up in the particular areas like, Bhuwana, Dabok road and city's peripheral areas in the form of planned and unplanned way. Udaipur is also developing sectoral way along NH8 to Ahmedabad and NH76 to Chittorgarh. Thus, major development activities in the city have increased near water bodies and highways of Udaipur. The percentage of area under different land uses are given in the Table 3.

Table 3: Udaipur City- Land Use of 2011

#	Land Use	Area in acre	Percentage of total Area	Percentage of Developed area
1	Residential	8052.00	29.90	55.70
2	Commercial	659.00	2.40	4.60
3	Industrial	1553.00	5.80	10.70
4	Institutional	212.00	0.80	1.50
5	Entertainment	534.00	2.00	3.70
6	Public and Semi-Public	2066.00	7.70	14.30
7	Circulation	1387.00	5.20	9.60
	Developed Area	14463.00	53.70	100.00
8	Government reserved	929.00	3.50	
9	Agriculture and Forest	1579.00	5.80	
10	Water Bodies	2394.00	8.90	
11	Other Open Areas	7560.00	28.10	
	total	26925.00	100.00	

Source: Udaipur Master Plan-Draft (2011-2031).

Residential Land Use

Residential land use accounts 55.7 percent of the total developed area i.e. 8052.21 acres. Residential area increases in north-east, east and southern directions of city. All the major development of residential areas coming up along the main roads like NH-8 (Delhi-Mumbai), NH-76 (Pindwara-Chittorgarh), and other roads towards Jhadol, Banswara, etc.

Affordable housing scheme plan and development is done by the UIT and housing Board in different areas of the city like Goverdhan Vilas, Bhuwana and Hiran Magri. To overcome the housing shortage, the various schemes like slum development project under JNNURM through IHSDP Schemes are coming up at Biliya & South Extension Scheme. The new development concept of housing is upcoming in the areas of Bhuwana, Fatehpura, Pula, Shobaghpora, Mahveer Colony, Bedla, Sukher, Partap Nagar, Bedwas, Saveena, Hiran Magari, Baleecha, Titradi, Goverdhan Vilas, Badi, Devali, etc.

Commercial Land Use

Land utilization for commercial purpose increased 659 acre from 1971 to 2011. This constituted 2.40 and 4.55 percent land for municipality and developed area of the city respectively. Now, commercial areas are developed along the main roads of the city and it is changing into residential cum commercial area. The planned commercial area and various nodes have been developed in the form of Hathipole to Jagdish Chawk, Surajpole to Clock Tower, Delhi Gate to Dhan Mandi, Hathipole to Chetak circle, Delhi gate to Shastri circle, Surajpole, Udayapole and railway station. UIT's sub-city commercial scheme is now serviceable. Udaipur city has witnessed the tremendous increase in the number of hotels and guest houses, and they are mainly developed at places like Bus stand at Udayapole, Railway station road, etc. Various luxury hotels and resorts and farm houses have come up along the lakes and outer skirts area of the city.

Industrial Land Use

Udaipur is considered as one of the developed district in the state of Rajasthan due to the availability of raw material and good connectivity and consequently, it has enhanced the

growth of Udaipur city. Industrial land use accounts 10.7 percent of the total developed area i.e. 1553 acre. Mostly all industries are coming in the planned industrial area, developed by RIICO in the city. RIICO has future plans to expand Kaladwas Industrial area & Gudli Industrial area in the city. Industrial areas are still affecting residential areas by their pollution due to their adequate locations.

Recreational Land Use

Udaipur city has an easy accessibility to various recreational places because of availability of various lakes and water bodies. Recreational land use accounts 3.7 percentage and recorded 534.34 acres of the total developed area of the city. The major parks in Udaipur city are Saheliyon Ki Badi, Gulab Bagh, Moti Magri Park, Sukhadiya Circle, Nehru Park, Rajiv Gandhi Park, Guru Govind Singh Rock Garden, Town Hall Park, Aravali Vatika, Maharana Pratap Memorial, Dindayal Park, ML Verma Park, Swaran Jyanti Park, Sanjay Park, Bhamashah Park and Marwel Water Park. The newly developed Maharana Pratap Khel Gaon on an around 30 hectares in the north-east direction of the city is promoting the sports activities. There are also two stadiums in the city namely Lav-Kush Indoor Stadium and Maharana Bhopal Stadium. With the pace of development, parks and open spaces are also coming up in new planned areas undertaken by UIT and Municipal Council.

Circulation

Udaipur city having a connection with three state highways i.e. 8, 27 and 76 and is connected with Chittaurgarh, Dungarpur and Banswara districts' highways. The high volume of traffic is associated with the Udaipur- Nathdwara, Udaipur-Chittaurgarh, Udaipur-Ahmedabad and Udaipur-Gogunda routes because the new development has taken places in these areas. The central bus stand of Rajasthan Parivahan Nigam has been situated in Udayapole circle. There are two private bus stands namely at Surajpole and Chetak Circle with improper facilities. Public transport is very improper in the city. Two railway stations i.e. Rana Pratap Railway station and City Railway Station situated in near Thokar Chauraha and Udayapole-Patel Circle road respectively. Udaipur city also has one international airport named Maharana Pratap Airport in Dabok.

Public and Semi Public Facilities

Public and Semi Public Facilities include educational structure, medical facilities, water supply, electricity, and sewerage & sanitation. Udaipur city has 332 primary, 412 upper primary, 66 secondary and 70 higher secondary schools in Udaipur and its surrounding. Twenty one colleges and six universities are giving higher education to its population. These universities are Mohanlal Sukhadia University, Maharana Pratap University of Agriculture and Technology, Rajasthan Vidyapeeth, Pacific University, Geetanjali University and Sir Padampath Singhania University. Recently newly approved Bhupal Nobles University is the seventh University in Udaipur. Indian Institute of Management (IIM) is enhancing the quality of education in the city too. RNT Medical College, Ayurvedic College, Udaipur Polytechnic College, Vidya Bhawan and many more institutions and colleges are enhancing the quality of education and making Udaipur as an education hub in southern Rajasthan. There is two major government hospital named Maharana Bhupal Hospital and Ayurvedic Hospital which are serving public for medical services. American Hospital near Bhatt je ki Badi, Chaudhary Hospital in sector 6, Narayan Sewa Sansthan and satellite hospital in Hiran Magri, Rajasthan Hospital in sector 14 are giving 24 hours medical services to the public. Except these, many dispensaries and homeopathy and Unani medical services are available in Udaipur city.

Further, the main sources of water supply in Udaipur city is surface water as well as ground water to fulfill the daily water needs. Fatehsagar, Pichola, Jaisamand Lakes and Mansi Wakal Dam are the main surface sources of water for the residents of Udaipur city. Water from hand pumps and punghats is used for domestic purposes and provided free of cost to the users. Generated sewerage is collected through sewerage networks and soaks pits since the city didn't have underground sewerage network. Only 13 percent population

is directly connected to the sewerage network. The sewerage system in the city is managed by UMC and UIT. The outfall sewer is laid from Surajpole to ManwaKheda. Electricity or power supply and its maintenance have been done by Ajmer Vidhyut Vitaran Nigam in Udaipur city. Kota thermal power station is the main source of power supply in the Udaipur city.

Conclusion

The Ahar valley, where, the Udaipur city came into existence, has been known for human occupation and settlement for the last 400 years. Development of Udaipur city historically discussed into the two broad periods of time as Pre-independence and Post-Independence. Udaipur Municipal Limits covers an area of about 64.28 square kilometres at present and it has increased from 47.11 square kilometres in 1946 to the present. The main sources of water supply in Udaipur city is surface water as well as ground water to fulfill the daily water needs. The maximum minerals activities and small scale industries are located in the north and north-eastern directions. The growth of the Udaipur city in the eastern direction is due to the availability of plain areas. Therefore, all new developmental activities are coming up in the particular areas like, Bhuwana, Dabok road and city's peripheral areas in the form of planned and unplanned way. Udaipur is also developing sectoral way along NH8 to Ahmedabad and NH76 to Chittorgarh. Thus, major development activities in the city have increased near water bodies and highways of Udaipur.

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