

Analysing the Spatial Patterns of Land Use / Land cover: A Case Study of Panipat City

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Abstract

Presently Land usages and land cover patterns indicate the nature of society's close physical relationship with its surroundings. Planners and management authorities need land use / land cover data to perform land suitability assessment and demand supply calculations as part of their planning duties. Land use and Land cover trends can be used to get an idea of how humans use the earth surface and how it is organized in space. A big part of monitoring land cover around the world is to look for long term changes that happen because of changes in local or regional climates. In the current study, urban expansion and land use / land cover changes in Panipat city are detected, indicating a substantial change in the city cape and land transformation. Using spatial primary and secondary data from several sources, this paper analyzes the breadth and direction of Panipat city's expansion in the terms of built -up area, agricultural land area, open land area, recreational area etc. It also attempts to identify the mapping of spatial data using the software GeoEye image within supervised classification modified by National Urban Information System.

Introduction

Usually, an area's land use and land cover are determined by the extent and speed of urbanization. Information of land use and land cover is an important element informing policies regarding economies, demographics and environmental issues at national, regional and local levels. The relation between man and land determines all the productive and economies activities. Land is not only a resource but also resources base in itself. Land use and land cover changes are affected by human intervention and natural phenomena such as agriculture demand and trade, population growth and consumption patterns, urbanization and economic development, science and technology and other factors (research on land use change and agriculture, international institute for applied system analysis, 2007) Urban morphology has become a common and important research method for the analysis of the physical structures of cities through quantitative analysis. In this context, Hillier and Hanson, (1984) with the support of technological developments, combined this morphological concept with quantitative analysis of city patterns and called it 'space syntax'. According to Hillier, space syntax is a

method that can be used for morphological analyses of buildings, architectural plans, urban areas, and urban plans. It is possible to give quantitative descriptions of built spaces by using this method (Hillier and Hanson 1984). Morphological studies often deal with development of forms and patterns of the present city or other urban areas through time, in sort with evolution (Murphy, 1966). In fact, an urban settlement is apparently a physical entity and the morphology it acquires is a result of a long process of growth. In a more restricted sense, the terms of “morphology, refers to the internal structure of various land uses in urban areas ... In a specific period of time, the structure of a town passes through various development stages and is the consequence of the processes it undergone.

Objective of the Study

The present study is aimed at the following objectives:

- : To identify the Land use / land cover information of Panipat city.
- : To analyze the spatial expansion of the Panipat city along with categories.
- : To Study out the morphological analyses of Panipat city.

Data Sources and Research Methodology:

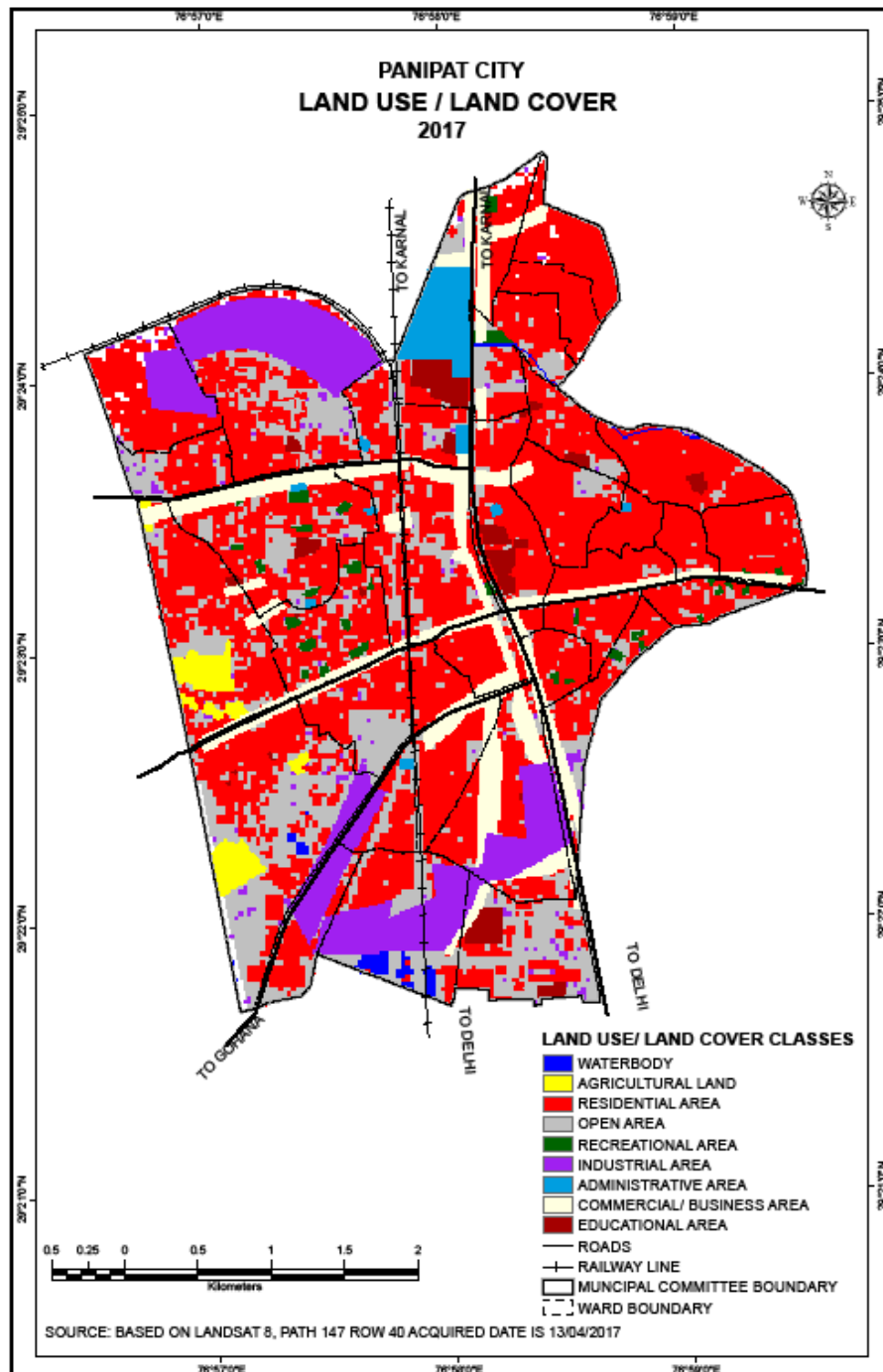
The physical development of the Panipat city and land use / land covers are measured using Landsat satellite data. ArcGIS software and GeoEYE have been used for making the map and image interpretation. In this study ten major land use /land cover categories, water body, Agricultural land, open area, educational area, commercial area, recreational area, residential area, industrial area, administrative area and medical area are used. The study is based on Primary and Secondary data sources taken from Primary Survey and the sources of secondary based data from Municipal Corporation of Panipat city 2011and Statistical data from census abstract of 2011 has been used for this study.

Results and Findings:

Land use / Land cover of Panipat City

Sr No	Land Use	Area In hectares	Percentage
1	Water Body	9.9675	0.5%
2	AgriCultural Land	25.0425	1.17%
3	Open Area	306.787	14.30%
4	Educational Area	32.94	1.52%
5	Commercial/ Business	152.46	7.10%
6	Recreational Area	15.3675	0.72%
7	Residential Area	852.772	39.75%
8	Industrial Area	170.707	7.95%
9	Administrative Area	34.245	1.60%
10	Medical Area	545.119	25.40%

	2145.4075	100.00%
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Residential Area: - Residential areas play most important both quantitatively and qualitatively in the morphology and sustenance of the city. They provide shelter and living accommodation to its inhabitants who are the earners, designers and builders of the city. These areas draw more attention of all-concerned with the welfare of the city, because they share more than 47%¹ of the total developed area of the Indian cities, and happen to be the largest component of the urban space. The natural setting or the site of a place, generates centripetal forces, functioning as a negative or positive force determining both the original layout as well as the later expansion of the settlements. Riverside, confluence of rivers, river meanders, spurs, bridge-points, forts, road junctions, temples, tanks and marketplaces have attracted the residential areas and other functions. It appears that there was no check in the process of intermixture of functions in the cities. Mostly upper floors as well as the rear side of the houses were occupied for residential purposes while the lower and front sides along the roads were given to the business and commercial uses. It may be emphasized that the residential sites were originally influenced by the religious nuclei, defensive sites and by the proximity of employment centers.

General Morphological Characteristics of Existing Residential Areas: -

The time changing patterns of building structure and trends of economic growth have been the most influencing factors in shaping out the morphological characteristics of the residential areas of Indian cities. The aggregation and segregation trend of the residential areas and economic and political status of the people have been responsible for the evolution and growth of different types of residential areas. The tendency of people to reside in the area occupied by the persons of their own group, based on whether caste, community, religion, occupation or other interests have resulted in the segregation of different cultural groups in different parts of the city.

Panipat Household Density

Low Household Density: - In this category only seven wards are found which are as ward no. 29,20,31,3, 26,28 and 25. When we analyze the Panipat city map we can easily find that small and interlocked wards are located in eastern direction and big and clear-cut boundary wards are in western direction. Old industrial belt is in the south west part of the city. Newly industrial belt is in the north west direction of the city. Distribution of open area and agricultural area also justify the household density. Ward no 26 and 25 are the part of the older planned area of

the city as Model town and 8 Marlr colony. Ward 25 is the part of the older planned area of the city as Model town and 8 Marlr colony. Ward no 31 is a newly added village named Nangal Kehri is a part of Panipat city. Ward no20 has more proportion of newly industrial zones and commercial areas than residential areas.

Moderate household Density: -There are two belts found with Moderate household density. First belt is going along the railway track and Grand Trunk Road With ward no 4, 5, 6, 18, 17,13 ,14 and 24. This represents the extension of the city which follows the road and railway pattern. Railway track and Grand Trunk Road plays an important role in development of panipa city .C B D of the city also follows the transport network. Panipat Assand road,Panipat Gohana road ,Jattal road ,Sanoli road also play a centrifugal force role for city development. Another belt with moderate density exists in the outskirts of the city. These wards are 22,27,30 and 21 which form this belt. Ward no 30 is along Gohana road and Sugar mill. Ward no22 is in the outer southern part of the city. Ward no 27 is spared between Assand and Jattal road It is surrounded by Model town. Ward no 21 have more percentage of commercial and open area than residential area

High Household Density: -Ward no 7,8,10,11,12 and 15 are located in the eastern boundary of the city which is decided by drain no 8. Low class residential area is found along the drain. Ward no 1and 2 also have a high density of households. Ward no 3 is an industrial area and residential area is not available here. Ward no 25 and 26are planned as part of the city, so land prices are very high. The labor and workers are living in ward no 2 and 1 due to the low price of land and rent. People choose this area for residence. Maximum density is in ward no 15 It is a part of oldest city streets. The narrow area of each house is very low.

Business \commercial area: - Total area of Business/ Commercial zone of Panipat city is 152.46 hectares. This is only 7.10 percent out of the total city area. The business and commercial areas have shifted from the original place to the city. The commercial activities of the city are mainly concentrated in the. In this time, the tendency is for the heart of the business area. The commercial Land use of town/city has been divided into following parts.

1. Central Business Districts (CBD)
2. Main Business Centre
3. Outer business Centre

4. Neighboring Business Street
5. Scattered shops or the isolated store cluster.

Central Business Districts (CBD): - This is the most inner zone or core of the city, defined by the name of C.B.D. This is a zone, where sky carper buildings are found in huge numbers. This is the focus of commercial, social and civic life and of transportation. These are most frequented by the people of the city and the surrounding areas for various purposes. It is an area of retail trade, business, with its departmental stores, apart shops, offices buildings, clubs, bank, hotels, theaters and organization headquarter. It is spread between the Bus stand and the railway station road. There are mostly shops famous for handlooms.

Main Business Street: - Main business Street developed along the side corners of the roads or other transport streets. Business area always develops on the road which connects the main business buildings that have developed on the main business street along with G.T. road and railway line. Other markets are developed on Assandh Panipat Road, Gohana Road, Khanna Road and sanoli road, Jattal Road.

Outer Business Centre: - With the expansion of the cites the business activities have been developed in those areas of the city, which are distantly located from the central business area. In different parts of the town small business centers develop for convenience and to fulfill the needs for surrounding areas. Such types of caters develop with the development of the city, when C.B.D fills a faraway from those areas. In these business centers those kinds of activities and ships develop which are present in CBD, such as clothes shops, shoes and general stores etc. the people living in the outer areas have to cover a long distance and have to face certain problems like traffic congestion, no proper parking facilities in the CBD area and wastage of time, crowdie at morpheme and high cost of goods in CBD area and so many others. All these inconveniences have encouraged the development of outlying business centers and automobile showrooms that exist in the outer part of the city. Sector 18 sec 13 and sec 17 and sec 6 market are some pockets of business which are scattered in the northern part of the city.

Neighboring Business Centers: - Some small business areas established along the roads connecting the CBD with nearby villages and towns, such types of ships are also developed in new residential colonies. These small business shops develop in the adjoining areas. Some scattered ships can be seen in the residential area of Panipat city. It is spread between outer

areas of the city namely Kundli, Rai and Delhi. These areas are neighboring business centers for the Panipat city. In these areas many malls, cloths and handlooms shops are there which is the neighboring business center zone.

Scattered Shops: - Scattered shops are the primary link of the commercial series. These shops are scattered in residential areas which is the main characteristic of these shops. This kind of shop fulfills the demand of the people of surrounding houses. Small quantity of all daily needs are available in these shops. Secondly these scattered shops are where people can take things on credit from here. In spite of that these scattered shops are active because of Local demand, credit facility and because of individual's behavior. These small scattered shops bring their things from the main business center of that area and serve their surroundings.

Recreational Area: - Total area under recreational area is 15.367 hectares. This is only 0.72% of the total city areas. The recreational area included all the parks, community centers and cinema halls. Recreational area is mostly found in planned areas of the city like as. Panipat has 40 recreational spots. There are two cinemas namely Surya cinema in the city. Model Town has the maximum parks of the city.

Residential Area: - Total area under residential area is 852.77 hectares. This is 39.75 percent of the total city areas. The residential area always covers a big part of the city, It is mainly used in settlement, housing buildings. Panipat is the city of "Weavers" so the handlooms industries are developed here. Growth of the city and migration for employment are the main reasons for the highly populated area. Most of the land is used for household industries and households.

Older part of the city growth was haphazardly and unplanned form. So, the residential area is also spread haphazardly, where the basic facilities are available but defecting in modern facilities. Along the drain No.8 lower class residential ready found. Sector II, Sec 6, Sec-7, Sec-13, Sec-17 and Yamuna enclave are newly planned residential planned area. In the Western area of the city unauthorized colonies were developed with unplanned infrastructure found at regular distances. These markets are visited by many businessmen from around the country who collect the Panipat Furnish ship and textile item in wholesale quantity to be sold in retail through their respective establishments. Since the city is textile oriented with numerous industries producing quality handloom items, most of these markets cater these products to local as well as tourists. These are separate markets selling each variety of

handloom and textile produced in Panipat city. Due to handlooms industries, there are some exportable things are here as cotton durries, Made Ups, bed covers, carpets, Bath Mats, Rugs Curtains, Terry Towels, Floorings and furnishing fabrics. Most of these markets in Panipat are located in its key areas. They are mostly the old markets that were established with the development merchandise along with culture of Panipat reflected through them. The shops some of which are quite age old and chowks render a nostalgic feel to these shopping places. Many of these markets also have small eateries offering local flavors to the shoppers along with big restaurants.

Industrial Area: -

Industries play a significant role in the city economy. In fact, most of prosperous cities today are industrial. Large Indian cities with their large markets and technical skills act as powerful magnets attracting industries both of producer and consumer goods. In fact, light and consumer goods industries are quartered in outer areas away from the residential areas, so that these industries may not have the adverse effect on the health of city people. According to Kusum Lata Taneja (1971) in our country, the percentage of industrial area in some of the cities is 14.5 in Mumbai, 10.5 in Jaipur, 9.2 in Kolkata, and 1.8 in Delhi. Sonipat has been experiencing great development during recent years. The study of the industrial structure of Indian cities has significant importance in Their overall appraisal. While the business areas tend to be centralized in the CBD" in the inner side, modern industries have started emerging in the outer portions of the city and thus' help not only to the balanced development of Land use but also the population and other urban activities. Industries play a significant role in the city economy, as they provide the basic export channels for earning money. In fact, most of the prosperous cities, today are industrial. Existing cities have been offering to industrial concerns the required personnel, capital and markets of growing concerns. They have attracted and continued to attract more than required number of rural laborers from the environs which bring to 'the city problems of accommodation and unemployment etc.

Administrative area of Panipat: -

Grand Trunk Road from South to North direction. Main administrative area is lying North of the city in a polygon shape. Where we can see its area is very small but when we see the building of the administrative area, they are multistoried buildings and most of the offices are located here in a mini secretariat building as D. C office, A.D, C office. DC camp and DC

house are near Hali Lake. The joint director General of foreign trade office is at Ram Lal Chowk, Model town. HUDA office is situated at out of municipal committee boundary at sector – 18, HUDA Tehsil Camp is in the eastern direction of mini secretariat. Quarters of Government are in the North direction of the mini secretariat along the G.T Road. There are 7 Police stations and chowkies are scattered around the city. Police line is situated along G.T.Road.

Morphology of Educational Areas: -

Educational zones are morphologically different from those of others. The increasing need for the provision of educational facilities of different standards and types has led to the intensification of educational zones. The: universities and big institutions with their defined campuses, the colleges and higher secondary schools of composite pattern and the nursery and primary schools and small training centers accommodated in private or other public buildings in the densely populated zones of the city are the three main classes of. educational areas. Total area under the educational area is 32.94 hectares. This is only 1.52 percent out of the total city area. The educational area mainly included educational institutes, schools and colleges. There are mainly 64 schools and 3 (P.G) Colleges in Panipat city. Their names are respectively- Aarya P.G College, S.D College, I.B college. These colleges are along the G.T Road near the bus stand of the city. Some other colleges like education, engineering, Polytechnics and management colleges are found in the outer area of the city

Early. Most educational institutes of Panipat were located in the mid-eastern part along the Grand Trunk Road.SD education institute and Arya College are existing in ward no 18,17 and 10. Nowadays the educational area is extending in the northern and southern outer part of the city. Here the cost of land is low and far away from overcrowdedness, lack of air pollution and noise pollution. There is a great difference which I found that educational area is more lies in east of railway track and there is very small area exist in west of railway track.

Medical Area:

The recent trend of enhancing medical services in the cities are opening a new chapter by establishing specialized services such as sanatoriums, eye hospitals, maternity u centers, etc. in the open surroundings away from the city proper. These medical service areas, though small, are sufficient to attract the growth and expansion of the city by attracting business and residential establishments and other activities related to medical services.

The second category of medical establishments consists of the private dispensaries, clinics and nursing houses, etc. Such establishments are generally located in the residential buildings in the form of shops along the roadside. The clinics and the dispensaries generally possess one apartment in which some place is occupied for storing the medicine in racks and admirals and some for the inspection of patients. The maternity and nursing homes consist of two or three big rooms in which the beds are provided for the patients. The doctors also reside in the same building or premises. Total area of medical bodies in Panipat city is 545.12 hectares. This is 25.40 percent out of the total city area. This category included all the medical ships, Hospitals and medical institutes. There are 65 hospitals in Panipat city namely Ravindra Hospital, Chhabra Hospital, G.C Gupta Hospital and civil hospital. The medical zone is divided into two parts, first is surrounding the civil hospital and second is with the Jattal and Sanoli Road. Medical area is also following the residential and educational area. Most of the hospitals in these cities are along the transport network.

Recreational Area: -

Recreational areas are defined as areas consisting of parks, green spaces, and other open areas. The landscape of open space and recreation areas in an urban setting can range from playgrounds and playing fields to community gardens to highly maintained environments to relatively natural environments. These areas may include city-owned, state-owned, and federally owned properties that are accessible by the general public. A definition of recreation the term recreation has spawned many definitions over the years. There is a further distinction possible between in-home and out-of-home recreation activities, and although both are of value to the consumer we predominantly focus on the latter. Hence, whenever we use the term recreation in this thesis, we actually refer to out-of-home recreation. Parks and recreation have three values that make them essential services to communities.

- 1) Economic Value
- 2) Health and Environmental benefits
- 3) Social importance

Just as water, sewer and public safety are considered essential public services, are vitally important to establishing and maintaining the quality of life in a community, ensuring the health

of families and youth, and contributing to the economic and environmental wellbeing of a community on a region. There are no communities that pride themselves on their quality of life, promote themselves as a desirable location for businesses to relocate, or maintain that they are environmental stewards of their natural resources, without such communities having a robust, active system of parks and recreation programs for public use and enjoyment.

Parks and recreation programs produce a significant portion on Health And Environmental Benefits are Parks are the places that people go to get health and stay fit. Parks and recreation programs and services contribute to the health of children, youth, adults and seniors. According to studies by the centers for disease control and prevention creating, improving and promoting places to be physically active can improve individual and community health. Parks and protected public lands are proven to improve water quality, protect groundwater, prevent flooding, improve the quality of air we breathe, provide vegetative buffers to development, produce habitat for wildlife and provide a place for children and families to connect with nature and recreate outdoors together

Recreational Area: - Total area under recreational area is 15.367 hectares. This is only 0.72% of the total city area. The recreational area included all the parks, community centers and cinema halls. Recreational area is mostly found in planned areas of the city like as. Panipat has 40 recreational spots. There are two cinemas namely Surya cinema in the city. Model Town has the maximum parks of the city.

Water Body: Total area of water bodies in Panipat city is only 9.9675 Hectares. This is 0.5 percent out of the total city area. This category included all water bodies like- lake, pond and water tank natural and manmade sewerage and river etc. The main water body is brain No- 8, that crosses all over the city from north and follows towards the East direction of the city. It also determines the eastern boundary of the city. Other water bodies are located in the outer area of the city. This is mainly the waste water of National Fertilizer Limited and Sugar Mill. There is also a water treatment. Plant in the southern direction of the city. Panipat has only two water bodies which are in the older industrial zones. National Fertilizer Limited and Sugar mill effluent stagnant water in these water bodies. Third water body is also not a natural water body. It is the water storage of a water treatment plant. Panipat –

Agriculture Land: -There are small patches in the West direction of the city. One patch is found in ward no 28, which is in between Refinery Road and Panipat co - operative sugar mills limited. The other agricultural land is scattered in ward no 27. These are along the Refinery road and surrounded by Virat nagar , Krishana Nagar and Jattal road . There are two small patches of agricultural land along the Assandh Panipat Road in ward no 27.

Open Area:

In Panipat Total area under open space is 306.787 Hectares and this is 14.30 percent of the total city area. It includes that area which is mainly scattered on the outer boundary of the city. In the southern direction of the city the open are found near the industrial area. Most of the open area is found in the western direction of the city along with the Gohana Road. Third belt of open area existed near the northern industrial belt of Panipat city. Open area In Panipat city is also found in western Panipat. Maximum patches of pen land are existing in ward no 28, 24, 22, 31 and 3. In ward no.28 it is part of Sugar Mill Colony. Houses are scattered in this area. This is a part of the older industrial zone of the city. In ward no.24 there are also small pockets of open area which is plotted land of 8 Marla Colony.

Ward no.22 and 31 have open areas between Railway track and Grand Trunk Road. This is existing in N F L Town. This area is the open area of Government ITI Panipat, Regional Vocational Training Institute for Women, near New Grain Mundi. This is also a part of green belt surrounding industries.

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