Cloud Publications
International Journal of Advanced Remote Sensing and GIS
2017, Volume 6, Issue 1, pp. 2097-2102
ISSN 2320 – 0243, Crossref: 10.23953/cloud.ijarsg.113

Research Article | Open Access

Urban Expansion and Loss of Agricultural Land: A Remote Sensing Based Study of Shirpur City, Maharashtra

Yogesh Mahajan[1], Shrikant Mahajan[2], Bharat Patil[3], Sanjay Kumar Patil[1]

[1]School of Environmental & Earth Sciences, North Maharashtra University, Jalgaon, Maharashtra, India
[2]Department of Geography, Shri D.H. Agrawal Arts, Commerce and College, Navapur, Maharashtra, India
[3]Department of Geography, R.C. Patel Arts, Commerce and College, Shirpur, Maharashtra, India

Publication Date: 8 April 2017

DOI: https://doi.org/10.23953/cloud.ijarsg.113

Abstract In present urban expansion is important field of geographic study. This is an attempt to study the urban expansion and land use pattern of Shirpur city of Dhule district (MS). For that purpose used land landsat images (1991, 2001 and 2011) of Shirpur city. These satellite images further processed and analyzed by GIS software. Shirpur city lies in Shirpur tehsil and administrative head quarter of tehsil. Total population of Shirpur city was 44246 in 1991 that increase up to 76905 in 2011. The total area of Shirpur city is 1113.36 hectares out of that 459.64 hectares area under built up in 1991 that increase 760.16 hectares in 2011. This expansion of city area responsible for loss of agricultural land there were 540.33 hectares in 1991 that has been decline 298.72 hectares in 2011. Finely it is concluded that the growing population and its increasing demands of land for non-agricultural activities responsible for turn agricultural land for built up area, industrial plants, roads and plotting for future growth of city.
Keywords *urban expansion; landsat images; population growth; agriculture*

1. Introduction

Today expansion of urban centers and their impacts are important study matter of urban geography. This is an attempt to study the urban expansion and changes in land use pattern of Shirpur city and their fringe area in Dhule district (MS). Over the world, the cities cover only about one percent of the earth's surface, but most of the issues happening in the cities greatly impact on the environment and global change [5]. Urbanization leads to urban spatial expansion due to the demand for development and housing growth, as well as facilities areas to serve human life of increasing population [8]. Land transformation is one of the most important fields of human geography. Increasing population size of urban centres demands land for non-agricultural activities like built up area, roads, market, shopping malls and industries etc. hence agricultural land decrease surround to the cities [2 and 4]. Bayo [3] illustrated the relationship between urban expansion and transportation cost, traffic, and the populations and their food requirements.

2. Study Area

Shirpur town is administrative headquarter of Shirpur tehsil (Dhule district, Maharashtra). It is situated at $21^0$21' 02'' North latitude and $74^0$53' 07'' East longitude (Toposheet No. 46 K/15) with an altitude of 159 meters from mean sea level. Shirpur is located on right bank of the Arunavati River (Figure 1) and Bombay-Agra highway.

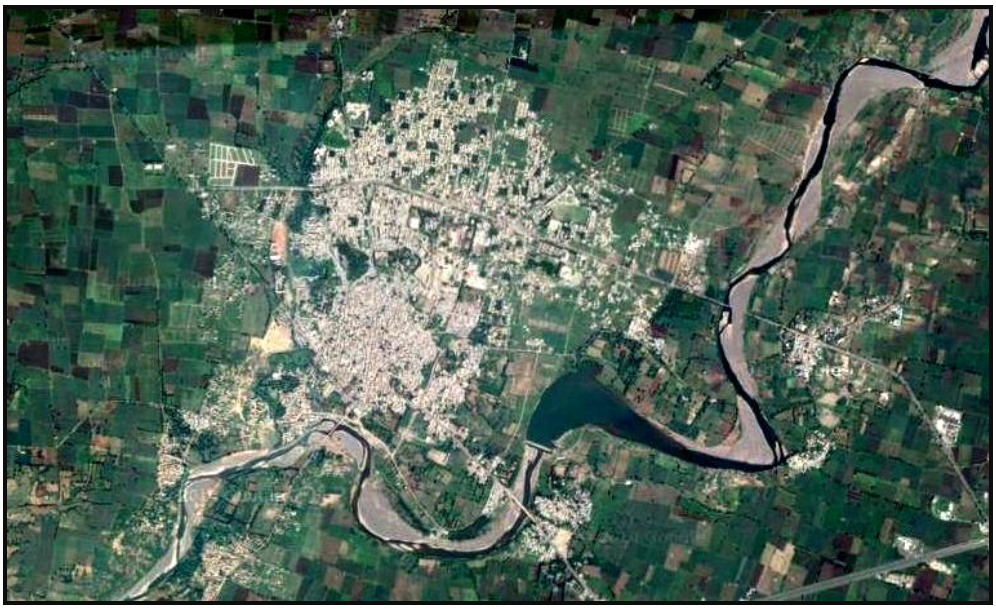

Figure 1: *Shirpur Town in Shirpur Tehsil*
(Source: Google map)

It is single urban centre of Shirpur tehsil hence the population of surrounding villages also depends on it for goods and administrative services. Hence surrounding population migrates towards Shirpur town for the purpose of better life style, medical facilities, education facilities, pleasure etc. That immigrants population and natural growth population has been of responsible for expansion of city. Shirpur is agriculturally well developed hence several agro based industries are setup at Shirpur like Textile mills and Oil refinery. Gold refinery and Steel Factory also help in economic growth of Shirpur town.

3. Database and Methodology

The present study is based on secondary source of data. The secondary data is the available from municipal corporation Shirpur, district statistics office Dhule, Census hand book, agricultural census etc. The methods applied includes bar diagram, pie chart, Graphs, Maps, Statistical analysis etc. Urban expansion of Shirpur town studied with help of decadal land sat images. These land sat images of 1991, 2001 and 2011 processed with the help of ERDAS Imagine software and GIS software.

3.1. Data Collection

Land satellite data of three dates of august month used for the study of general land use pattern in 1991, 2001 and 2011. Because in month of august land use and land cover is nearly everyone clear and proper. Land sat data of the past three decades has been downloaded from USGS Earth Explorer website. All the data are pre-processed and projected to the Universal Transverse Mercator (UTM) projection system. The details of collected satellite data are shown in the Table 1.

Table 1: *Details of Landsat Data Collected from USGS*

Sr. No	Landsat Image		Landsat Band			Date of Image
	Path	Row				
1	147	45	4	3	2	16th August 1991
2	147	46	4	3	2	16th August 1991
3	147	45	4	3	2	8th August 2001
4	147	46	4	3	2	8th August 2001
5	147	45	4	3	2	24th August 2011
6	147	46	4	3	2	24th August 2011

Source: USGS Earth Explorer website

The present study involves the collection of Toposheets from Survey of India and Shirpur city map from relevant authorities. Processing the imagery and image interpretation for development of Land use and Land cover maps is to be done in ERDAS Imagine software. The obtained maps are studied and analysed to detect the change in general land use pattern.

3.2. Data Processing and Classification

All the downloaded images contain different types of bands and stacking get the composite image create mosaic of landsat images using ERDAS image software. Selects Mosaic Landsat digital image data for classify each land cover class in the digital image. Generate sample land cover classes are called “training sites”. The ERDAS image classification software uses the training sites to identify the land cover classes in the entire image.

The classification of land cover is based on the spectral signature defined in the training set. The ERDAS digital image classification software determines each class on what it resembles most in the training set. In this study use supervised classification algorithms are maximum likelihood and minimum-distance classification [1]. The landsat images are classified by supervised classification through the steps select training areas generate signature file and classify. The classification finally gives the land use/cover image of the area on which analysis. Five land cover classes namely cultivable area, forest area, water bodies, built up area and barren land.

3.3. Population Changes and Urban Expansion

Explosion of population and immigrants in urban centers is mainly responsible for Urbanization or urban expansion. The term urbanization as traditionally measured by demographers is urban population divided by total population of a region [7]. The total population of Shirpur was 44246 in 1991 that increased 76905 in 2011. There are 40235 Males and 36670 females in Shirpur. There were 7532 houses in Shirpur town in 1991; these are increased up to 15187 in 2011. It means number of houses becomes double in last two decades (1991 to 2011). House hold size is decreased by 0.81 from 5.87 in 1991 to 5.06 in 2011. The population density of this town is 6910 persons per sq.km. in 2011 that was 3975 in 1991. The population density of Shirpur town is too much high than average density of Shirpur tehsil (179) and Dhule District (254).

Table 2: *Shirpur Town: Population Changes (1991-2011)*

Sr. No.	Particulars	Year			Changes in (1991-2011)
		1991	2001	2011	
1	Total Population	44246	61994	76905	32659
2	Total Houses	7532	11003	15187	7655
3	Household Size	5.87	5.63	5.06	-0.81
4	Population Density	3975	5570	6910	2935
5	Population Growth Rate	21.64	40.11	24.05	3.59
6	Literacy Rate	58.09	68.78	74.9	16.81
7	Sex Ratio	933	920	911	-22

Source: Census of India-2011 and compiled by the Researcher

According to Table 2 population growth rate has been continuously increased in Shirpur town due to immigrants from surrounding villages and natural growth of population. Growth in urban population goes with no equivalent growth in land supply [6]. 40.11% population growth rate noted in 1991 to 2001 but in last decade that observed 24.05%. The literacy rate also increase during last two decades from 58.09 to 74.90. The sex ratio of Shirpur town decreased from 933 in 1991 to 911 in 2011. Shirpur Town exerts very high population pressure on agriculture land that responsible for brought significant changes in agriculture.

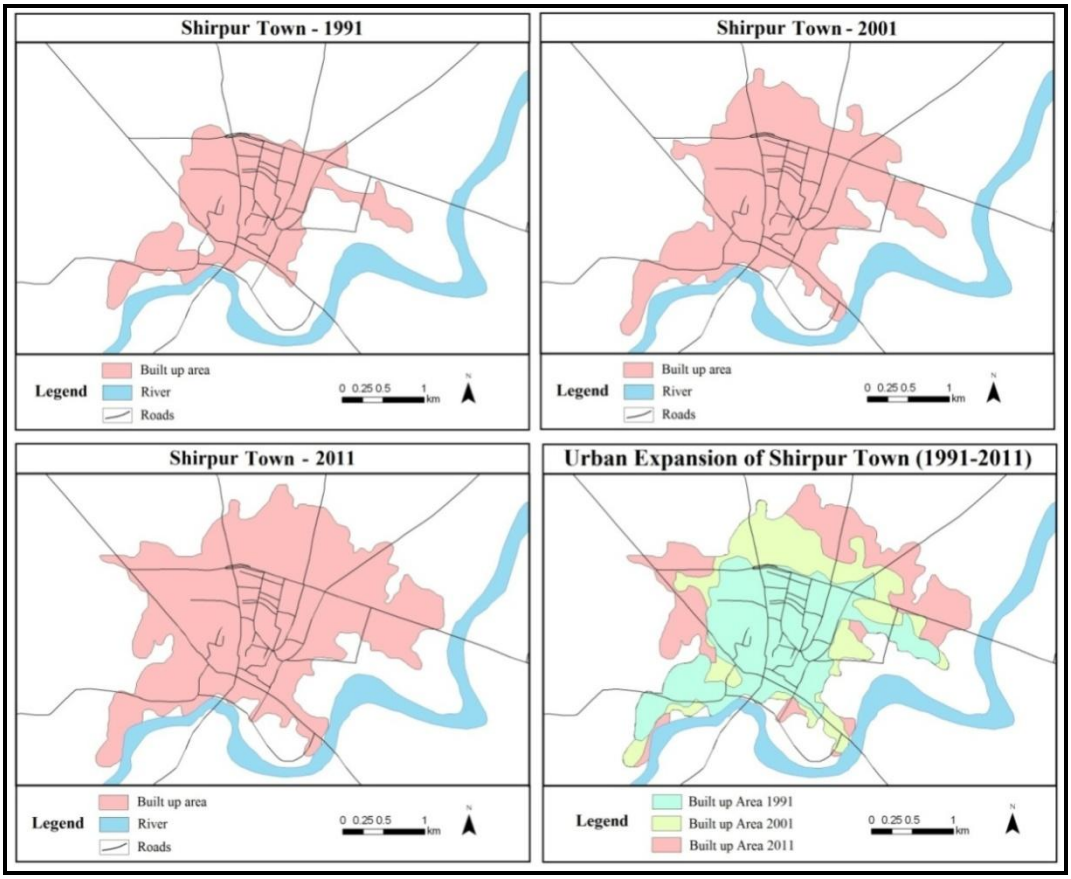

Figure 2: *Urban Expansion of Shirpur Town (1991-2011)*

(Source: Computed by the Researcher)

Table 3: *Land use Changes and Loss of Agricultural Land*

Sr. No.	Land Use		Year			Changes (1991-2011)
			1991	2001	2011	
1	Net Sown Area	in ha	531	465.22	291.84	-239.16
		in %	47.69	41.79	26.21	-21.48
2	Land not available for Cultivation	in ha	459.64	549.87	760.16	300.52
		in %	41.28	49.39	68.28	26.99
3	Other uncultivable land	in ha	91.25	68.77	32.34	-58.91
		in %	8.20	6.18	2.90	-5.30
4	Fallow land	in ha	9.33	7.36	6.88	-2.45
		in %	0.84	0.66	0.62	-0.22
5	Forest	in ha	22.14	22.14	22.14	0.00
		in %	1.99	1.99	1.99	0.00
6	Total Geographical Area	in ha	1113.36	1113.36	1113.36	0.00
		in %	100.00	100.00	100.00	0.00

Source: Revenue Record Office Shirpur and Computed by the Researcher

Shirpur city mostly expand towards North East and North West along with Shahada road (Figure 2) because of plane region, easily availability of water, being there all education institutes etc. Other hand towards south due to presence of Arunavati River, city has restrictions for expansion. Because of expansion of Shirpur city towards fringe area net shown area has been deduct by 21.48% from 531 hectare to 291.84 hectare. Now only 26.21% area under net shown (Table No. 3 and Figure No. 3).

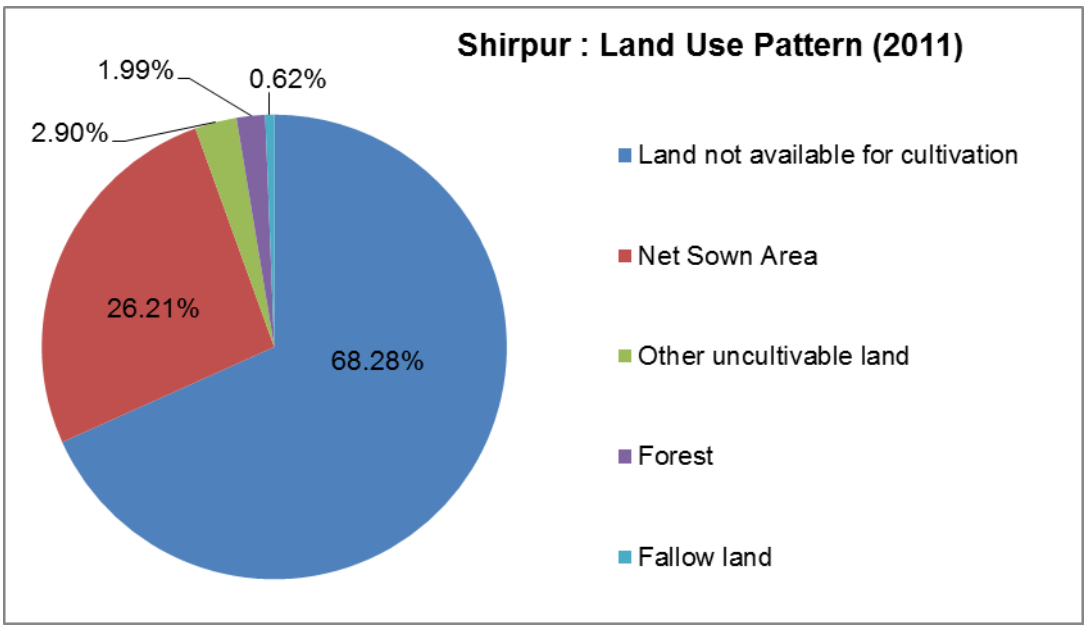

Figure 3: *Shirpur: Land Use Pattern (2011)*

(Source: Computed by the Researcher)

4. Conclusion

The research results showed that population explosion was the main cause of urban expansion. Shirpur City is the biggest industrial and commercial centre of Shirpur tehsil. The high economic growth, education facilities and employment opportunities caused influx of labour immigration.

According to demographic survey of 11 Oct. 2010, Shirpur City had 14 thousand immigrants in the population total of 76905. Local increase of population plus immigrants made the city become too stuffy. According to statistics, the urban population has increased 73.81% from 1991 to 2011.

The population density in 2011 reported 6910 people per square kilometres. In last two decades number of houses also became double in Shirpur town from 7532 in 1991 to 15182 in 2011. Due to housing demand and city development, agriculture land was transformed into land for houses, roads, industrial and commercial areas.

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