

Urban Landuse and Aspects of Urban Growth of Hisar District Decadal Change: Using Geostatistical Techniques

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Abstract

Usage of urban Growth Urbanization is a global phenomenon, and growth refers to the scope of that phenomenon. Urban Growth is having an alarming impact on natural resources, mostly due to population increase and widespread migration in emerging countries. Urban Growth in Hisar, India, has been studied at a mid-scale level from 2012 to 2022 in order to extract data on its pervious surface, sprawl, and temporal variability. Hisar is located in the Indian state of Haryana. Remotely sensed photos from Google Earth were classified using a statistical approach, and the results were consistent. Hisar is one of the Haryana cities that is currently expanding quickly; the built-up area of the city increased significantly. Between 2012 and 2022, the amount of urban built-up area grew steadily. There were only 43.07 km² of built-up area overall in 43.07. The urbanized area covered 44.25km² in 2022. Urban sprawl is the result of flow alterations and urbanization. It has engulfed the NH 9. Along with NH 9, it has expanded along other transportation routes in both the north and south. Numerous roads and a few railway lines connect the city to its environs. The most significant factor in the city's evolving layout has been its road system. It interacts with smaller urban areas quite a bit. This study can be used to forecast urban sprawl in the future.

Keywords: Urban Growth, Geostatistical, GIS, Remote Sensing, Landuse, Classification.

Introduction

Urbanization is the process through which rural areas are transformed into towns, then into cities, and so on. There is no unified definition of what constitutes an urban settlement. Different nations use different standards to define an urban settlement. Even the character of urban areas varies. On the basis of clearly defined demographic characteristics and readily available infrastructures, this can be distinguished. According to Trewartha, the process of turning villages into cities is known as urbanization, and the amount of

urbanization is determined by the ratio of the urban population to the overall population living in urban places. Recently, significant advancements in geospatial technology adoption methodologies have made it possible for urban planners and managers to examine and monitor urban conditions and growth, which was previously unachievable (Huang, Wang, and Li 2018; Sumari et al. 2019a). It is a limited process that a country goes through when it transitions from an agricultural to an industrial culture (Davis and Golden, 1954). He identified three stages in the urbanization process. The first stage is characterized by a rural, traditional society with an emphasis on agriculture and a dispersed habitation structure. The second stage, referred to as the acceleration stage, is when the economy is fundamentally restructured and investments in social overhead capital, such as transportation and communication, are made.

2015 saw the adoption of the 2030 Agenda for Sustainable Development by the United Nations (UN), which served as the foundation for the 17 Sustainable Development Goals (SDGs) and 230 indicators. The SDGs and its corresponding indicators are regarded as products of society generated via cooperation and the shared ambition to establish a balance between human progress and environmental conservation, according to United Nations (2018).

Study Area:

Based on an initial inquiry into the areas where urban sprawl has occurred, the current study of the city of Hisar and its surroundings was selected. The criteria for choosing the research region are based on the availability of data from various time periods, accurate location data from an urban built-up area, and ultimately, a real problem that needs to be solved using a scientific approach. This is situated between latitudes of 29°11'50" and 29°5'50" north and longitudes of 75°51'10" and 75°41'10" east. On the N.H. No. 10, it is located 164 kilometres north-west of Delhi. Rajasthan state and the districts of Fatehabad (North), Jind (East), Rohtak (South-East), Bhiwani (South), and (West). There are currently four tehsils and three sub-tehsils in the Hisar district.

Hisar, Hansi, Narnaund, and Adampur are the tehsils, and Barwala, Uklana, and Bass are the sub-tehsils. Both the Divisional Commissioner's and the Police Range's divisional headquarters are located in Hisar. It serves as the battalion headquarters for the commando force and B.S.F. 3rd Bn. H.A.P. A five-story District Administrative Complex building was finished and offices moved in 1980 in order to bring all departments under one roof. It is adjacent to the newly constructed, operational Judiciary Complex. Figure 1 shows the study area's location map.

Location Map of Study Area

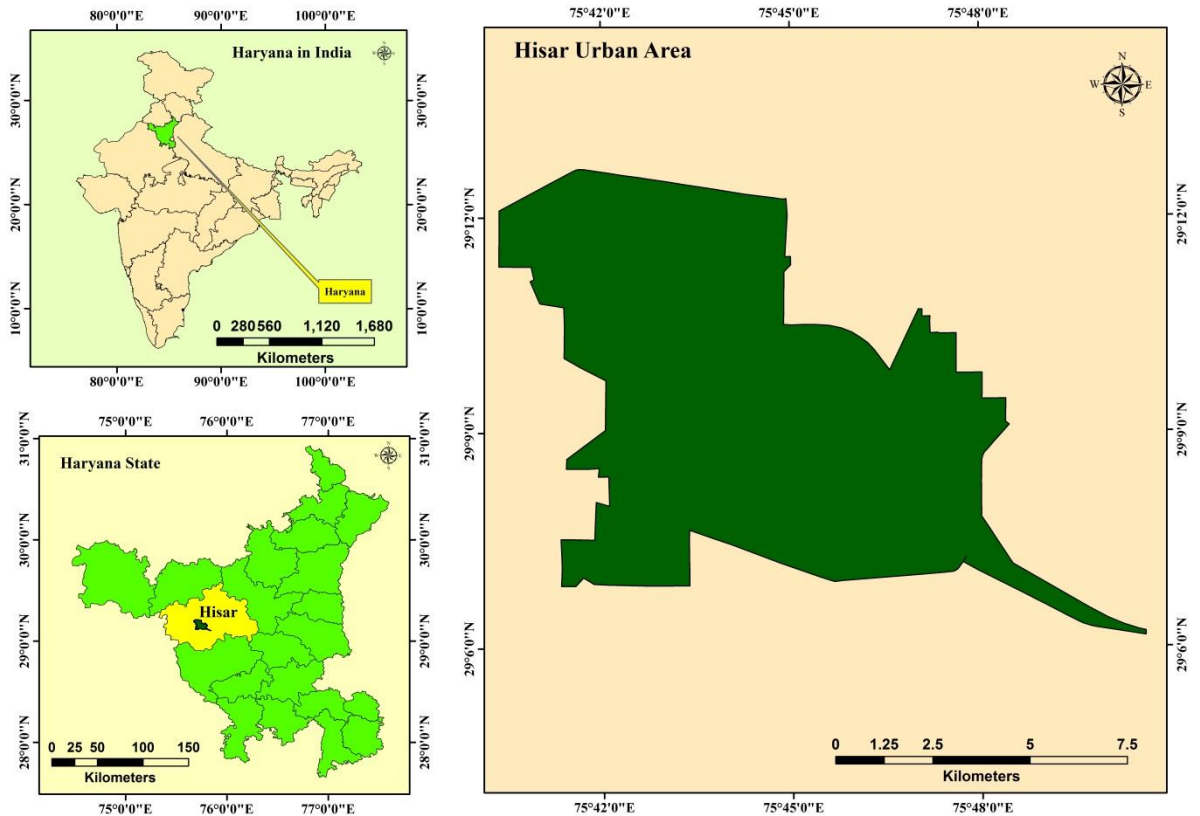


Figure:1 Study Area Map

Methodology:

The use of satellite data sources is a major component of the current study. A survey of India (SOI) toposheet with a scale of 1:50000 and satellite images were captured from Google Earth to study the temporal changes in the physical pattern of Hisar city. The following list includes the remote sensing information and other materials utilised in the study:

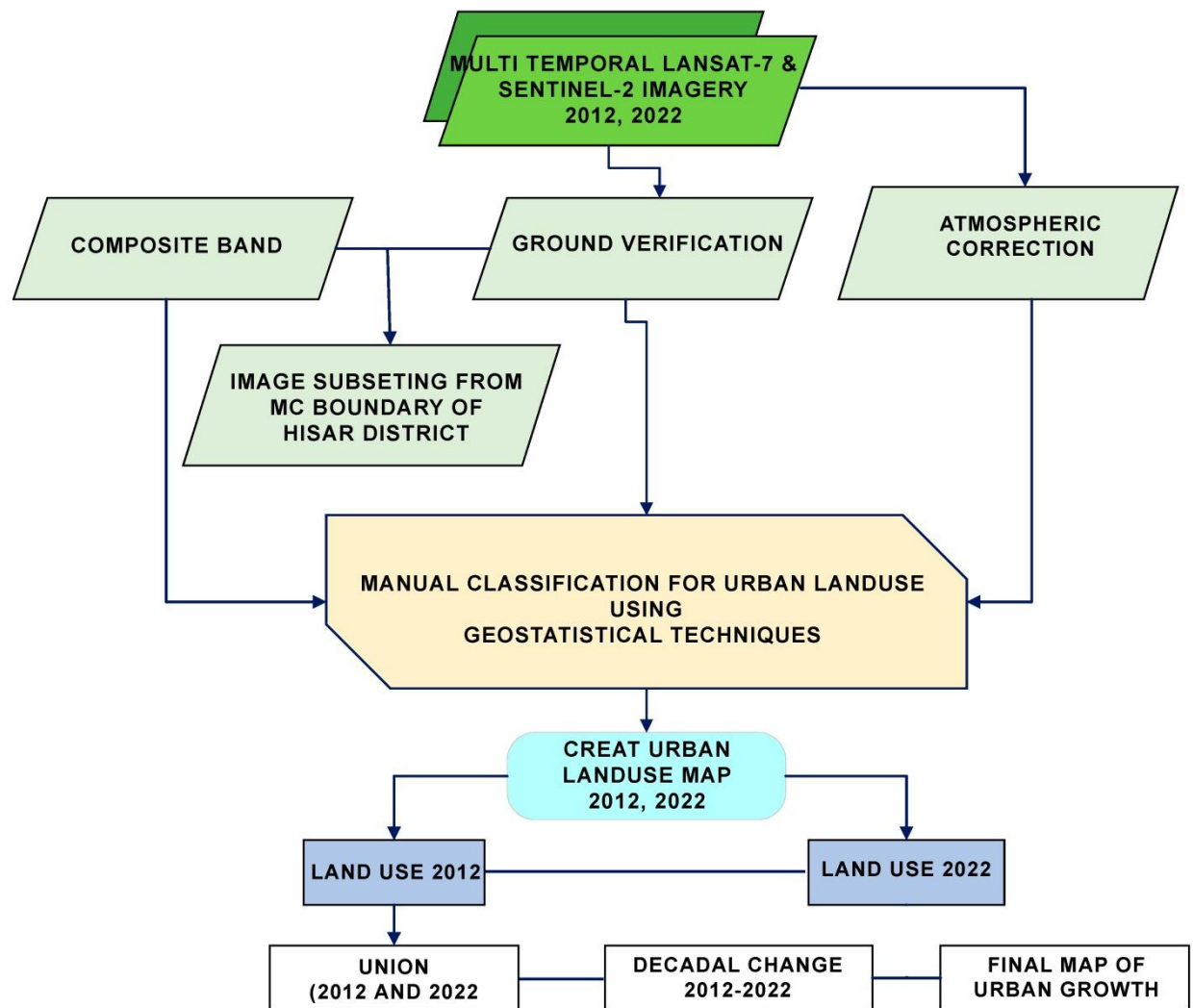


Figure:2Methodology Chart

Software: Arc GIS 10.2 is the programme used for cartography, georeferencing photos, modifying maps, subset image page layout, and map analysis. Microsoft Office 2010 is the programme used for creating tables and graphs.

Ground Verification: It is a crucial component of every study and research activity. It means physically going to the affected area or region to gather data on the research area. The goal of field work is to verify the accuracy of the work done in the lab and to add additional knowledge and information about objects that could not be analyzed or identified in the lab.

Result and Discussion:

Urban Growth is a sign of physical growth that extends outside of incorporated urban boundaries. The entire urban built-up area measured 43.07 Sq km in 2012 Show in Figure-5. Additionally, sprawl has changed in its direction.

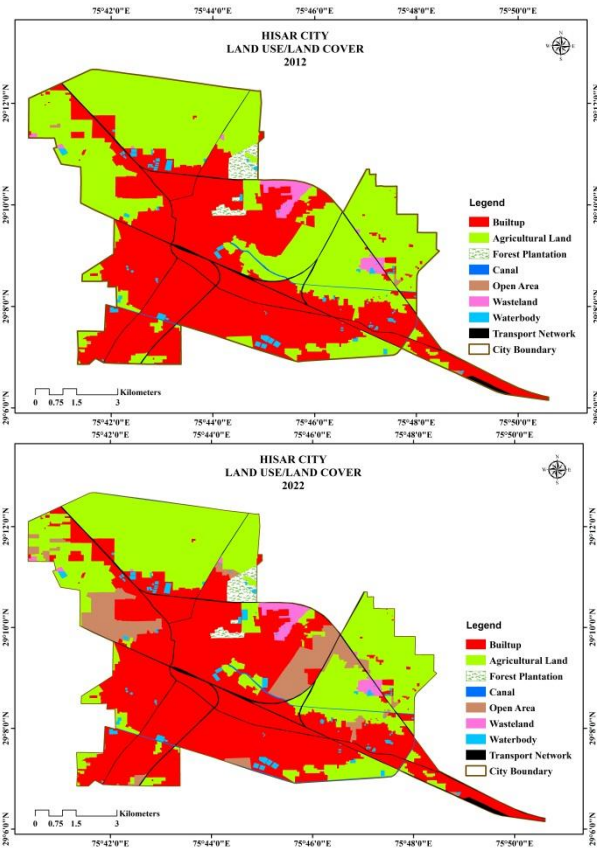


Figure:3 Landuse 2012

Figure:4 Landuse 2022

The entire urban built-up area measured 44.25 sq km in 2022, Show in Figure-6. Additionally, sprawl has changed in its direction. The majority of the newly developed area is expanding the jindal industrial and Sector 1-4 district nearby. The city further extended to the north-east along the Barwala Road, where G.J. University is located. Along the Raipur Road, Tilak Nagar and Rajeev Nagar were also built without any planning. The entire newly developed region was residential. The following locations are near NH 9, Sainik Adarsh Enclave, Industrial Area, and Devi Lal Colony. The most important development is that Gangwa Village joined the city.

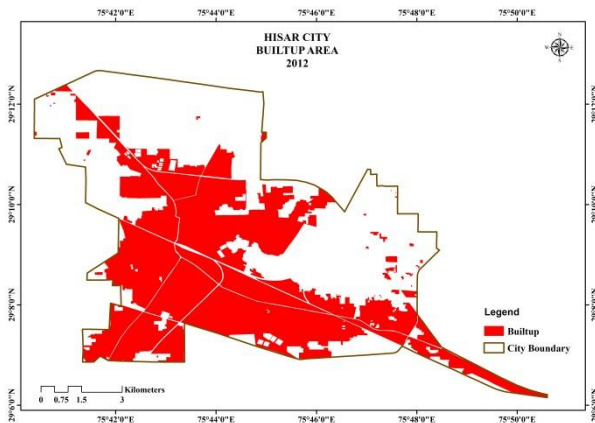


Figure:5 Builtup 2012

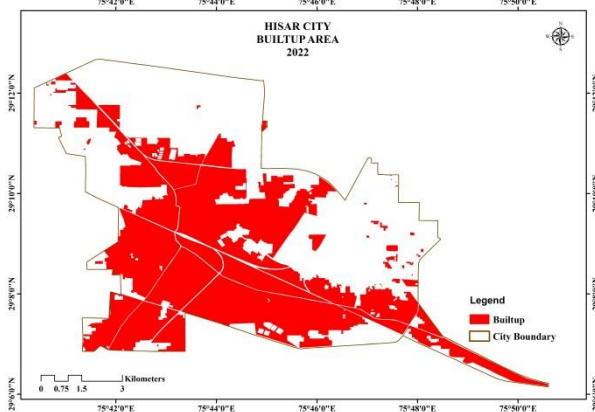


Figure:6 Builtup 2022

which expanded to 1.18 km² in that year. Urban Growth has been measured throughout the city throughout this time around the boundaries of the continuous built-up and along the main highways. However, the majority of the newly developed area has been identified near the city's southern Dabra Road and KaimriTosham Link Roads. Along the Barwalaroad, the newly developed areas have been identified as Sector-1-4, Show in Figure-7, Mahesh Nagar, EktaVihar Colony, Partap Enclave, and Azad Nagar. Dabra, Holy Angle School, ShemrockBalloors, and Sidharth International School around Dabra Road have been identified as the newly urbanised region. In addition to Master Colony, BadiSatrod, and SatrodKalan, the city is also growing eastward. The crucial development is that SatrodKalan and BadiSatrod became a couple.

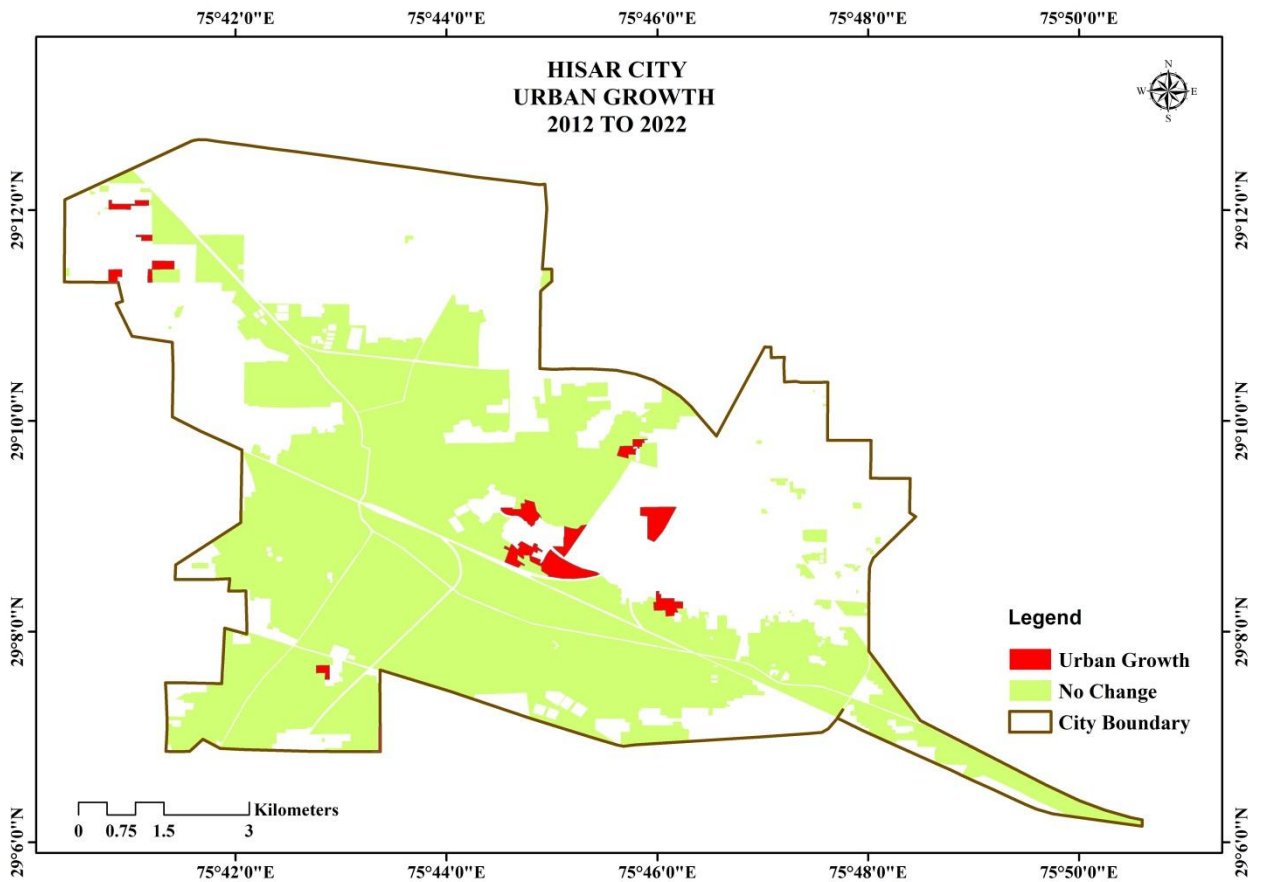


Figure:7 Urban Growth 2012 to 2022

Conclusion:

Using remote sensing and GIS, the current study reveals the size and direction of Hisar city's Growth over a span of almost five decades. Hisar is currently one of the fastest developing cities in Haryana. Between 2012 and 2022, the city's built-up area increased dramatically. The urbanised region was surrounded by vegetation, open space, and agricultural land. Urban changes and flow direction, as well as urban sprawl, have been observed using an overlay of the chronological maps of the built-up area and road network. It has engulfed the NH 09. Along with NH 09, and the Barwala Road it has expanded along other transportation routes in both the north and south.

Numerous roads and a few railway lines connect the city to its environs. The most significant factor in the city's evolving layout has been its road system. It interacts with smaller urban areas quite a bit.

Remote sensing and GIS are therefore useful tools for assessing the urban Growth of Hisar. This study employed satellite photos and geographic information systems (GIS) to give geographical inputs depicting Growth. This study can be used to forecast urban Growth in the future. This is helpful for urban planning agencies in poor nations when data is not

consistently accessible. Contrary to conventional methods, GIS and Remote Sensing can be very helpful in monitoring urban sprawl; however, regular monitoring of Growth should be carried out with the aid of Geo-Informatics.

References:

1. Davies Kingsley and Golden H.H. (1954) : Urbanization and development in pre-Industrial Areas, Economic Development and Cultural Change, vol.3, no. 1, University of Chicago Press (Oct' 1954, pp. 6-26), (accessed at <http://www.jstor.org/stable/1151656>).
2. Huang, X., C. Wang, and Z. Li. 2018. "A near Real-time Flood-mapping Approach by Integrating Social Media and Post-event Satellite Imagery." *Annals of GIS* 24 (2): 113–123. doi:10.1080/19475683.2018.1450787.
3. Resources Assessment", Clarendon Press, Oxford. Batty, M., Besussi, E., Chin, N. (2003), Traffic, Urban Growth and Suburban Sprawl, Centre for Advanced Spatial Analysis, University College London.
4. Glaeser, E. L., Kahn, M. E. (2003), Sprawl and Urban Growth, NBER Working Paper Series No. 9733.
5. Pumain, D. (2003), Urban Sprawl: Is there a French Case? In: Richardson, H.W.; BAE, C.C. (Eds.): Urban Sprawl in Western Europe and the United States. London: Ashgate, S.137–157.
6. Epstein, J., Payne, K., Kramer, E. (2002), Techniques for mapping suburban sprawl, *Photogrammetric Engineering and Remote Sensing*, Vol. 63(9): pp 913-918.
7. Bhatta, Basudeb (2012). Urban Growth Analysis and Remote Sensing A Case Study of Kolkata, India 1980-2010, ISSN 2211-4173, Canada: Springer.
8. Batty et al., 1999, M. Batty, Y. Xie, Z. Sun, The dynamics of urban sprawl Working Paper Series, Paper 15, Centre for Advanced Spatial Analysis, University College, London (1999).
9. Wilson, Emily H., Hurd, James D., Civco, Daniel, Arnold, Chester L. (2003). "Development of a Geospatial Model to Quantify, Describe and Map Urban Growth", *Remote Sensing of Environment*, S. 86(3), s. 275-285.
10. Ready, Richard C., Abdalla, Charles (2003). GSI Analysis of Land Use on the Rural-Urban Fringe: The Impact of Land Use and Potential Local Disamenities on Residential Property Values and on the Location of Residential Development in Berks County, Pennsylvania, Rural Development Paper No.18, The Northeast Regional Center for Rural Development, USA: The Pennsylvania State University.