Urban Sprawl of Hisar city using Remote sensing & GIS –A case study

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Abstract :-

Urban Sprawl Refers to the extent of Urbanization, Which is a Global Phenomenon Mainly Drawn by the population growth and large scale migration in the developing ,urban sprawl is talking it's on natural resources at an alarming .The present work urban sprawl of the Hisar city (Situated in Haryana, India) Had Been Studied at mid scale level over the period of 1989 to 2013 extract the information related to sprawl are in pervious surface and their sprawl and temporal variability. Statistical Classification approach has been used for the classification remotely sensed images obtain from google earth and got the result of same. Hisar today, is one of the fast growing cities in Haryana, the city showed tremendous rise in the built-up area. There is a continuous increase in the amount of urban built-up area from 1989 to 2013. The total built-up area in 1989 was just 18 km^2, In 2013, the urban built up reached to 313 km$^{2.}$ The urban changes and flow direction or urban sprawl. It has sprawled along the NH 10. Besides NH 10 it has also sprawl along other transport routs in North and South directions. The city is connected with its surroundings by many roads and a few railway lines. The road pattern of the city has played most important role in the changing pattern of the city. It has considerable interaction with smaller urban places. This study can be used for predicting the future urban sprawl. This is useful for the urban planning authorities in developing countries where data is not available regularly.

Keywords:-Temporal Changes, urban sprawl, Ground Truth, Georeferencing, Classification and GIS

1. Introduction

Urbanization is a process of villages to be developed into towns and further into cities and so on. There is no universally accepted definition of urban settlement Different countries adopt different criteria for defining the urban settlement. Urban places are not even similar in character. This can be distinguished on the basis of defined demographic characteristic and available infrastructures. According to Trewartha, the level of urbanization is defined as the proportion of urban population to total population residing in urban places by shifting population from village to city and the process of transformation of villages into city is called urbanization.

Urbanization is broadly defined as a growth of town sanding creasing ratio of urban to rural population of a country. The growth of a country's towns and cities is conditioned by the natural, economic and social progress. Urbanization and modern civilization go together for in developing stage due to increasing economic specialization and advancing technology. Today, industry is the most dominant factor of urbanization. It has accelerated the process of rural–urban migration and the creation of new and enlargement of existing urban centres. In a country like India, the level of urbanization is related to the degree of industrialization. Rapid Urbanization in the world is quite alarming in the developed countries, as compare to developing countries e.g. Asian countries. Urbanization is the process through which the forests, fertile agricultural lands, surface water bodies are being irretrievably lost, (Pathan, 1991). In India the percentage of people living in cities and urban area almost doubled to 27.78% in year 2001, which was low when compared to developed countries

The spatial patterns of urban sprawl over different time periods, can be systematically mapped, monitored and accurately assessed from satellite data along with conventional ground data. The recent technologies of geo-informatics and remote sensing help in identifying the pattern and rate of growth. Mapping urban sprawl provides a "picture" of where this type of growth is occurring and to suggest the likely future directions and patterns of sprawling growth.

The increasing population and rapid urbanization causes great change in the center of the city and the problem of the expansion of city center is complicated by the fact that, it must take place within the built-up area which is not possible. Thus the pressures of the continuous growing city center gradually change the surrounding environment and neighborhoods. Sprawl generally refers to some type of development with impacts such as loss of agricultural, forest, open land etc.

2. Description of Study Area

Present study of Hisar city its environs, is chosen based on the preliminary investigation where urban sprawl has taken place. The selection criteria for the study area is based on availability of the different time period and authentic location information of urban built up area and finally a genuine problematic situation that is need to handle with a scientific methodology. This is located between 29°11'50" to 29°5'50" north latitude and 75°51'10" to 75°41'10" east longitudes. It is situated one hundred sixty four kilometers north west to Delhi on the N.H No.10. It is bounded by district Fatehabad (North),Jind (East) ,Rohtak (South-East), Bhiwani (South)and Rajasthan state(West). At present Hisar district consists of four tehsils and three Sub-tehsils. These tehsils are Hisar, Hansi, Narnaund and Adampur and sub tehsils are Barwala, Uklana and Bass. Hisar is a divisional headquarter of the Divisional Commissioner and also headquarter of Police Range. It is also a battalion Headquarters of B.S.F. 3rd Bn. H.A.P. and commando force. In order to bring under the roof

of all the departments a five storied building of District Administrative Complex has been completed and offices shifted in 1980. It adjoins the new Judiciary Complex, which is also made functional. Location map of study area is displayed in figure-1.
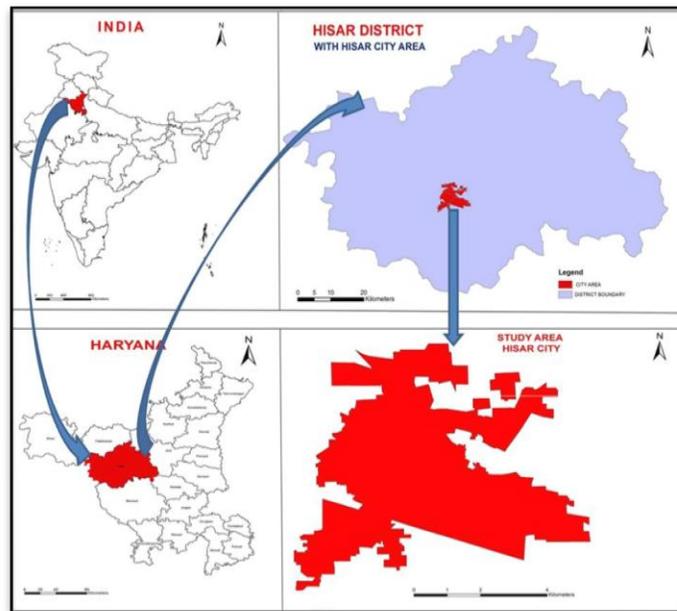
Figure-1

3. Material and Methodology

The present study mainly involves the use of secondary data sources. For studying the temporal changes in physical pattern of Hisar city, a survey of India (SOI) toposheets with the scale of 1:50000 and satellite imageries were captured from google earth for temporal change of urban area. The remote sensing data and other material used for the study are as given below:

3.1 Software used :-Arc GIS 9.3 for cartography, georeference to images ,map analysis and editing in maps, subset of images page layout and Microsoft office 2007 is used for making tables and graphs

3.1.1 Ground Truth and Verification :-It is the integral part of any study or research project. It refers to manually visit the concerned area or region and make a ground truth of the study area. The purpose behind field work is to check the

validity of the action completed in the lab work and also add some additional knowledge and information gathering regarding the objects which could not be analyzed or identified during lab work

Research methodology, is the core of any research process. It is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically. The techniques of remote sensing and GIS provide a powerful tool for studying urban issues, like urban sprawl etc. In this study, the various steps that are adopted in studying the research problem are as figure-2.
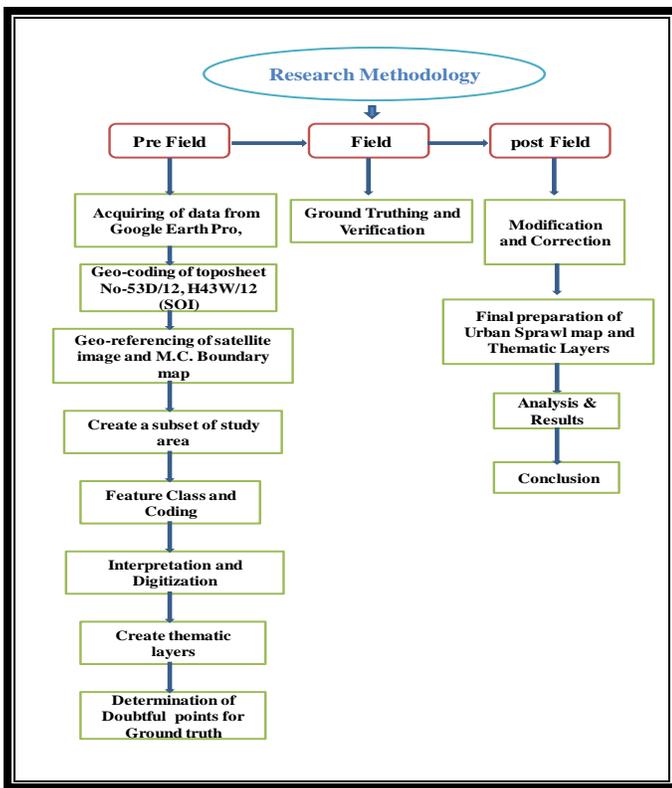

Figure-2

GIS technology can be integrated into any enterprise information system framework. The processing of geographical referenced data is the unique feature of GIS. Geographical data shows both the location and characteristics of spatial features on earth.

4. Results urban sprawl is indicative of physical growth of an area beyond the limits of an incorporated urban unit. The

peripheral growth is not only dispersal from the city center, but also there is another kind of growth. The routes of transportation cause this growth. All along the major and minor transport routes uncontrolled and unauthorized urban development takes place without necessary basic civic amenities. In the absence of any regulation and planning, land uses in these areas are usually in a flux. Because of cheap land value, certain industries and other related urban activities crop up in these areas. To the residents of these, there is hardly any distinction between peripheral area and the main city.

The urban sprawl is consuming peripheral cultivated land and vegetation cover at a faster rate. In the case of Hisar city too, land conversion has occurred due to urban expansion. Unchecked urban sprawl has a variety of undesirable's consequences. Out of which the land conversion from rural to urban or more particularly the potential loss of prime agricultural land and vegetative cover are most important. Urban planners have no up to date information regarding this sprawl because they are dependent on conventional method of physical surveying that is very slow. There is large gap between urban sprawl and information collection as well as between information collection and planning and implementation process. Land use map of Hisar city in 1989 is displayed in figure-3 . Land use map of Hisar city in 1998 and 2013 is presented by figure-4 and figure-5 respectively while urban change sprawl is displayed in figure-6.
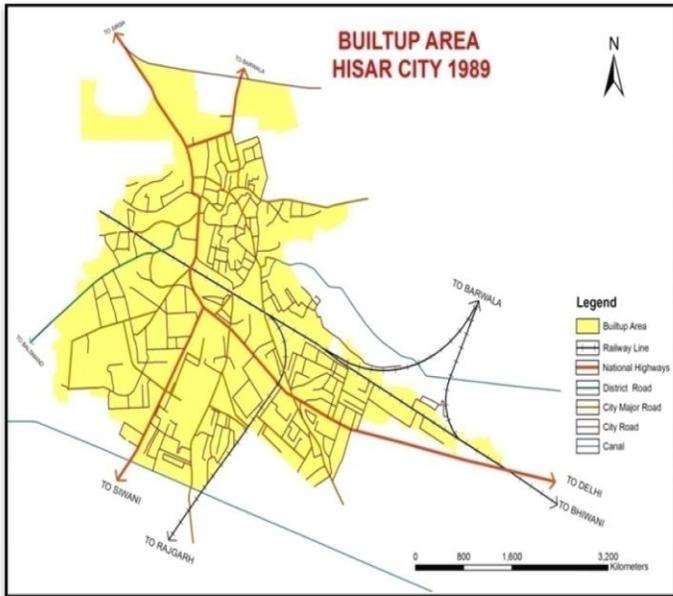
Figure-3
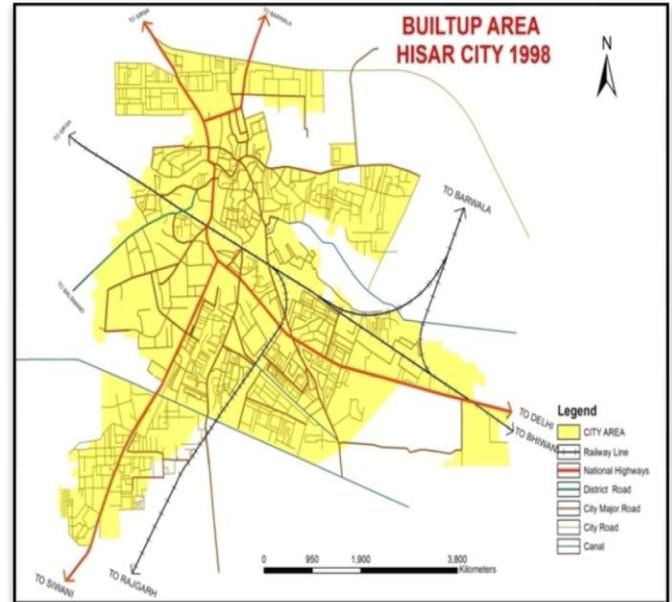
Figure-4

In 1989, the total urban built-up area was 18 Sq km .The direction of sprawl also has changed. Most of the newly built-up area as Sunder Nagar, HRLD Colony along NH 65.The city also spreaded the North-Eastern part as Guru Jambheswar University along Hisar-Delhi Bypass.Tilak Nagar, Rajeev Nagar was also constructed without any planning along Raipur road. This new built-up area was totally residential. Mayyar Village, SainikAdarsh Enclave along the along the NH 10, Industrial Area, Devi lal Colony along the Hisar-Bhiwani Railway Line. The major thing is that, Mayyar Village became a part of city.

In 1998, the total urban built-up area was 29.62Sq km .The direction of sprawl also has changed. Most of the newly built-up area as increase nearby jindal industrial area .The city also spreaded the North-Eastern part as G.J.University along Hisar-Delhi Bypass.Tilak Nagar, Rajeev Nagar was also constructed without any planning along Raipur road. This new built-up area was totally residential. Mayyar Village, Sainik Adarsh Enclave along the along the NH 10, Industrial Area, Devi lal Colony along the Hisar-Bhiwani Railway Line. The major thing is that, Mayyar Village became a part of city.

Figure-5

which increased to 36.6 km^2 in 2013. During this period, the sprawl has been measured all around the city along the edges of the continuous built-up and along the major roads. But most of the newly built-up area has been recorded along the Dabra road and Kaimri Tosham Link road located in the South part of the city. The newly urban built-up area has been recorded as Mahesh Nagar, Ekta Vihar Colony, Partap Enclave, Azad Nagar along the Kaimri road .The newly urban built-up area has been observed as Dabra, Holy Angle School, Shemrock Balloors, Sidharth International School along Dabra road. The city also grow in the East direction as Master Colony, BadiSatrod and SatrodKalan .The major thing is that, SatrodKalan and BadiSatrod, became a part of city.

Figure-6 Urban Sprawl of Hisar City Between 1989 to 2013

5. Conclusion

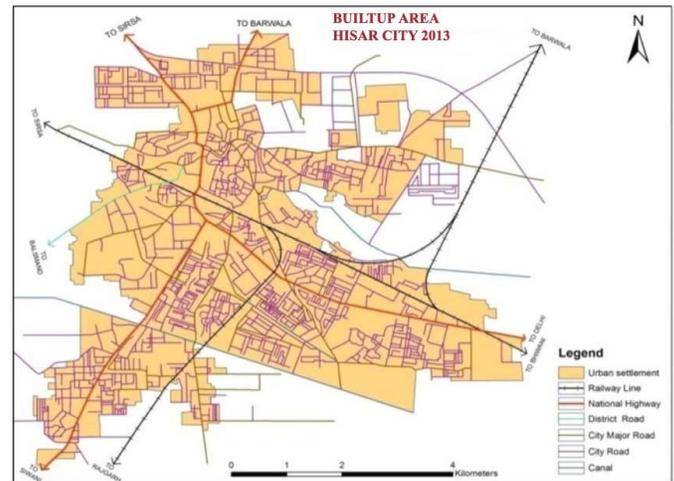Present study brings out the extent and direction of sprawl of Hisar city over a period of nearly five decades using Remote Sensing and GIS. Hisar today, is one of the fast growing cities in Haryana, the city showed tremendous rise in the built-up area from 1989-2013. The urban built-up area spreaded on agricultural land, vegetation and vacant land. Overlay of the chronological maps of built up area and road network has been used to observe the urban changes and flow direction or urban sprawl. It has sprawled along the NH 10. Besides NH 10 it has also sprawl along other transport routs in North and South directions. The city is connected with its surroundings by many roads and a few railway lines. The road pattern of the city has played most important role in the changing pattern of the city. It has considerable interaction with smaller urban places.

Therefore, Remote Sensing and GIS are valuable tools for measuring sprawl of Hisar city. Geographical Information System (GIS) and satellite images have been used in this study to provide spatial inputs describing sprawl. This study can be used for predicting the future urban sprawl. This is useful for the urban planning authorities in developing countries where data is not available regularly. GIS and Remote Sensing can help a lot in monitoring urban sprawl compared to conventional techniques, further monitoring of sprawl on a regular basis should be done with the help of Geo-Informatics.

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