An Assessment of Land Use Changes Influenced By Urbanization: Implication with Spatial Distribution of Land Using Remote Sensing Technique

Basweshwar Jirwankar[1], Bikram Prasad[2]

[1]Research Scholar,
Department of Civil Engineering, Oriental University, Indore, 453555, Madhya Pradesh, India
b.s.jirwankar@gmail.com

[2]Associate Professor
Department of Civil Engineering, Oriental University, Indore, 453555, Madhya Pradesh, India
bikram2010@gmail.com

Abstract*: *Rapid urbanization caused by land-use changes is one of the major concerns provoked by human beings, which has become a tailback to hamper the provincial civilization and economy's defensible development. To establish the root causes subsidized to land poverty, the insinuations will be rendered by altitudinal land distribution using the Geographical Information System (GIS) techniques used as remote sensing. The shift of land use/land cover (LULC) is one of the root causes of the global environmental shift. Over recent years, recognizing the global climate impact of LULC has become a hot-discussed topic around the globe. Many studies have explored the impact of LULC on the regional climate in specific cities, regions, or agricultural areas. However, the fast-urbanized areas that are highly influenced by human activity have the most extreme land-use shifts in developing countries, so their infrastructural effects cannot be overlooked. The results showed that the transition in land use had a growing influence on the sample area's regional temperature, while the impacts on land-use zoning were not so large. In consideration of the development of national land transition, the studies can provide valuable knowledge of urban planning policy. This work uses the Remote Sensing Approach and the spatial distribution implications to analyze land-use transition as influenced by rapid urbanization in Nasik City between 1985 and 2012. Methods / Statistical Analysis: This research focuses on the accessibility evaluation of the study region using spatial analysis, gravity accessibility test is used to evaluate accessibility along with map digitization in a GIS environment. Transport improvements along with the efficiency of a zoning framework to evaluate the potential of the accessibility test for evaluating the impacts of mobility on land usage. Applications / Improvements: The verdicts referred to the activities of discovery. Realistically showed the connection between land use and sprawl. The current study aims to explain the Spatio-temporal features of urban growth and its consequences for the hydro-meteorological parameters in the Indian state of Maharashtra's Nasik Municipal Corporation (NMC) is considered one of the most important anthropogenic shifts in the environmental system. The paper's empirical approach is based on changes in land use/land cover (LULC) and a standardized built-up difference index (SDBI) based on remote sensing and GIS techniques. Spatiotemporal satellite images and traditional evidence are used to describe the phase of urban growth, while unregulated classification methodology is focused and used to alter LULC. The interpolation method of Inverse Distance Weighting (IDW) is used for spatial allocation of land use and study of services. It is noted that in the last decades the overall metropolitan built-up region has risen with variations in depth of groundwater rates on the city's north, northwest, and southwest side. Notably, there have been built-up developments from the north-east to the south-east. There are pieces of evidence of urban sprawl or shrinkage suggesting that the built-up region is increasing and thus creating environmental degradation in the urban area. While the methodology used in the paper has the potential to understand the process of urbanization, the findings have significant implications for designing policies and regulations that are necessary. Such research assists the spatial allocation of land that is affected through automated technologies by rapid urbanization.

***Keywords*: Land Cover, Land Use, LULC, Remote Sensing, Urbanization,**

I. INTRODUCTION

Remote sensing methodology of high-resolution images has proved to be a reliable contrivance of land-use transition identification. Remote sensing technique has the potential to detect increase or shrinkage in some land use (capital speculation) for example Remote sensing technique can be used to investigate whether marketable investment growth has contributed to shrinkage in other types of property speculation. The method of remote sensing has proven to be an important tool in environmental impact evaluations. Studies from such surveys have consistently supported grounded verdicts on zoning and additional land usage. In Nasik city where ground data congregation is typically met with difficulties and inaccuracies, the technique of remote sensing offers profusely accurate data. Transformation of

land use as influenced by urbanization in the present study. The population of Nasik is expected to grow to almost 40,000,00,00 by 2030 (Registrar General And Census Commissioner India, 2014). The town is experiencing accelerated motorization, elevated congestion, and noise with the growing population. It can avoid the pitfalls in communities with similar characteristics with successful measures at this point and can set high standards for other cities to emulate. Nashik has a population density of 42 residents per hectare, suggesting the likelihood of rising densities and creating a more streamlined type of the community as the city grows (Nayak et al., 2012). While the urbanization cycle has significant implications for shifts in demographic characteristics and physical landscape transition, unplanned, unsystematic and rapid urbanization may have profound impacts on various environmental components, notably on land and water. Therefore, to cope with environmental changes and promote biodiversity, a detailed understanding of the complexities of urbanization-induced land-cover transition is required.

This is particularly so because most of the world's urban areas have experienced significant shifts in ground cover over the years. In fact, these urban areas use most of the world's energy, causing serious environmental problems and habitat destruction by air, water and land contamination. The report is structured as follows: Section 2 discusses Nasik City's study area and how its network of public transport progressed from 2011 to the current. Land use research outlined in Section 3 and the conclusions and comments discussed in Section 4. Finally, Section 5 puts together a summary of the key findings regarding Nasik City case study and some lessons to be learned for future studies on the inequality impacts of transport policies and land-use zoning policies.

II. THE STUDY AREA

Nashik, a very old town with history right from the days of Ramayana, has changed all over according to the developments. It is the city in North Maharashtra with a good mix of pilgrim area and commercial center. Kumbhmela is the city's holy icon every 12 years. Government and large-scale private units working in and around the region add particular importance to the area on India's economic diagram. There are also large numbers of small and medium-sized enterprises that are suppliers of all such big-scale units and have produced a large number of jobs. The town of Nashik lies on the northwest side of Maharashtra at 529.5 m, between 20 ° 02'00 'North and 73 ° 50'00' East Longitude (Gadakh B. L., 2018). Nashik City is a town located in Maharashtra, India with an area of 259.10 square kilometers. Its located 180 km from Mumbai and 206 km from Pune in the northwestern part of Maharashtra. Nashik City is the Nashik District and Nashik Division's administrative headquarters. In Western Ghats, on the western edge of the Deccan peninsula on the Godavari River. The Nashik City in Maharashtra is said to have the fastest growth.

In the last two decades or so, Nashik has transformed from a small pilgrimage town into a modern mid-sized town. The growth of industries has resulted in a significant population growth resulting in the expansion of the city's footprint into the hinterland and the growth of suburbs along the city's periphery. This development was catalyzed by the inherent advantages of geography and environment and by the ample Indian retail movement has had an impression on Nashik with the launch of several medium and large shopping malls in the region after 2002. The phenomenon has been adopted by stand-alone label clothing shops and food chains, establishing outlets for the rising urban population. Given the city's need, regular aircraft service to Mumbai, India's financial hub, is also initiated.

Fig. 1 Location map of Nashik

Nasik is the fourth largest city in the western Indian state of Maharashtra, and the third largest urban area. Nasik has a population of 1,48,000,00 according to the 2011 census (Directorate of Census Operations, 2011). The population of Nasik is expected to grow to almost 4,00,000,00 by 2030. The town is witnessing rapid motorization, increased congestion, and pollution with the growing population. It can avoid the pitfalls in communities with similar characteristics with effective approaches at this point and can set high standards for other cities to suit. Nasik has a population density of 42 residents per hectare, suggesting that as the city grows, there is room for enhanced densities and a more streamlined shape of the city.

A. Objectives

1. Study of spatial growth of Nasik City
2. To study the land use
3. To study the land use patterns
4. To study the total built up area
5. To study the population growth and development
6. To study the developed and undeveloped land patterns.

B. Data Sources

TABLE I. DATA SOURCES FOR THE STUDY AREA AND ANALYSIS

Type of Data	Nashik	Sources

Primary Data	Topo sheets No. 46H/12, 46, H/16, 47 E/09,47 E/13	Survey Of India, Scale 1:50000
	Satellite Imagery - LISS-3; IRS-P6 Path: 95 Row:59	National Remote Sensing Centre (NRSC), Hyderabad

Nashik is one of India's fastest growing cities; since 2002 the credit goes tremendously towards its industrialization and growth with malls, new urban areas, roads, educational institutions, etc. This growth has been catalyzed by the natural benefits of geography and climate and abundant water availability. Nashik area's industrial development can be considered primarily in two periods, namely pre-independence and post-independence. It can split the post-independence period into several years, 1881, 1881 to 1931, 1931 to 1951, and 1951 to 2010, as shown in the spatial growth figures of a region, as the figure 1 below indicates a demographic increase that has been steady over the past decade and is moving ahead (Registrar General And Census Commissioner India, 2014). The factors responsible for the spatial growth are given in the table 2.

TABLE II. KEY FACTORS ON WHICH THE SPATIAL GROWTH OF THE CITY DEPENDS

Sr. No.	Factor	Percentage
1	Nasik's literacy rate	85.67%
2	Population living below the poverty line	5.6%
3	Level of human development (2001-2008)	90.00%
4	Growth of infrastructure	80%

C. Analysis of Land Use

Land is one of a country's key natural resources. Land use and land use can be referred to as built-up human development (residential, industrial, agricultural land, recreation area) and property use is referred to as natural forest, water bodies and hills. Nashik city as the research area of the Topographic base map used and the satellite images like to be improved using edge enhancement methods. Supervised system of assessment is used to determine the research area's land use and ground cover. The geographic information system is used to prepare various layers of different land uses identified from remotely sensitive data (Weng, 2001). Analysis of land use cover results shows that the built up area and reduced vegetation cover with city limits are significantly higher. The geographic information system. Accessibility is widely interpreted as the ease with which a person may access places and opportunities in space from a given location, arising from the relationship between the transportation system, trends of land use, and individual's different constraints (Papa, te Brömmelstroet, Silva, & Hull, 2016). This paper performs a pre-and-after analysis of Nasik's transportation system to quantify the improvement in mobility arising from Nasik's latest policies between 2011 and 2017. The goal is to assess the impact of these policies on improvements in mobility for different social groups and city areas and to examine how better-off places were more

open than poorer areas in 2010. The approach used in this study involved the compilation as GIS and remote sensing of secondary data sources and two key phases. The research includes continuity differences in the built-up and the amount of construction within the study period, particularly in 1981 & 2001, although correlated with 1971 (Registrar General And Census Commissioner India, 2014), it indicates a significant droplet in the space area compared to the wonderful blown-up of the city by 2001 and 2011. The residential area is growing rapidly, and the agricultural area is starting to decrease from 1985 to 2012 as shown in Fig.
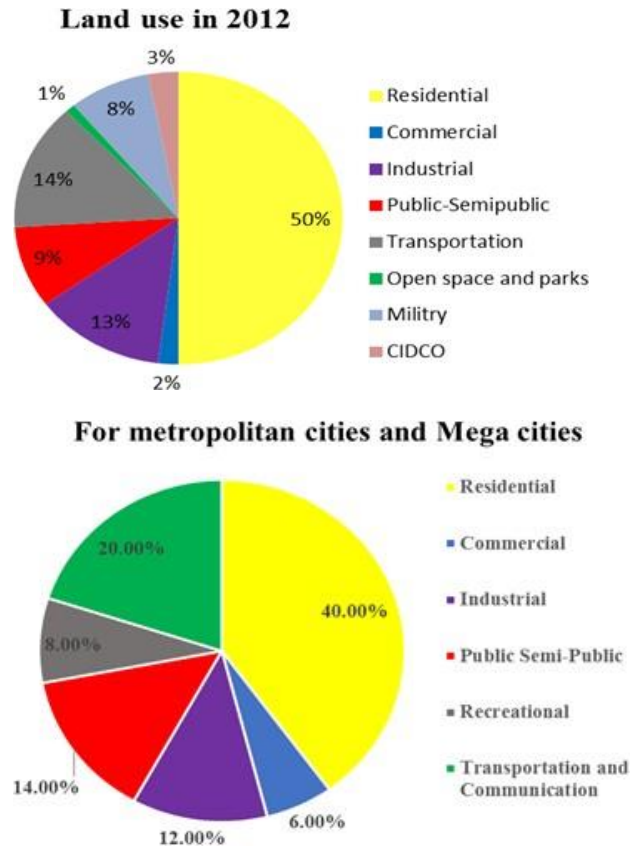

Fig. 2. Land use data

The built-up population is highest in the core area along with regions surrounding Satpur, Ambad MIDC and Nasik Road Built-up zone map reveals that the city is expanding towards an industrial area that occurs in the city along the NH and SH. NH-3 splits the region into two sections on the Dwarka Circle that cross NH-50. Four SH passes through Nasik area, namely SH-2, SH-3, SH-34, and SH-30. The above chart also shows the location of the city's bus terminals. CBS is Nasik City's main bus terminal in a core area.

One of the key elements of research is Technique. For data processing or analysis purposes, the performance or outcome of the study depends greatly on the technique. The following methods will be used to accomplish the above objective:

- Step-1: Reference knowledge will be collected; a detailed literature review on the topic of study is to be carried out. Documents from various libraries,

institutes and agencies will be collected, etc. written literature. In addition to this relevant literature, novels, articles, comments will also be accessed via the website.

- Step-2: Digitalization will be carried out of the features of infrastructure and property usage, irrigation networks, road and rail network and institutional borders of the toposheets.
- Step-3: Using the classification of the supervised and unsupervised methods.

The aim of studying the change of land because of its stretch of city lands is to understand the trend of the land transition particularly in relation with the modification of agricultural land, and vegetation cover in the region of development. The table describes the different types of land conversion data between 1981-2011 and contrasts land use / ground cover maps from 1981, 2011. Land conversion data was collected.

TABLE III. COLLECTION OF LAND USE DATA

Sr. No.	Class	Years			
		1981		2011	
		Area (Sq. Km.)	Percentage	Area (Sq. Km.)	Percentage
1	Built up	7.5	2.89	98.63	38.07
2	Vegetation	64.4	24.86	52.46	20.75
3	Fallow Land	103.1	37.79	32.56	12.57
4	Waste Land	84.1	32.46	75.45	29.12
	Total	**259.10**	**100.00**	**259.10**	**100.00**

The overall accuracy of the classification was 89.0% (Patra, Sahoo, Mishra, & Mahapatra, 2018). The area of study was defined as having seven categories of land use and land cover: Water Bodies, Grassland, Forest, Cropland, Bush-land, Built-up Area and Bare-land. The classification of land use land cover for 2014 is shown.
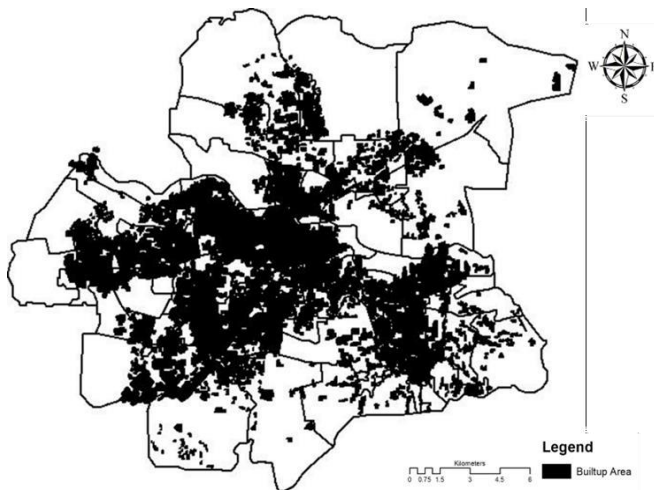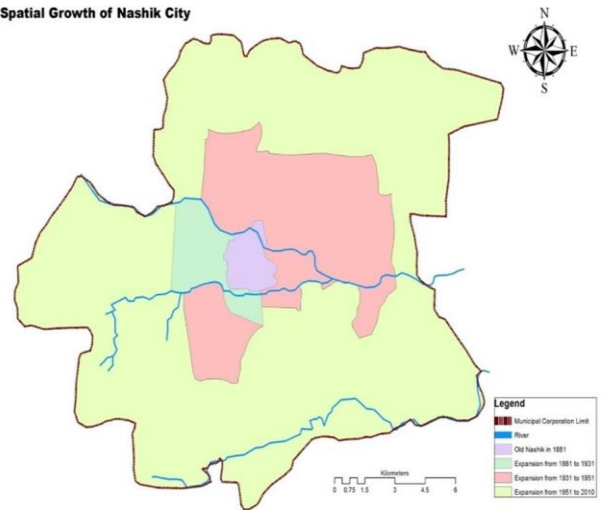

Fig. 3. Built-up area of Nasik city

Fig. 4. Spatial Growth of Nasik City

The per capita household income data collected for all household members and all their income sources (including formal or informal employers, unemployment benefits, savings, government transfers, etc.) in the census report (Registrar General And Census Commissioner India, 2014). While the census has some drawbacks in measuring the upper end of income distribution, Nasik's income distribution remains the best data source to account for (Pereira, Banister, Schwanen, & Wessel, 2019). Such approach has to be used with care since, by disregarding socio-economic differences inside Human Development Units, it creates ecological errors (Aithal & Ramachandra, 2016).

The Nasik City traffic situation cannot be known only by secondary survey. The primary study is therefore being performed in Nasik City to consider the city's existing travel trend, accessibility issues occur during a work trip and educational trips, and Nasik City's present accessibility scenario (Pereira et al., 2019). For this reason, as shown in Figure 5, the following technique is adopted.
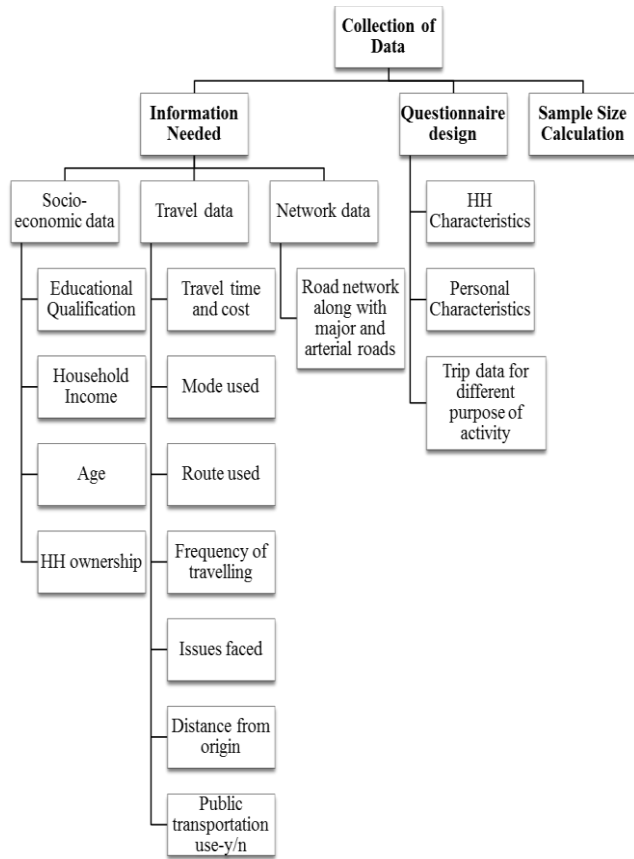
Fig. 5. Methodology used for primary data collection

In the city's core area and CIDCO region, population density is highest. The maximum population density is 1121 PPHa (Nasik Municipal Corporation, 2019) in ward number 10 located in the city's core area as well as being close to City Center and the minimum population density is 11 PPHa in ward number 707 (Parry, Ganaie, & Sultan Bhat, 2018). City's average population density is about 212 PPHa as well as the density of population continues to decline steadily as it exits the city center as shown in Fig. 6.
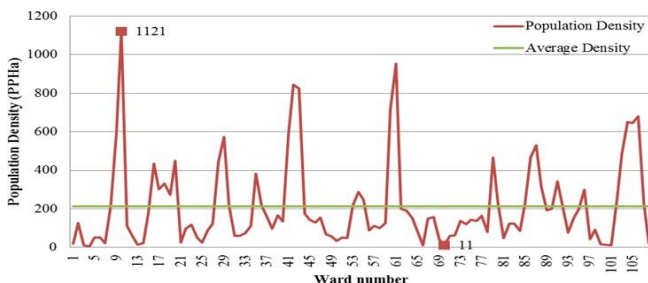

Fig. 6. Population density

D. Results and Discussions

It has been demonstrated in this work that the supervised classification of multi-temporal satellite images is an effective tool for quantifying current land use and detecting changes in a changing environment. For the GIS and RS image analysis, Landsat 7 satellite images from 2000, 2005

and 2016 were used (Verburg, Neumann, & Nol, 2011). The reported variations ranged over the two observational cycles (2000-2005 and 2005-2016) from one LULC group to another with several maintaining a constant shift (increase or decrease). In the first cycle, certain groups witnessed a reduction and a rise in the second period and vice versa was valid for other types in LULC (Sahebgharani, Haghshenas, & Mohammadi, 2019).

This study advocates that multi-temporal satellite data is very useful to detect the changes in land use and land cover comprehensively. Land use and land cover changes have a wide range of consequences at all spatial and temporal scales. The study reveals that the LULC pattern and its spatial distribution are the major rudiments for the foundation of a successful land-use strategy required for the appropriate development of any area (Yeh & Li, 2001). This paper has focused on physical accessibility, land use and its limitations that need careful attention in future studies. According to the GIS mapping, the public transportation accessibility index for work trips and educational trips was considered while finalizing links to increase public transportation accessibility in the notorious areas of Panchavati and Nasik Road where the city will expand in Future. Developed and undeveloped Nasik City's Present, Future area is identified as shown in Fig. 8, and the program in question is shown in Fig. 7.
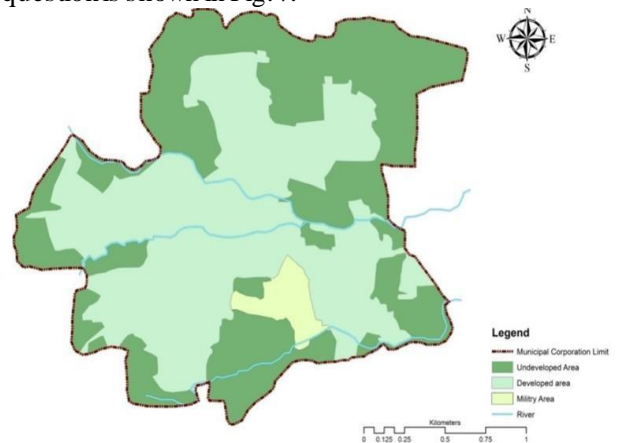

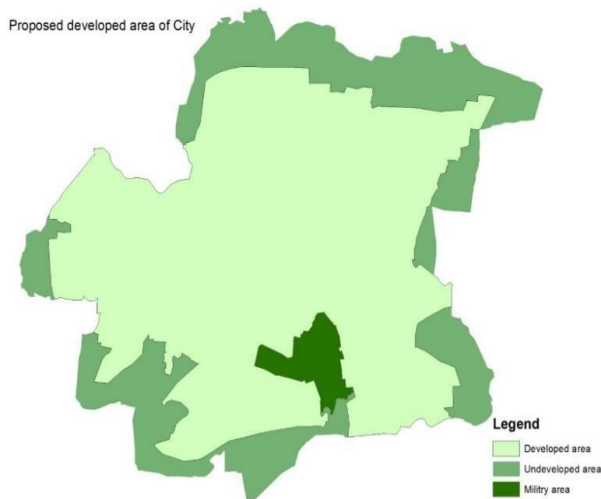Fig. 7. Existing map of Developed and Undeveloped area of Nasik City

Fig. 8. Proposed Developed and Undeveloped area of Nasik city

A drawback of this report is that it does not include job opportunities in the informal labor market because the addresses of informal workers do not provide any data source (Pereira et al., 2019). While a significant proportion of Nasik City workers operate on the informal labor market (about 46% in January 2011), informal employment are comparatively more available with shorter commute times and distances than formal jobs, and it is reasonable to assume that formal jobs are generally preferable provided the related labor rights and social benefits. In comparison, Nasik's 2007 household travel survey shows a correlation between the number of formal and informal workers in each traffic zone at 0.78, indicating that the geographic distribution of formal and informal jobs in the city is not radically different (Chang, Parvathinathan, & Breeden, 2008).

In two decades land utilization and land cover analysis in built up areas has been increased but the number of slum areas has been reduced, as well as land fallows, waste lands, vegetation cover and road networks and water bodies along both sides.

Conclusion

The effect of land-use transition from unbuilt-up areas to built-up areas on surface temperature in Nasik region during 1981-2001 was investigated in the present study using body research. Land-use / land cover shift (LUCC) is one of Nasik city's main triggers of equitable environmental variability, and urbanization results in uneven land-use development. While urbanization is increasing, other studies have shown that property not too near to the cement plant attracts higher rents due to less pollution impact, the unequal distribution and rapid growth of infrastructure would inevitably result in the loss of stability in the Nasik City in the coming years. According to the results of adaptation from cultivated land to built-up environment, under the rapid urbanization process, the most important form of land-use transition in the region was predictable as 'urbanization of property' and the strenuous forfeiture of water bodies was

another significant source that enabled the advancement of built-ups. The research shows the existing and undeveloped property that needs to be addressed in terms of the city's resources, policies and compliance practices to prevent the loss of climate change on earth and also the remote sensing technology needs to help integrate these problems for potential examination. The city of Nashik expands in all directions, leading to huge urban spreads and changes in the use of urban land. This study contributes to the evaluation and description of land use changes for urban and sustainable planning.

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Author Profile

Basweshwar Jirwankar

Author is currently a PhD research scholar (2018-2021) at Civil Engineering Department, Oriental University, Indore, Madhya Pradesh, India, 453555. He pursued his Masters dissertation at Amravati University, Maharashtra, India. He published around Eight plus research and review papers mainly focused on the urban transportation, pedestrian safety and driver behavior, traffic planning, geo spatial data analysis, intelligent transportation systems and urban land use by Artificial Intelligence etc. He also completed his research based trainings on MX Road suite and GIS toolbox for the accessibility analysis on existing infrastructure.

+919850093300, Email- b.s.jirwankar@gmail.com
https://www.linkedin.com/in/basweshwar-j-60ba76195/
https://orcid.org/0000-0002-7582-1570