



A Geospatial Analysis of Rohtak City, India, Focusing on Urban Growth and The Effects It Has on The Cityscape

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Abstract

Rohtak was chosen as one of eight priority locations to develop into Regional Centres in the NCR Regional Plan 2001. The Indian city of Delhi lies around 70 kilometres to the north-west. National Highway No. 10 passes through it, and its total area is 100.57 km². It is located at 28°41' N latitude and 76°12' E longitude, in the NCR region of the state of Haryana. In the year 2001, it was predicted that the city's population would rise to half a million. The area's urbanisation rate remained dishearteningly low despite its closeness to the nation's capital. The city of Rohtak grew more slowly than the rest of Haryana during the thirty years ending in 2001. After being promoted to the level of Municipal Corporation in 2010, Rohtak's urbanisation sped up, as the city gained more land and absorbed eight previously urbanised villages. Responsible land management is a must in today's economy. Critical to urban planning and development operations is the capacity to track and recognise changes in land use and land cover types over time, as well as the spatial information defining these shifts. The actions taken here are a direct result of this. It looks at the effects of urbanisation on Rohtak by analysing the correlation between population growth and changes in land use. From 1983 to 2010, that's the time period we'll be looking at. The conclusions presented here were compiled using data collected both directly and via the use of secondary sources. The ground truth and field pictures are examples of primary sources of data, whereas guide maps, topographical sheets, and high resolution satellite imageries are examples of secondary sources of data. These secondary data sets were used to identify changes in the study area's land use and land cover.

Keywords: *Rohtak City, Urban Growth, Land Use, Population, Haryana*

Introduction

Rohtak was designated as a Priority Town in the National Capital Region Regional Plan 2001, which was drafted by the National Capital Region Planning Board and the State Governments (Regional Centers). In 1985, the Board was established to guarantee uniform growth throughout all jurisdictions. Uttar Pradesh, Rajasthan, and Haryana are all part of its sphere of influence in India. The Plan estimated that by 2001, Rohtak will be home to 500,000 people, up from 1,671,000 in 1981 and 2,160,000 in 1991. It was planned for a maximum gross density of 110 persons per hectare. Additional NCR towns may expand based on their ability to accommodate growth and their potential for future development, as outlined in the NCR Regional Plan 2021. The NCR's individual states' Development/Planning Agencies must provide their approval to this expansion. The Plan envisions these regional centres taking on secondary and tertiary sector tasks that are too specialised for lower order centres to handle, hence generating additional job opportunities. The NCR Plan promotes the growth of such hubs as centres for high-tech manufacturing and other economic activity, with the main aim of centralising administrative and higher-order service supply. As Haryana's commercial and employment opportunities increased, the state government issued Notification No. CCP (NCR) R-C. A./98/1464 in the Haryana Government Gazette on September 3, 1998. An estimated 700,000 people would live there by the year 2031 AD, with a population density of 110 people per square metre, according to an article published in (Extra) on September 8, 1998. The numbers do not include the areas under government control. The low population density was planned for in light of the current growth trend to make way for future expansion in the Delhi area.

Although its position implies it has considerable potentials for industrial development through induced growth, the town's economic foundation is weak since it has so few industrial units. This has resulted in the city's population falling short of the 500,000 predicted under the Regional Plan for the year 2001. The present economic condition in the nation has added to the challenges faced by urban management. It is imperative that urban municipalities be self-sustaining. Budgetary needs must be met via effective resource mobilisation and tax collection. In addition, Municipal Corporation status has been bestowed to the Rohtak municipality. The vast amounts

of additional land will be used for a wide range of purposes. This raises the issue of how to develop and maintain land in a sustainable way.

Objectives

This study looks at how land use changed in the city of Rohtak between 1983 and 2016 as a result of urbanisation and other forms of development.

Material and Method

This study combines remote sensing data from different locations and periods with non-spatial information. The Rohtak District Gazetteer, the Haryana Town Directory, the Statistical Abstract of Haryana, and the 2011 India Census were used to create this data. Images from Cartosat-1 and LISS-IV from 2010 were received from the National Remote Sensing Centre in Hyderabad, while a land use map of the study area from 1983 was sourced from the Survey of India Guide Map. The images were digitised on-screen so they could be used in a geographic information system. Topographic Sheet No. H43W9, with a scale of 1:50,000, is used as the georeference for the Guide Map, Cartosat-1, and LISS-IV pictures. The results of this study are based on a combination of supervised categorization and manual analysis of Guide map and satellite photos. In order to accurately map each land use type throughout the classification process, a field survey was conducted over the whole research region using GPS units. The image taken in 2010 by Cartosat-1 and LISS-IV is 27 years newer than the one shown by the land use map from 1983. Instead of checking our findings against the actual world, we based them on easily available historical data for the research area based on the map's appearance in 1983. However, all of the digital data from Cartosat-1 and LISS-IV images from 2010 have been checked against the ground truth. Canals and important roadways have been represented digitally as both linear and polygonal features. Due to a lack of data, the 1983 map does not depict the growth of public utilities and infrastructure. Land use shifts in the city of Rohtak between 1983 and 2010 were mapped using remote sensing and geographic information system methods. The spatial data was geo-referenced using the ERDAS 9.0 software. Land use change data from the city was digitised, integrated, overlaid, and shown using Arc GIS 9.3. The land-use patterns of Rohtak, India, were

analysed using the NUIS third-level classification system (2008 edition). Rapid urbanisation and the ensuing changes in land use have had a significant visual impact on Rohtak. The dynamics of urban land use change are evaluated by analysing demographic and satellite data in this research. The study area is delineated by the Rohtak City Municipal Corporation. Changes in land use/land cover and trends in urbanisation are analysed using data from the Guide Map, Cartosat-1, LISS-IV, and the Census. To learn more about how environmental changes affect urbanisation, a database is created. This method has the potential to confirm the effects of urbanisation on rural regions and reveal newly formed spatial configurations. We utilised a comparison method to show that satellite images combined with a geographic reference system may reveal changes in the built environment. It is possible to get insight into the inner workings of development, the causes of urban expansion, and their consequences on local life by examining Rohtak's evolution over a 27-year period.

Land Use in 1983 in the City of Rohtak

In the 1981 census, the city had expanded its borders by about 11 km². As a result, agricultural usage of land began to increase dramatically after 1983. It took up 33.17 percent of the city's total land area, or 9.04 km², with public and semi-public uses accounting for 20.70 percent and residential use taking up 20.59 percent. The workplace, schools, churches, hospitals, community centres, and cultural hubs all fall under the category of "public and semi-public space." Tilyar Tourist Complex, the sole medical college in Haryana, and other government and semi-government agencies are all located in this bustling metropolis that also serves as a district headquarters. The urban core, symbolic of the original settlement, is a densely populated region serving as the city's primary economic, cultural, and social hub. Land uses are not segregated from one another since the town is so ancient and conventional.

Land Use Analysis

Understanding a region's current environmental condition and continuing changes requires an examination of geographical and temporal alterations in land use and land cover (LULC). The most obvious effect of urbanisation is the shift in land consumption patterns. The landscape abruptly shifts in an unchangeable way. It's crucial to grasp the changes that take place when

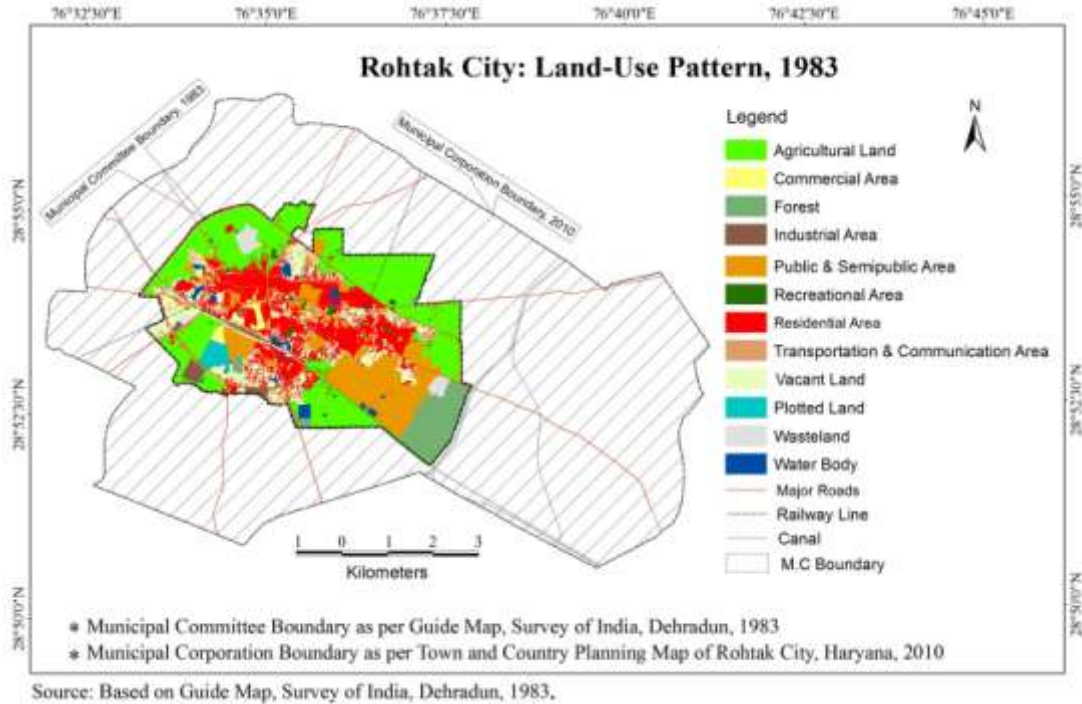
land is put to diverse uses. Land use data may help us make sense of the positive and negative effects of population expansion and decrease. This might provide interesting information for policymakers and leaders. Residential, agricultural, public and semi-public, commercial, industrial, transport, and communication; unoccupied land; planned land; water body; recreational area; forest; rural settlement; wasteland are some of the land use categories represented on land use maps from 1983 and 2010.

Rohtak City: Land Use in 2016

The expansion of Rohtak city's municipal limit and subsequent major urban growth in 2016 have both contributed to an increase in agricultural land. The region depicted on the map, 100.57 km², is now being used in a variety of ways. More over half of the land is used for farming right now (44.21 percent). Twenty-four percent of the land area is designated for residential use, while 8.24 percent is used for public and semi-public use. Land use for rural communities accounts for 2.88%, while transportation and communication uses 2.06%. A total of 8.82 km² of land is reserved for future use in residential and other sector development. In 2016, deforestation is very noticeable. Furthermore, more land has become unusable due to garbage.

Analysis of Change Patterns: 1983-2016

From 1983 to 2016, we monitor the percentage and area (in km²) of each land use class over the course of 27 years. Undeveloped area, forest cover, and wastelands are the main counterexamples to the aforementioned expansion tendency. The amount of forest cover has decreased little, but the amount of undeveloped area has increased significantly. Cities have expanded into once-productive agricultural regions. The latter is around 45 km² in area, which is almost double its size from 1983. Fertile farmland may be used for different purposes in the future by many other communities as well.



The real estate market will see more activity in the near future. People from all walks of life with extra cash see real estate as a safe long-term investment, and the brokers, developers, and investors who together push up land prices reap tremendous financial rewards. The built-up residential sector of cities has also undergone substantial changes as a result of urbanisation. From 5 km² to 20 km², residential development has increased by a factor of four. Most of the change in the residential category is attributable to the transformation of vacant land and suburban sprawl along major thoroughfares into homes. As the city grows, more land is made accessible for farming. Other types of land cover have mostly expanded into or into agricultural and underdeveloped territory. Increasing urban populations and the trend toward smaller, nuclear families have sped up the process of redeveloping rural areas for housing. The most low-density planned-habitation in the city may be found in the HUDA zones, which are the product of urban sprawl. Eight surrounding villages are also part of Rohtak's municipal corporation. The urban spread follows the paths of highways and state roads. The city's entrances and exits have been upgraded with overpasses, and encroachments have been removed to make space for broader roadways. The expansion of the ring-road system is an important force that contributes to our understanding of the spatial and temporal pattern of land use change. There has been an increase

in the amount of land that has been plotted, which includes both the sectors and the prototype Industrial Township. Some of the land is reserved for the development of new HUDA sectors, while the remainder is sold to developers for the creation of new residential areas. The main sections of both Route 10, which leads to Delhi, and Route 71 are where you'll find this property. The manufacturing industry has grown as well. A new Industrial Model Township has been built in an effort to attract the type of investment that will revitalise the local economy.

Category	1983		2016		Change 1983-2016	
	Area in Km ²	Percent Area	Area in Km ²	Percent Area	Area in Km ²	Percent points
Agricultural Land	9.04	33.17	44.46	44.21	35.42	11.04
Public & Semipublic Area	5.64	20.70	8.29	8.24	2.65	-12.45
Residential Area	5.61	20.59	20.56	20.44	14.95	-0.14
Vacant Land	3.81	13.98	3.47	3.45	-0.34	-10.53
Plotted Land	0.34	1.25	8.82	8.77	8.48	7.52
Rural Settlement	0.00	0.00	2.89	2.88	2.89	2.88
Transportation & Communication Area	1	3.67	2.07	2.06	1.07	-1.61
Water Body	0.52	1.91	2.45	2.44	1.93	0.53
Forest	0.16	0.59	0.00	0.00	-0.16	-0.59
Recreational Area	0.16	0.59	1.72	1.71	1.56	1.12
Wasteland	0.25	0.92	3.19	3.17	2.94	2.25
Commercial Area	0.43	1.58	0.95	0.94	0.52	-0.63
Industrial Area	0.29	1.06	1.69	1.68	1.40	0.61
Total	27.25	100	100.57	100	73.32	

Source: Computed from Guide Map, 1983 and Cartosat-1(PAN) image and LISS-IV Image.....

Conclusion

Beginning in 1983 and continuing for the last 25 years, an effort has been undertaken to investigate the patterns of land utilisation that have been seen in the city of Rohtak, which is located in the Indian subcontinent. Using a mix of satellite and conventional ground data, we successfully plotted, monitored, and validated the relevant information. This was done in order to ensure accuracy. This was done so that the results would be accurate. Not only has there been an increase in the population in Rohtak, but there has also been an increase in the total land area. A major growth in the urban population may be attributed, in large part, to the migration of

individuals from rural regions into urban settings. The size of the city has greatly expanded as a direct result of the incorporation of eight formerly unorganised rural villages that were situated within the territory of the municipal corporation. This resulted in the expansion of the municipal corporation. A city's ever-increasing population may put a strain on the city's infrastructure, notably its public services and other amenities, as the city continues to develop. The city's infrastructural issues mean that it can't support its existing population, and it also has the usual issues like power outages, clogged drains and sewers, rubbish buildup, and pollution in the air and water. The city is losing population due to poor infrastructure, which only makes things worse. All of these problems contribute to the city's inability to keep its current population. As a direct result of urban sprawl, the majority of urban land development has migrated out from the central business districts of cities and toward the fringes of these same districts. It is difficult to find any significant amounts of greenery in the metropolitan region. When determining the overall quality of the urban environment, it goes without saying that parks and other green places that are open and have vegetation in them are the most significant aspects to take into consideration. It is possible for a city to considerably reduce its ecological footprint and its emissions of carbon dioxide if the city commits large resources to the planting of trees and the creation of green spaces. We need a plan in order to revitalise areas that have been neglected.

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